SMART TRANSPORT

Issue 1 – Jan 2019
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Breaking down the barriers

What will it take to achieve a joined-up approach to transport?

POWER STRUGGLE
What is needed to boost electric vehicle adoption?

SMART BRITAIN
Where can the UK lead in the global mobility market?

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Ensuring that transport innovation is inclusive

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SMART TRANSPORT

Connecting Policy to Solutions

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- Share research and insight on *https://www.smarttransport.org.uk/insight/event*
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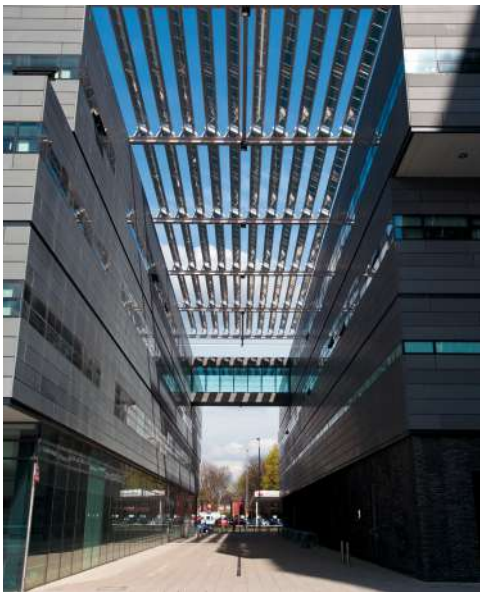

Issue 1-Jan 2019
First and last words...

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The important strategic issues

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What *Smart Transport* is all about

An introduction by **Stephen Joseph,** former Chief Executive of the Campaign for Better Transport

'Smart' is an overused word in the transport world. It is applied to everything from better traffic lights through ride-sharing to autonomous vehicles. There are also many magazines and events focused on smart or 'intelligent' mobility. So it's worth setting out what *Smart Transport* can bring the frenetic world of transport and technology.

First, a bit about me. I've come to this after 30 years as CEO of a small environmental charity, the Campaign for Better Transport, which promotes sustainable transport policies (my successor, Darren Shirley, is also involved in this project). This has meant I've dealt with many different interests in and around transport and have seen the advent of new technologies being applied to the sector. I've also talked to policymakers at local and national level and have seen their preoccupations and priorities.

From this, I've observed that there are deep silos operating. There are policy statements from local and national government, and pressure on them from their voters and even from lawyers, but then you can hear presentations from technology or automotive people who seem to be ignorant of these pressures and are operating as if they didn't exist. On the other side in the policy world, there is a lot of misunderstanding about technology and the disruption it might bring, and an obsession with autonomous vehicles as the next big thing, with less focus on all the other opportunities and challenges that technology could bring to transport.

In both cases, there is a tendency to focus on specific pathways and projects - in the case of technology companies and the private sector, to develop new clever ideas for transport without considering their application in the real world. Transport policy meanwhile can in some places be driven by old schemes revived, unaltered in any way, as the answer to local transport problems. This means that the wider questions - such as "what kind of place do you want to live in?" - are passed over by both sides.

Cutting across these silos, and enabling collaboration, engagement and partnerships between them, will bring benefits for both sides. Only an active and engaged public sector can make slogans such as 'Mobility as a Service' into a reality on the ground, in which people pay for transport services as a whole rather than for individual routes, operators or modes. And the technology world is brimming with ideas and projects which could create really great places and solve the problems facing policymakers.

And that's what *Smart Transport* is about - promoting engagement between policymakers/advisers in the public sector and key players in the private sector and encouraging networking and knowledge transfer between key players in different parts of the private sector.

A good starting point is where cities and their administrations are. They are facing a lot of pressures. Air pollution is a huge problem; there is ever increasing medical evidence that pollutants from vehicles, especially diesel engines, harm human health in several ways, so cities are facing increasing public and political pressure, and legal challenges, to cut pollution. Emerging responses include the Mayor of London's Ultra-Low Emission Zone and proposal in other cities to charge vehicles entering highly polluted areas. There are also increasing controls on where private vehicles, vans and trucks are allowed to go, with bus lanes, public realm improvements and cycle

About the author

Stephen Joseph is the Chairman of the *Smart Transport* Editorial Board and was Chief Executive of the Campaign for Better Transport for 30 years before taking up a position as advisor to the charity last summer. He has also been a member of various government advisory groups, and was awarded an OBE in 1996 for services to transport.

> "Only an active and engaged public sector can make slogans such as 'Mobility as a Service' into a reality on the ground, in which people pay for transport services as a whole rather than for individual routes, operators or modes. And the technology world is brimming with ideas and projects which could create really great places and solve the problems facing policymakers."

networks taking priority.

Congestion and the domination of road traffic in public spaces is also a problem for cities - increasingly they are having to take decisions on prioritising road space between different users. And they also face a challenge of social exclusion, of central areas that are commercially vibrant surrounded by low-income neighbourhoods where the priority is getting people to work and training opportunities in the central areas and elsewhere.

All of this can be summarised as a requirement to create attractive places where people want to and are able to live, work and invest. Increasingly, cities are looking at what they call "good growth" strategies, seeking to spread the benefits of growth rather than merely focus on high profile city centre redevelopment that has no impact elsewhere. The different private sector players need to understand these pressures and work with cities to meet these requirements, and not operate in isolation from them.

In some cases, this might lead to new and unusual alliances - maybe cities could join with logistics providers to put pressure on van manufacturers to make left-hand drive electric vehicles for UK cities, or to get new housing built with proper broadband. *Smart Transport* can help bring such alliances about by identifying shared objectives.

However, policy makers have their own blind spots. There is mounting evidence of changes in young people's travel (*https://www.gov.uk/government/publications/young-peoples-travel-whats-changed-and-why*), with less car ownership and driving licence holding than older generations, especially in cities. The growth of internet shopping has resulted in reduced car trips to shops and increased van travel. Yet the Government (and many politicians at local level too) find these changes difficult to imagine or allow for, so rely on old projections based on past trends and travel patterns continuing. This leads to an emphasis on building new roads (see the recent Budget) rather than using technology to make the roads (old and new) smarter and more intelligent and joining them up with other modes of transport.

Aside from the environmental and sustainability arguments about road building (on which I spent a lot of my time at the Campaign for Better Transport), this represents a failure to understand current trends and opportunities for doing things differently and making more efficient use of transport systems we have now. As I noted above, there is an obsession among policy makers with autonomous vehicles - and it's clear from talking to them that there is an expectation that these will be available very shortly, will cover the whole country and will enable people to do the same trips as now, only without drivers. There are also expectations of giving older and disabled people much better travel with autonomous vehicles (AVs) coming to collect them and take them out to visit relatives and generally reduce isolation in rural and suburban areas.

▲ **Other cities can learn a lot from London which has been a global leader in harnessing emerging technologies and pioneering smart transport initiatives.** JACK BOSKETT/*SMART TRANSPORT*.

Even the most optimistic proponents of AVs do not offer such visions soon, or maybe ever. It is also clear that were any of this to happen it would result in huge changes in travel patterns - business as usual is the least likely option. So a task for *Smart Transport* is to help policymakers understand the full range of options open to them and the impacts and expectations to be placed on them, and maybe moderate a fixation on AVs to the exclusion of other innovation.

If AVs have too much attention, the opportunities presented by the gathering and use of transport data have too little. There is a lot of transport data around already. Used properly it can help plan and manage transport networks, give people much better travel information and travel choices, and allow better value for money in transport spending. Hopefully, we can help explain to policymakers how the much-used phrase 'Big Data' can help them meet people's needs ▶▶

and make good use of public money.

Into all this are arriving disruptors: large companies, small start-ups and in some cases social enterprises offering new mobility services and technologies. Some of them are aggregating journeys so as to use existing transport better; others are providing wholly new services, better information, new payment and marketing systems for transport.

Dazzled by these disruptors, some commentators are foreseeing the death of conventional public transport services, with autonomous, electric ride-sharing replacing buses and metros. I'd say the death of conventional public transport has been much exaggerated - even Uber and Lyft have reinvented buses in some of their US operations ("Uber Pool Express") as the most efficient way to transport a number of people around a city. In the UK, where cities still have reasonable public transport and (unlike the US) there is still a large passenger rail network, it makes sense to use new technology to improve this public transport, integrate it and supplement it with the new services. In fairness, that is the business model being adopted by most of the so-called disruptors.

This brings its own challenges for policymakers. It is widely recognised that laws governing taxis and private hire vehicles are out of date, and indeed the distinction in law between taxis and buses might need to be revisited. More generally, cities would like the ability to experiment and apply light-touch regulation to new ideas, and also powers to intervene to manage problems with new providers (for example, dockless bikes littering the streets). Giving city authorities such powers, to experiment but also manage disruptors, and also powers to break down distinctions between taxis and buses, will help create the partnerships and collaboration that will bring the benefits of innovation. I hope that *Smart Transport* will be able to showcase disruptors and identify what tools policy makers will need to help them flourish and maximise their benefits while minimising downsides.

However, the UK should not beat itself up. It does have some advantages - and in London it has a great model for change and for harnessing technology. London has pioneered the smartcard and contactless bank card as payment for transport and other services; it has also opened up and made freely available its transport data, for others to make use of. London has innovated in other areas too, but it has also been unafraid to set boundaries for innovators and disruptors. Notably, it withdrew Uber's licence to operate and has forced the company to change its practices as a result.

Less high profile has been Transport for London's management of new service providers such as Citymapper and Ford's Chariot on-demand bus services, where TfL insisted these should supplement rather than replace or compete with other public transport services. London also has three statutory plans - the Mayor's Transport Strategy, the London Plan (the spatial development plan for the city) and the Economic Development Strategy. These interlink and feed off each other, allowing greater co-ordination between planning and transport.

Other cities are learning from London but have also been innovating themselves. More generally, the UK has an under-reported advantage, which is that it has focused on city regions, not just cities, for its mayors. The Mayors in London, West Midlands, Greater Manchester and Liverpool cover the whole city region - their equivalents in other cities like Paris, Toronto and New York cover a much smaller area so have to argue with the authorities in surrounding suburbs or at state government level to get anything done.

> "Giving city authorities powers to experiment but also manage disruptors, and also powers to break down distinctions between taxis and buses, will help create the partnerships and collaboration that will bring the benefits of innovation."

This city region focus gives a much broader scale for planning. Having said that, the mayors in other English cities don't have the same powers as the London Mayor does, though they are seeking to increase those that they have. Showcasing city plans and the directions of travel here and in other countries is another potentially helpful role for *Smart Transport*.

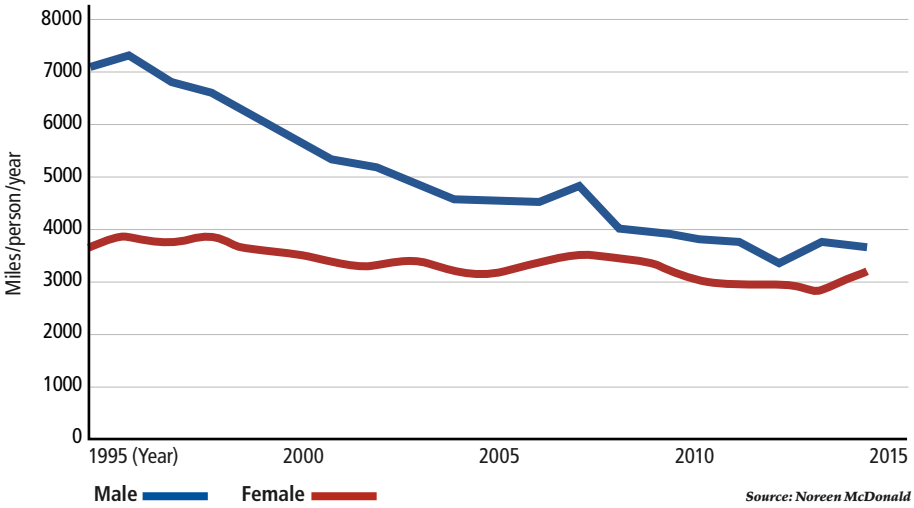
A final challenge that *Smart Transport* might be able to pose and answer is -'what do ordinary people want and expect'? There is among public policymakers and among the private sector entrepreneurs an expectation that transport users will take to new technologies - including apps, payment systems, new services and systems - and adopt and use them.

Yet history is littered with technologies that failed and products that looked great in theory and had no attraction in practice. We know that people will take to some innovations - smart ticketing, ride-sharing - but surveys suggest people are sceptical about autonomous vehicles, and while sympathetic to electric vehicles are worried about range and recharging.

The innovators can reasonably retort that in the 1890s, if asked, people would have requested faster horses rather than cars, but the issue of user preferences is still to be tested. Hopefully *Smart Transport* can interrogate this too.

Smart Transport is a new venture - but I think there is plenty for it to do. By bringing people together from the public and private sectors who are thinking about transport in its broadest sense, we can hope to create better understanding across different silos and help people develop new partnerships that work for everyone. ST

Miles driven by 18-30 year olds in England 1995-2015



Source: Noreen McDonald

Current Editorial Board members

The *Smart Transport* Editorial Board meets quarterly to discuss the content of the previous issue and to debate current focus points in the industry that warrant exploration in the next issue

Stephen Briers

Editor in Chief, Bauer Automotive B2B

Stephen Briers represents the views of 20,000 businesses running hundreds of thousands of cars, vans and trucks, with whom he shares insight and analysis as editor-in-chief of *Fleet News*' magazines, websites and events.

Matt Dale

Head of Mobility, ALD Automotive

Matt Dale has led ALD Automotive's Consultancy Team for nearly five years and was crowned 'Unsung Fleet Hero' by the Energy Saving Trust in November 2017. Previous roles include National LCV Sales Manager at Nissan Motors GB.

Stephen Joseph

Chairman of the Board

Stephen Joseph has recently stepped down as CEO of Campaign for Better Transport, having been in that role since 1988. Awarded an OBE in 1996 for services to transport and the environment, he is now an independent transport policy advisor.

Richard Bruce

Director of Energy, Technology and Innovation, Department for Transport

Richard Bruce was appointed in August 2016 to lead on policy to move the nation's road transport onto a more sustainable footing. His teams direct and deliver UK-wide policies and programmes worth around £1 billion.

Dr Jo Dally

Head of City Partnerships Lead, BP's Advanced Mobility Unit

Dr Jo Dally leads the Advanced Mobility Unit at BP which was created to build material, sustainable businesses for BP in a low carbon, digital future. Previously Head of Policy at the Royal Society. Innovation in the Government Office of Science.

Edward Kulperger

Vice President, Geotab Europe

With 18 years of experience in the telematics industry, specialising in operations and business development, Edward has delivered applications to the international telematics, automotive, fleet management and wireless sectors.

Siobhan Campbell

Head of Central Research Team and Deputy Chief Scientific Advisor, Department for Transport

Prior to joining DfT in May 2016, Siobhan Campbell was responsible for policy evaluation at the Department Energy and Climate Change and also worked as deputy head of the Government Social Research Unit based in HM Treasury.

Carlota Hudgell

***Smart Transport* Lead, Bauer B2B Media**

Carlota Hudgell joined Bauer Media in May 2016 and is tasked with bringing the *Smart Transport* membership together by forging relationships with key market leaders, innovators and thought leaders within the public and private sectors.

Chris Lane

Head of Transport Innovation, Transport for West Midlands

Chris Lane is responsible for delivering change through people, processes and technology at TfWM. He is currently leading its Commercial MaaS Initiative, and helped successfully deliver its Smartcard and Passenger Information schemes.

Rafael Cuesta

Head of Innovation, Transport for Greater Manchester and Vice Chairman, ERTRAC

Having started his career in Colombia, Rafael Cuesta has worked on the NET tram development at Nottingham City Council, and held other public transport operational and policy roles at Birmingham City Council, TfWM and now TfGM.

Michael Hurwitz

Director of Transport Innovation, Transport for London

Michael Hurwitz is responsible for making sure transport in the capital is ready for the future and helping determine which new business models or services could help address challenges facing the city.

Ben Lawson

Vice President of Strategy and Mobility for the UK and Ireland, Enterprise Holdings

As VP of Strategy and Mobility for the UK & Ireland, Ben Lawson is responsible for the strategic development of all lines of Enterprise Holdings' business in both countries, while driving efficiencies and growth within the organisation.

Sam Li

Senior Innovation Officer, Transport for Greater Manchester

Sam Li is the Transport Thematic Lead of the Cityverve project in Greater Manchester, which is an InnovateUK-funded project and the UK's demonstrator for smart cities and the Internet of Things.

Stewart Lightbody

Head of Fleet Services, Anglian Water

Stewart Lightbody joined Anglian Water in January 2014. The company provides the largest water and water recycling service in England and Wales by geographic area, and operates a fleet comprising 700 company cars, 1,800 vans and 200 HGVs.

Tim Lucas

Managing Director, Bauer B2B Media

Tim Lucas began working with Bauer Media in 2009 and led the restructuring of its B2B operations in the UK while also overseeing the business's recent growth in the rail and automotive sectors.

Andy Pascoe

Business Development Director, Meridian Mobility UK

Andy Pascoe has represented high performance technology brands for his whole career. Initially he spent over a decade in Formula 1 before moving into defence, aerospace and automotive.

Professor Nick Reed

Head of Mobility R&D, Bosch

Having previously worked at Transport Research Laboratory, Professor Nick Reed holds a visiting professorship at the University of Surrey 5G Innovation Centre. His role at Bosch centres on research to improve mobility in cities.

Dr Daniel Ruiz

Chief Executive, Meridian Mobility UK

Dr Daniel Ruiz joined Meridian Mobility UK as CEO in January 2018 having previously led a 500-strong team at Dynniq UK. He now leads the UK's £100 million connected and autonomous vehicle (CAV) programme.

Khaled M Shahbo

Corporate Vice President/ Managing Director for the UK and Ireland, Enterprise Holdings

Khaled M Shahbo has been with Enterprise since its inception 24 years ago. He was appointed to his current role in 2015 with responsibility for all three Enterprise Holding Brands – Enterprise Rent-A-Car, National Car Rental and Alamo Rent A Car.

Elliot Shaw

Executive Director, Highways England

Within Highways England, Elliot Shaw has responsibility for the development of the strategy for the Strategic Road Network, the company's organisational transformation agenda, analytical and economist functions and key relationships.

Darren Shirley

Chief Executive, Campaign for Better Transport

Darren Shirley was previously leading the *Which?* campaign in regulated and retail markets before joining Campaign for Better Transport in August 2018. He has also worked for Green Peace UK, National Energy Action and WWF.

Dr Mike Short CBE

Chief Scientific Adviser, Department for International Trade

Dr Mike Short CBE joined DIT in December 2017 as the department's first ever chief scientific advisor following 30 years in telecommunications with Telefonica. He is currently a visiting professor at five universities including Coventry and Leeds.

Adam Simmons

Director, Future Road Investment Strategies

Adam Simmons joined Highways England in October 2017 to head up the team responsible for the organisation's preparation for the second Road Investment Period (2020-2025). He had previously led a number of projects at the DfT.

Jason Torrance

Clean Air Cities Director, UK100

Jason Torrance has 25 years' experience in various disciplines. He is a respected partnership convener, and has previously held roles as Policy Director at Sustrans and Co-chair of the Stakeholder Advisory Group at Highways England.

Martin Tugwell

Director, England's Economic Heartlands

Martin Tugwell is director for a strategic alliance of county and unitary councils and Local Enterprise Partnerships spanning from Oxfordshire to Cambridgeshire that is promoting a new model of integration for strategic planning and delivery.

Mike Waters

Director of Policy, Strategy & Innovation, Transport for West Midlands

Mike Waters is responsible for establishing many of the collaborative public environment Intelligent Mobility projects and connected vehicle projects in Coventry and across the West Midlands. He sits on the Meridian CAV Hub Advisory Board.

Caroline Watson

Programme Director, Transportation and Urban Planning, C40 Cities Climate Leadership Group

Caroline Watson is Co-director of Transportation and Urban Planning at C40 Cities which represents over 90 of the world's largest cities committed to tackling climate change. She also leads the Zero Emissions Vehicle Network.

JACK BOSKETT/SMART TRANSPORT.

Finding the missing link

Holistic thinking's one thing, but **Mark Smulian** asks whether joined-up action for land use and transport policy is possible

Building a large new mainline station near to only a few dozen homes and nothing much else might look perverse, but Cambridge North stands as a rare example of holistic thinking being applied to planning and transport.

It is there to meet the needs of large planned developments, in particular the city's science park, and one day it should be busy. Contrast this with Warrington's Chapelford Urban Village. According to the sustainable planning and transport group Transport for New Homes (TfNH) the first domestic properties were sold on the 80 hectares former RAF site in 2003, but Warrington West station is due to bring a train service to Chapelford only in mid-2019.

It's clear that transport, housing and other services and amenities can be planned well together, but that does not always happen. Add into the mix potentially rapid changes like electric vehicles, autonomous vehicles and mobility-on-demand services and it becomes clear there is another danger.

Planning for homes and jobs without the transport infrastructure to support them is one thing, but a further complication is the need to plan for the transport of the future, not just what we have now.

It's a common complaint that planning for land use, homes, transport, energy and employment exist in 'silos', whether because of departmental divisions in central and local government, or perhaps differences in professional training. Rather less heard about are workable solutions for demolishing these silos so that policy areas work together and are alive to innovations.

Indeed, while holistic thinking about these issues might be successful, is holistic action even possible given that the vast range of subjects to be considered means that lines must be drawn somewhere to make them manageable?

Siobhan Campbell, head of the central research team and Deputy Chief Scientific Advisor at the Department for Transport (DfT) says: "People are aware of the silos problem and accept that something needs to be done. It is structurally difficult though, and I worry we have not cracked it.

"The problem is that managing a complex system is difficult so people will manage what they are responsible for and, even within transport, integration is really challenging. I'm not sure we have the necessary set of tools, and it's not for want of trying. Probably the answer lies in the fields of operational research and systems engineering, but we do not yet have great examples of the tools there being applied."

Richard Bruce, DfT Director of Energy, Technology and Innovation, has led some changes to try to demolish silos. "I have joint teams on low emissions vehicles, air quality and autonomous vehicles," he says. "It is different to the traditional Whitehall approach where one department would want to do something and write to other departments to see what they wanted. This is trying to get that done beforehand by joining up ideas. DfT also works with teams in local government to know what is going on, as there is a good chance innovations will happen first in cities and they will be in the vanguard as they have transport and licensing powers."

Senior civil servants can see the silo problem, and those old enough to remember will know that there was once a huge experiment in silo-demolition in Whitehall. This was carried out by the Department of the Environment, Transport and the Regions (DETR), led by then Deputy Prime Minister John Prescott from Labour's 1997 victory until 2002. DETR reflected Prescott's enthusiasm for joining up these policy areas, but its relatively short existence suggests it did not solve the problem - environment was separated off in 2002 and transport in 2006.

Steve Gooding, now Director of the RAC Foundation, worked in DETR and recalls that bringing people together was harder than it appeared. He says: "The silo problem is one of historical making, as to run any complicated business you have to divide up the spreadsheet somehow, for example between highways, public transport and capital and current spending.

"I've been suspicious of the idea that if something is done in DfT as well as something related in the Ministry of Housing, if only we merged them it would all be straightforward - all you do is change the name, not the organisation.

"I was at DETR and it meant genuine tensions that needed to be recognised and thought through and reconciled were brushed under the carpet once it was merged."

Gooding says it is important to recognise that planning decisions that make good sense on their own terms have transport consequences that might be missed.

"For example, a new hospital on the edge of a town is readily accessible from one side but not the other, so you need to build a very big car park and then most people will choose to drive there," he says. "It is very hard to solve. All life is about trade-offs, and very few things achieve total consensus."

> "There is a good chance innovations will happen first in cities and they will be in the vanguard as they have transport and licensing powers."

Richard Bruce, Director of Energy, Technology and Innovation, Department for Transport

About the author

Mark Smulian is a freelance journalist specialising in local government, law, travel, transport, housing, construction and planning. He has featured in a wide range of publications including the *Local Government Chronicle*, *Civil Service World*, *Law Society Gazette* and the *Sunday Telegraph*. He is also a former editor of *Housing Today* and news editor at *Inside Housing and Surveyor*.

> We are starting to get combined authorities and sub-national transport bodies such as Transport for the North, but we don't yet know how those will work.

James Harris, Policy and Networks Manager, The Royal Town Planning Institute

If it's problematic to consistently join up policy across Whitehall departments how much more so is joining that with the confusing patchwork of local and regional bodies now emerging? Unitary councils exercise all powers in their area but elsewhere counties are responsible for highway and waste planning, while districts cover land use planning and housing.

To further complicate matters combined authorities have emerged in Greater Manchester, Merseyside, the West Midlands, Tees Valley, North of the Tyne, Cambridge-Peterborough and Bristol-Bath - each with a different devolution deal - while Greater London has long had devolved powers. A tortuous internal dispute has delayed the final definition of devolved bodies in Yorkshire.

There is considerable variation both in the degree to which local authorities are joined up internally, and these combined authorities with their constituent councils.

Gooding notes: "Take the Mayor of London's expanded ultra-low emissions zone, which takes in residential parts of outer London. If you don't have an idea of the travel options for those people you could find you're cutting off their access to work and services.

"Translate that thought to Leeds, for example, where public transport offerings are less dense than in central London. You might still seek similar policy outcomes on clean air and you'd really want your transport strategy to look at all the options, not have one report to council about highways, one on rail and another on buses.

"Problems come because that is pretty much what does happen. Highway maintenance budgets are in large part provided by DfT, money for trunk roads goes to Highways England and money to subsidise buses through general council funds."

The Royal Town Planning Institute also recognises this problem of disjointed approaches, says Policy and Networks Manager James Harris.

"It probably isn't possible to get rid of silos as the problem starts in central government and cascades down to local level and is made worse by the lack of any regional intermediate layer apart from London, and very recently Greater Manchester," he says.

"The silo problem falls down through to local level. We are starting to get combined authorities and sub-national transport bodies such as Transport for the North, but we don't yet know how those will work. I have some sympathy with central government as they are set up in departments to do specific things and it must be difficult to integrate that, which is why it would be better to devolve as much as possible to city region or county level."

Harris says the loss of regional spatial strategies and regional assemblies, after the Coalition dismantled them, made joined-up policy across more than one council area even more difficult to achieve, but the industrial strategy "has been a new approach and may be a better way to join up policy because it has given central government broad themes to work with rather than individual policy areas".

The industrial strategy means Richard Bruce has an additional piece of joining-up to do around innovation in the DfT, as mobility is among the strategy's four parts, the others being artificial intelligence, the ageing society and low carbon technology.

To progress electric and autonomous vehicles and on-demand mobility he must work across government to ensure the UK benefits both industrially and in transport terms from them. He says: "The future of mobility is our great challenge. It's about changes that are happening simultaneously, for example electric cars may become lower cost and there may be better batteries meaning almost anything could become electrically powered; you could have hybrid planes, boats and trams.

"Then there are services such as Uber which are very disruptive. It could be that in future you pay monthly for a transport subscription for trains, bikes, cars - say £40 buys you a certain amount of travel in any mode. There are also major tech companies coming into the travel market, with Apple and Google moving in quickly, and then there is Tesla. It's a huge shift in something that has remained the same for a century."

Bruce says these innovations will lead to a blurring of modes making it difficult to continue to plan for them individually even were that desirable. "It used to be something was a car, or a bike or van or whatever. Now there is more granularity," he says. "There are electric bikes, mopeds and trikes and there will be a lot of new ideas and modes for different things. It is all changing and we have to get ready for the industrial opportunity this gives the UK, not just the transport benefits."

Some innovations might even recently have sounded like science fiction but Bruce says they are approaching quickly and the major questions over their adoption may be not so much technical as cultural.

"Autonomy is happening though there is a question over whether consumers will really be happy using a vehicle with no driver," he says.

"People are perfectly happy flying in aircraft that is controlled by a computer large parts of the time, or travelling on the [London Underground] Victoria

Cambridge North opened in May 2017 to not just serve the city's science park, but support new development in the surrounding area. There is an interchange with Cambridgeshire Guided Busway and cycle space for 1,000 bikes. PAUL BIGLAND.

Line, which could be driverless, but it may be different with a road vehicle."

Siobhan Campbell can see data issues around public acceptance of transport innovations."Most new transport modes depend on data to make them work and if the data for an autonomous vehicle, say, is different from a bus or a taxi it is difficult to integrate,"she says.

"User expectations evolve and requirements change. There is a big risk that we end up with a really disaffected travelling public unless we can integrate the systems. They expect to be able to sit at home and use an app to plot a journey between modes and they want it to be seamless. Indeed, someone recently asked me what is the point of cutting the journey time from London to Birmingham if on arrival you have to hang around 20 minutes for a bus or taxi?"

There is also a cultural concern about data, with Campbell noting that we may have reached peak data trust in the degree of public willingness to have its data held and used by official bodies. She says:"We need to overcome that. Central government holds relatively little transport data. Most is in private or local government hands but central government can regulate how that is used and shared."

> "User expectations evolve and requirements change. There is a big risk that we end up with a really disaffected travelling public unless we can integrate the systems."

Siobhan Campbell, Deputy Chief Scientific Advisor, Department for Transport

She also says that transport innovations can affect policy areas quite remote from housing and planning if the implications are not thought through. Door-to-door autonomous transport might sound inviting and might well be technically feasible but there is a problem of unintended consequences."What does that do to anti-obesity strategies if people no longer even have to walk to a bus stop?"she asks. "There is also an equity issue - what does government do to ensure transport stays available to all and deal with market failure?"

TfNH shares these concerns about health policy. Researcher Joey Talbot comments: "Autonomous vehicles are still going to need roads and there is a risk of more congestion if anything. Problems caused by obesity and heart disease may increase in people who are no longer walking and we should promote active travel."

The RAC Foundation's Steve Gooding points to another example of well-intentioned policies with negative impacts elsewhere. Brighton and Hove is noted for its good bus service and council road safety policies - the city is replete with 20mph speed limits and'sleeping policemen'. It has also been provided with low emission hybrid buses, and the two may not mix.

"Brighton is a mix of joined up and unjoined policy,"says Gooding."You don't want to send a hybrid bus up a hill with

lots of pedestrian crossings and sleeping policeman because the stop-start means you are over-working a diesel engine that is also having to lug around an electric motor."

Technological innovations can be exciting but should not detract from the need to keep the infrastructure already in place in good condition and, if possible, adaptable to new vehicle types.

Matthew Lugg, President of the Chartered Institution of Highways and Transportation, says:"Things are moving fast but I'm not sure it means we should plan for less traffic as the roads will still be used by autonomous vehicles or electric ones and we may see increased traffic, for example as shops close on the high streets there'll be a proliferation of delivery vans for online retailers.

"We cannot assume these innovations will make it less important to maintain highways and we will need to supply the infrastructure new vehicles will need, such as charging points, and perhaps changed road markings or electronic equipment they use to navigate."

Issues with policy links, technology, data and infrastructure show just how complex joining up transport with other policy areas can be. But how much more so when the nature of the transport involved is so unclear?

Gooding believes the future in transport terms is about as uncertain as it has ever been and the best we can do is think very hard about how much we might regret those decisions if in 20 years' time our forecasts turn out to be wrong.

"Take the Dartford Crossing," he says."It is many per cent above design capacity so the Government concluded it needs another crossing.

"But it's important that the Government looks at a range of possible futures, some with high travel growth and some low, and considers what might cause those things to happen. It would recognise that building a new crossing might be quite poor value for money on the balance of probabilities.

"We don't need any traffic growth for there to be massive queues at Dartford Crossing. Many parts are already horribly overcrowded and there'd have to be a reduction in travel for those problems to go away. It feels unlikely that the combined forces of electrification of vehicles, automation and moves to Mobility as a Service will mean that if I get to M25 junction 3 I won't still be in a queue of traffic."

One example of forward thinking about joining up transport policy with land use and housing is emerging in the Oxford-Cambridge corridor, at least at one end.

James Palmer, the Conservative elected mayor of the Cambridgeshire and Peterborough Combined Authority, has come up with a transport solution to the burgeoning growth of Cambridge and its surroundings that is certainly innovative - though may have both technical and financial hurdles - but which he says is being planned in an integrated way with the Oxford-Cambridge road and rail links planned by the Government.

Oxford and Cambridge are two powerhouses of the 'knowledge economy' based on their respective universities, yet road links between them are poor and there has not been a direct rail link since 1967, although most of the track remains. Places along the route such as Bedford, Aylesbury and Milton Keynes are also growing fast and are important to the economy.

Palmer's idea is to create an integrated, autonomous rapid mass transit system for Greater Cambridge and beyond"to

Former Deputy Prime Minister John Prescott's efforts to join up policy areas and government departments in Whitehall were met with little success between 1997-2002. ALAMY.

alleviate chronic congestion and foster continued economic growth". The Metro would serve transport corridors to St Neots, Mildenhall and Haverhill, with a short section under central Cambridge intended to be tunnelled. Metro stations would accommodate bus passengers, pedestrians and cyclists to change mode, but have minimal car parking. Vehicles are yet to be specified but are expected to be rubber tyred, electrically powered tram-like vehicles.

The transport corridors can bring forward significant new housing with garden villages, and with the intention that the Metro infrastructure will be in place first.

It will link to the reborn Oxford-Cambridge rail line at the city's present and future stations.

Rob Hopgood, the partner who leads on the Oxford-Cambridge corridor at planning consultant Bidwells, says: "The combined authority is thinking big on infrastructure for road and rail and that is supposed to be built by 2030 and the new settlements by 2050, the idea being that you could get from one city to the other by car or train in 75 minutes.

"But by the time they are built we may be travelling very differently, we may be using electric and/or autonomous vehicles - indeed a few are being tested in Milton Keynes. I would say they are generally not thinking about the future, but about transport as it is now, when it needs infrastructure that will adapt to whatever comes."

He points to hit-and-miss joining up of local development to date with the new settlement of Cambourne (nine miles west of Cambridge) having no station, while Northstowe (off the A14 between Cambridge and Huntingdon) has no station but is on a guided busway and Waterbeach (six miles north-east of Cambridge) may have its station moved to serve an adjacent development.

It remains to be seen if the mayor's ambitions come to fruition and how quickly the road and rail links are built, but Bruce rates the Oxford-Cambridge corridor as "a good example of getting everyone to talk about which sites are to be used".

The National Infrastructure Commission has recognised that the corridor is in great need of holistic thinking about its future. It bluntly characterised it in an interim report as facing "a chronic undersupply of homes made worse by poor east-west transport connectivity". Oxford and Cambridge's economic success made them "two of the least affordable cities in the UK…and the area as a whole has consistently failed to build the number of homes it needs".

The commission added: "Investment in infrastructure, including enhanced east-west transport links, can help to address these challenges, but it must be properly aligned with a strategy for new homes and communities, not developed in isolation."

This has not happened before, with the commission noting that in 2012-15 the average number of homes built each year in the corridor was 12,250, some 7,900 fewer than the assessed need.

It's clear that there are organisational, financial and cultural hurdles to holistic approaches to transport and other policy areas in central and local government. But, also, that while technology is not static the cultural shifts that would underpin, say, autonomous vehicles happen unpredictably when a new technology reaches a critical mass of accessibility and people alter the habits of a lifetime and adopt new ways.

The coming changes will involve both new forms of transport but also perhaps limits on existing ones for environmental reasons. How can potential solutions command public support?

Gooding believes the possibilities depend on local and national political leaders having the commitment to a policy and being able to seize opportunities. He says anyone standing for election has to be able to say: "I know you have chosen to own and run motor cars to get to work but we have this air quality problem in the town centre, so I'm proposing a solution. But we will still get you to work and the shops. Are you with me?"

The expansion of Nottingham's Express Transit network was part funded by a workplace parking levy. Nottingham City Council is the only local authority to date that has successfully funded local transport improvements by using this mechanism. PAUL BIGLAND.

He gives the example of Seville's widely-praised network of cycle lanes. "A lot of work was done, then along came one politician who saw a moment to push it through and did," he says. "You could have had all the same diligent work by professionals, but unless somebody brings together it won't happen."

Nottingham is an example of bold thinking, he says, where the council in 2012 imposed a workplace parking levy - still the UK's only one - and devoted the proceeds to extending the city's tram system.

Gooding worked on this and says: "The net result is that Nottingham is more accessible. It wasn't easy, but the money was raised, the promises on spending were met and I would say the people of Nottingham think it was a good thing. Any big change requires political bravery, but also a burning platform."

The UK faces future trends that include a decline in high street retailing, young people not taking up driving at the rate their parents did, technological change in vehicles, concern about sustainability and the possibility of mobility on demand rather than car ownership becoming the norm.

If a simple way existed for transport to be holistically linked to all the other matters that it affects, that would have been adopted decades ago. The sort of integration being used by the DfT and others perhaps offers a way forward but above all it is a matter of professionals and local and national politicians being willing to talk to and learn from each other. ST

> "It's important that the Government looks at a range of possible futures, some with high travel growth and some low, and considers what might cause those things to happen."

Steve Gooding, Director, The RAC Foundation

Jim Steer

Director and Founder, Steer Group

Mark Smulian has given us a great *tour d'horizon* on a subject that plagues the transport sector – the difficulty of joining-up transport arrangements with wider development. Smart transport solutions cannot by themselves crack this problem: they tend to continue to treat transport services as a free-standing market. True, there is already much thinking about smart cities, and this work starts from a premise that it would be madness not to look at everything together: the internet of things just takes you there.

Some helpful insights have been extracted from various luminaries that take the reader away from first-thought - but, it seems, ill-advised - solutions like combining government departments. But I was left wanting more than the encouragement that can be had from the (sadly rare) examples of good joined-up planning and from a hope that professionals will reach out and learn from each other. A smattering of examples is one thing, but I do wonder whether joined-up land use and transport policy is actually possible.

To answer this, we might first acknowledge that a number of other countries achieve this routinely, among them the Netherlands, Denmark and Switzerland; even China. So, what's different about the UK that makes it seem so intractable?

Two things perhaps. The first is our aversion to planning. Not just physical planning, town and country style, as practised for 30 years after World War II (when we could think big and plan new cities of a quarter of a million population), but to planning anything. Unbelievably, politicians often claim planning is standing in the way of progress.

The second is that Britain is, according to HM Treasury's Sharon White speaking in 2015, the most centralised developed country in the world. The problem this creates is that the joining-up has to be done at central government level - and then we're back to Stephen Gooding's angst at the DETR experience, as described by Mark in his article. Joined up policy and planning needs to happen at a devolved level to make it manageable.

Right now, we have incredibly light-touch planning guidance at a national scale. This can remain, but what is needed in addition is devolved responsibility (with duties and obligations to plan across the sectors – transport, land use, industrial strategy, addressing climate change – spelt out) and we need devolved funding too. By doing this means we can expect to get buy-in from communities for development and more realism around how to spend the scarce resources available.

Meanwhile, DfT can focus on big-picture policy concerns like the national infrastructure investment needed to achieve a switch away from carbon-intensive energy sources for transport. It even has a ready-made agency available to help it fulfil this function - the National Infrastructure Commission. And this has the further virtue of having started life as a child of Treasury with no sectoral allegiances.

As a department of central government, DfT

Martin Tugwell

Programme Director, England's Economic Heartland Strategic Alliance

Mark Smulian's article perpetuates a number of received wisdoms, meaning it misses out on some of the more recent thinking being undertaken at the strategic, regional level - thinking that actually answers the challenges set in the feature.

The initial couple of examples referred to are portrayed as contrasting what happens when one does or does not adopt a joined-up approach to transport planning - I'd argue they are more likely to illustrate the challenges associated with our approach to delivery and the challenges of funding and financing.

The reason Cambridge North was put in ahead of need is as much likely to be a consequence of someone being prepared to up-front the cost of delivering that infrastructure and then underwriting the cost of services using it. This is, therefore, an issue of forward funding. Experience suggests it is the public sector (in one of its disguises) that is best placed to act as the source of forward funding, primarily because of the need/desire to achieve a particular policy objective and it is also best placed to manage risks associated with getting the permissions required to deliver that objective. By comparison, the private sector would price any uncertainty into the cost of forward funding investment.

It is in part in response to that latter point that we at England's Economic Heartland Strategic Alliance (EEH) are promoting the need for a geographically specific National Policy Statement for the Oxford-Milton Keynes-Cambridge arc. One of the key arguments in support of such an approach is the benefit of what is in effect a long-term commitment (one that extends beyond a single Political cycle) from the Government to realising the potential of the arc. Get that established, get the NPS in place and one immediately sends a very powerful signal of intent to institutional investors operating in the private sector.

The 'silos' argument is over-played. As the RAC Foundation's Steve Gooding explains, there is always going to be a need to place activity and interventions into a structure - particularly when it comes to delivery. The issue is not the existence of silos - it's people.

Through the Sub-national Transport Bodies, we are rediscovering our ability to do genuine strategic thinking, and we used to have this capability in the Regional Assemblies (which were statutory Regional Planning Bodies).

I agree with the point about needing to have the right tools for the job (as mentioned by the DfT's Siobahn Campbell) – but even here the article is behind the times. At EEH, we are investing in a strategic policy model that enables us to examine and explore the relative implications of alternative policy scenarios over the medium to long term. The key points to pick up on are that this is scenario-planning work (as promoted by the Chartered Institution of Highways and Transportation's FUTURES initiative, led by Prof Glenn Lyons) and that it is based on looking at the relative implications of scenarios.

Such an approach enables us to look beyond the current paradigm and to explore the relative implications of alternative paradigms.

If I think about the Oxford-MK-Cambridge arc the narrative here is that we are looking at transformational growth, where through the combination of investment in strategic infrastructure we will fundamentally change the nature and shape of both strategic housing market areas and functional economic areas. Add into the mix the need to plan for and deliver transformational growth in a way that achieves net betterment and the limitations of the traditional approach to developing the case for investment becomes even clearer.

We are seeking to change the scale, distribution and type of future travel demand. That requires a scenario-based approach, one that enables decision-makers to explore what

could be much reduced in scale. While its function on big-ticket issues that are truly national - hub airports, port investment, high-speed rail - must be retained, it will need to work in partnership with devolved authorities. This way we should be able to avoid jigsaw pieces going missing.

Transport, along with the fashionable concept of mobility, is essentially a derived demand. Travel arises because of activities that people need or want to engage in at a particular time and place. It's an economic good that carries with it very substantial baggage. A good journey for one person can be a factor in poor air quality and poor health outcomes for someone else.

Smart thinking on transport requires us to recognise this reality and feel comfortable with looking first at overarching societal aims - around quality of life, say, rather than transport solutions. Then we can make progress with flair in design, community involvement, and thinking about what users (of all sorts) want from travel arrangements. And then good transport solutions, necessarily joined up, will readily follow. ST

sort of future they want for their communities and businesses.

The challenge in terms of trying to achieve an approach that is holistic is to invest in people with the skills, capability and time to do genuine strategic planning: develop the tools that help enable consideration of different scenarios and then once decision-makers have their direction of travel, empower existing agencies like Highways England to use existing tools such as WebTAG to develop the detail. In this way, we will define the vision and strategic framework that then enables functional activities to be undertaken in the silos that are needed to deliver on the ground.

When looking at the various forms of governance, the article makes a mistake in inferring that the situation in the emerging Sub-national Transport Bodies is comparable with that in London. The legislative framework for London is different from the STBs - moreover that the tools available to London (in terms of its control over the Tube, buses, etc) are also different. The point made about the challenges of having a number of types of governance is valid although the inference that the Mayoral Combined Authorities bring strategic leadership misrepresents the reality.

When it comes to the emerging STBs the powers and responsibilities will be on a bespoke basis - reflecting the requests of the partners promoting a statutory STB: this is probably the most appropriate way forward as it enables the partners promoting the STB to seek the powers required to support/deliver their respective Transport Strategies.

One thing the article doesn't develop - although it is hinted at when talking about silos at the local level - is the issue of capital/revenue funding. Constraints imposed by Government in the classification of investment tends to shape decision-making when it comes to identifying investment requirements.

A related theme is the use of 'challenge' funds - the scenario where Government announces a ring-fenced amount of money for investment in projects that address specific issues. The challenge with these is two-fold: first it forces organisations to promote particular types of solutions in order to receive funding. Such an approach restricts the ability of organisations to target the funding at the right issues for their area. Second, the rise of 'challenge' type funding pots often encourages organisations to spend time and resources pulling together funding from different pots to enable them to fund what is actually required.

While it's appropriate and important to make the linkage with the Government's Industrial Strategy the article needs to avoid creating the impression that it is the mechanism for joining- up policy. The grand challenges rightly need to be seen as drivers for change and, if used correctly, to shape the strategic vision and overarching framework for a region can incentivise investment in innovative ideas/solutions that better respond to the needs of customers.

We also need to be careful when talking about innovations such as Uber - fundamentally this is a customer-focused app that has disrupted the taxi hiring market. The extent to which it has disrupted the overarching business models that are used across the whole transport system is more questionable. If we are to meet the challenge of delivering transformational growth and realising net gain, then we will need more fundamental shifts in the business models beyond replacing a black cab with an Uber cab.

The reason for continuing to talk about what is starting to emerge from the STBs is that these are not - as suggested in the article - bodies whose functions/activities are unclear but rather they are at the forefront of tackling some of the concerns set out.

An issue that is not touched on is that of ensuring that our approach and thinking is inclusive. There is emphasis on the potential role of technology, yet for those parts of our communities that are just about managing, we need to think whether there is a danger that over-emphasis on the high value innovation risks creating or extending a divide within society - if you are a single parent family struggling to run a 15-year-old car, then promoting a world of high-tech CAVs risks accentuating the divide that exists in society.

The article becomes overly-focused on what the technological opportunities are and how we deal with the uncertainty - rather than coming from a perspective of how we and future generations would want our transport system to deliver. If we come at it from the latter perspective by setting out in broad terms what we want our communities and our lives to look like, then we can set the framework within which individual public and private sector organisations do what they do best and apply the technology and innovation they possess to achieve our vision for the future.

Which brings me back to the fact that a key ingredient missing from the debate is the need to rediscover our ability and capability to undertake genuine strategic transport/infrastructure planning. Towards the end of the article there is a sequence on the National Infrastructure Commission's draft report (2016) for the Oxford-MK-Cambridge corridor. This needs to be updated to reflect not only the proposals set out in the NIC's final report but also the Government's formal response, published in November 2018 – two years after the NIC draft report.

The way in which the report is characterised is a manifestation of why our current approach to strategic thinking does not help the desire to have a holistic approach. This is not all about housing. Yes, the NIC draft report talks about the challenges facing the housing sector, but this is in the context of the NIC seeing that as a constraint on economic growth.

The strategic political and business leaders across the arc view the challenges as much more nuanced. They know, for example, that productivity across the arc is not at levels that enable businesses to compete as effectively as they need to in global markets. Improving productivity will help deliver a significant uplift in the value of the economy without the need for additional workforce.

Now the self-same leaders accept that delivering transformational growth on the scale identified by the NIC will not be delivered by improved productivity alone – there will be a need for additional housing. But an approach that is focused on economic growth, delivered through a combination of investment in infrastructure that improves productivity plus some additional housing is more likely to be sustainable in the longer term than an approach that is driven first and foremost by an over-emphasis on housing.

This reinforces the fact that one of our greatest challenges is having access to the skills and capabilities that enable proper strategic transport/infrastructure planning. For the avoidance of doubt this does not require establishing massive new teams of people – it is about investing in skills and capabilities that help set the vision and overarching framework, within which our existing organisations can then operate. ST

Steering the transport revolution

Society transformation is inevitable, says **Dr Daniel Ruiz,** Chief Executive of Meridian Mobility UK. But he wonders whether mobile nirvana can be achieved in our lifetimes

About the author

Dr Daniel Ruiz joined Meridian as CEO in January 2018 to lead the UK's £100 million connected CAV programme. Prior to this Daniel lead a 500-strong team as MD of Dynniq, tackling traffic challenges with technology-based solutions. Daniel gained his engineering degree from Selwyn College, Cambridge and his PhD in engineering from New College, Oxford.

Are we in control of the future? No - but we can certainly influence it. Saying we are going to transform society is ignoring the fact that we are travelling with significant velocity and all we can do is nudge the steering, accelerate or brake.

In truth, a confluence of accelerators is at play: societal, economic and technological. There are enormous pressures to achieve greater purpose, greater safety and less stress, combined with greater productivity and greater wealth at lower cost. And these outcomes are enabled by technological advances that mean that transport (or the emerging 'science' of mobility) is driving a social revolution. So even if we do not have control we do have influence.

For any of those who think of themselves as engineer philosophers, politicians, or social scientists, this is an immensely exciting time. It is undeniable that there are massive theoretical efficiencies and benefits to be had by making all transport connected, automated, shared and electric (CASE). This potential is reflected in the forecast value of the road-based mobility market: between £900 million and £1.4 trillion by 2035.

The reality is that we are only just moving up the first part of the maturity curve and we will not achieve mobile nirvana for a long time. Stating with conviction when we will get there is not that important. What is important is to enable progress and to ensure we can frequently adjust our direction: taking what in product development might be termed a 'sprint' approach.

Mobility is indeed the key to productivity, prosperity and purpose. But mobility is also a multi-dimensional, multi-sector (and some may say chaotic) concept, which needs to be tackled on many fronts.

A vehicle-centric view of the world illustrates how the challenge has become more complex. With the evolution of artificial intelligence and telecommunications, the value chain of a decade or so ago has evolved dramatically; from one involving vehicle technologies, hardware, and data platforms, to one which also needs to accommodate connectivity, autonomous drive software, mapping, the human machine interface, cyber security, transport systems, and other enabling products, services and systems.

A comprehensive, holistic approach is essential. The temptation is to create stronger silos to make the problem more manageable ("Ignore the complexity: compromise and strive for mediocrity!"). But this approach would fail, leaving us as slaves to internationally developed solutions to the mobility challenge: having to import rather than self-supply the products and services which we cannot do without.

But there is another paradox at play: no country can develop mobility solutions at the optimal rate without collaborating with others. And there are areas such as safety which are of universal importance and where independent working would be irresponsible. This is a global challenge and to be among the winners we have to collaborate with others at the global top table.

To make optimal progress we also need focus. This requires leadership as shown in the UK by the Automotive Council, representing the whole of the industry from original equipment manufacturers (OEMs) to suppliers to unions. Their example complements the leadership shown by government through the Centre for Connected and Autonomous Vehicles (CCAV) which, uniquely, has roots in both the Departments for Business and for Transport. Industry, government and academia have come together behind the UK's industrial strategy and its four pillars: Artificial Intelligence, Ageing Population, Clean Growth and Future of Mobility. Building on this, we have an evolving regulatory landscape and major investment programmes which are underpinned by a maturing testing & development environment (coordinated by Meridian Mobility UK).

A wide cross-section of UK industry is now gathered behind this movement, further reinforcing the momentum we have in the UK and realising the dividends from our collaborative culture. As a result, we truly have the potential to be a global leader in this transport revolution.

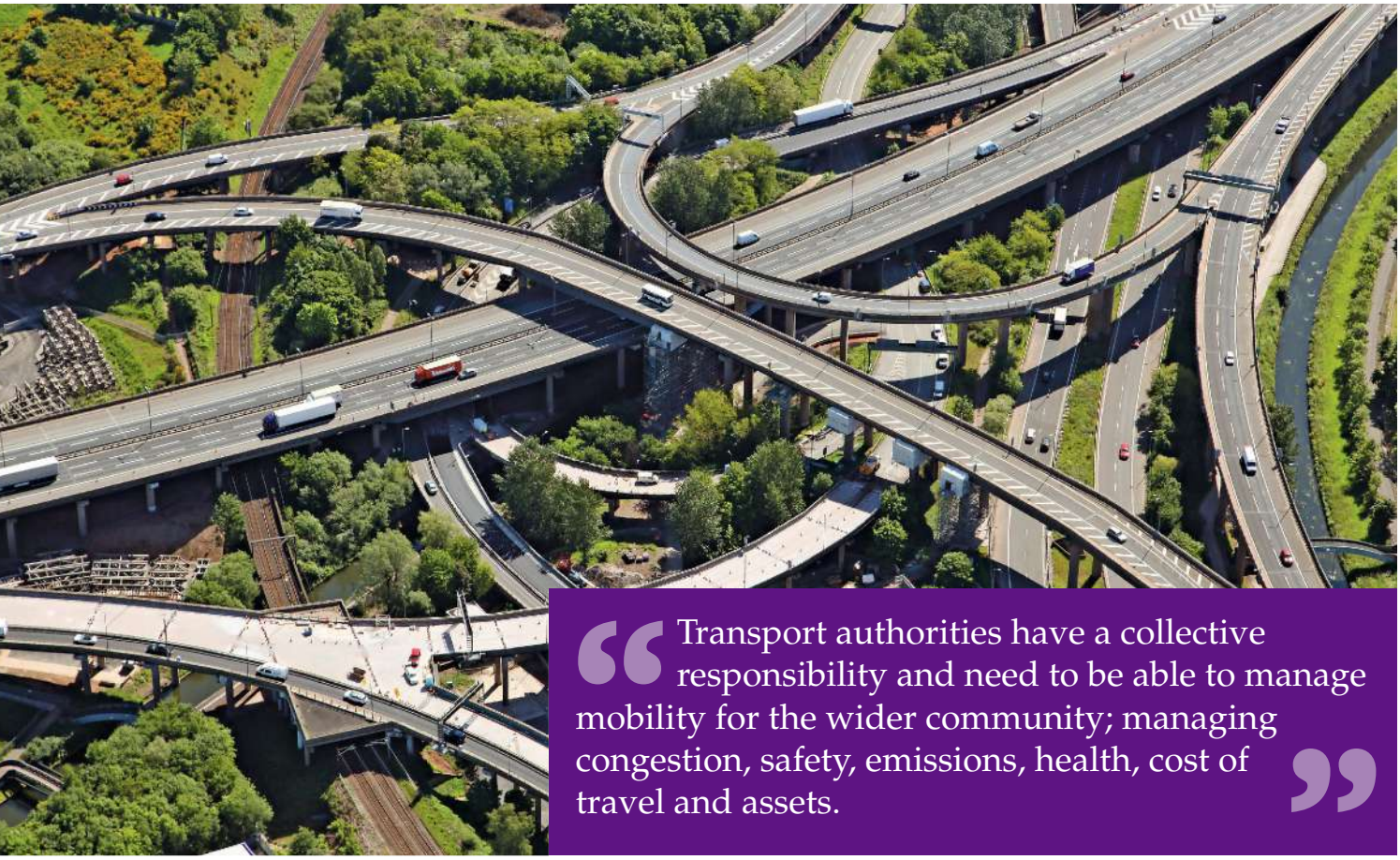
But there is a very long way to go in designing our mobile future, and we are entering what is often referred to as the 'valley of death' in innovation circles. This is when great concepts struggle to make it to the commercial stage because success only comes when all the pieces on the table are ready to be slotted together.

One of the pieces is transport infrastructure. This has lagged behind vehicle development and is arguably putting achievement of the wider social and economic benefits at risk.

There is an undeniable tension between the phenomenal rate of development of 21st century mobility solutions (including traffic technologies and app-based services or 'intelligent infrastructure'), and the persisting decade-scale lifecycle of roads and other large, high cost, low return-on-investment, 'unintelligent' infrastructure. The slow rate of decision-making in traditional transport circles is understandable and it has been argued that the lifecycle issue applies to the automotive industry too.

From memory, the standardised Ford Product Development System (FPDS) used to state that a facelift should take 24-36 months, and a full new vehicle programme would take at least five years from concept to 'Job 1+90 days'. But the current truth is that a company like NIO in China can get from nothing to medium-scale manufacture of a mature vehicle in three years. This must be because they are tearing up some of the conventions. It may be because there are some compromises being made on quality or functionality. The fact remains that they are halving the product development time. I suspect the main reason they are able to do this is because they are taking a novel, integrated and lean approach. Nothing new: look at Lockheed's World War II Skunk Works projects. What drove those pioneers in rapid product development was the desired outcome: they urgently needed a new aircraft to win a war.

If you look at the current levels of



> Transport authorities have a collective responsibility and need to be able to manage mobility for the wider community; managing congestion, safety, emissions, health, cost of travel and assets.

The notorious 'Spaghetti Junction' interchange at Gravelly Hill, Birmingham. Dr Daniel Ruiz says that transport infrastructure development must keep pace with new vehicle technologies to achieve economic and societal benefits. ALAMY.

autonomy, we are well on our way from Level 0 where the driver controls all aspects of a vehicle. Many cars will now assist drivers in some way. But we are still a long way from achieving the levels of safety that a widely connected, judiciously automated system can deliver. The transition to wide scale deployment of SAE Levels 3, 4 and 5 can only be optimised by evolution and integration of the whole transport system: a so-called 'system of systems' approach. The vehicle, infrastructure and commercial model are inseparable. The first of these elements is maturing rapidly, the second is behind the curve, and the third is dependent on the first two.

Transport authorities have a collective responsibility and need to be able to manage mobility for the wider community; managing congestion, safety, emissions, health, cost of travel and assets. The latest versions of adaptive traffic control systems (e.g. SCOOT, SCATS), video-analytics and other technologies can already be called upon along with pricing models and other economic measures to help influence traffic patterns and traveller behaviours. But highway authorities are more likely to spend millions on resurfacing and widening (with a return on investment of around 2.5:1) than implementation of technology-based solutions to congestion management (with a return on investment of more than 10:1). I have been told by executives at a major highway authority that this is because the low tech projects have a more dramatic impact on GDP and enable VIPs to do some vote-earning 'ribbon cutting'!

There are members of the vehicle crowd that won't wait for infrastructure to catch up, so they are trying to take it out of their complex equation. Reassuringly, the fast movers in the mobility movement are not unanimous in their antipathy towards infrastructure. Google AI evangelist Andrew Ng wrote in 2016: "Safe autonomous cars will require modest infrastructure changes, designs that make them easily recognised and predictable, and that pedestrians and human drivers understand how computer driven cars behave." Others in the same space have acknowledged the insights that can be provided by intelligent infrastructure and which can, on one hand, accelerate the maturation of connected and autonomous vehicles and, on the other, provide means for transport authorities and operators to influence traffic and manage mobility for society.

The good news is that this tension is beginning to make key players sit up and rethink their business models - where there is hiatus and higher levels of risk there is a need for leadership and shared investment.

So, in summary, society is going to transform whatever happens. We can influence the rate and direction in which it moves and there are enormous social and economic benefits to be achieved if we influence with adequate commitment. Therefore, my priority list for accelerating this social revolution (driven by transport) is:

First, to develop intelligent infrastructure in tandem with vehicles and service models to ensure rapid transition to the future state.

Second, to collaborate: nationally to ensure the sum of the parts is greater than any other country's 'whole', but also globally on critical topics (especially those linked to safety) to ensure we can exploit the potential to save lives through safer roads and reduced environmental impact.

And finally, we should use the UK's diverse, accessible and integrated development environment to carry out experiments which explore the potential of emerging technologies rapidly and courageously. A few fast (safe) failures from which we learn will be to the credit of the leaders that inspire us to remain at the vanguard. ST

Smart technology: the UK in a global context

Business and technology journalist **David Fowler** looks at where Britain stands in the development and application of smart transport technology

About the author

David Fowler is a freelance business and technology journalist. In addition to being editor of *Maintenance and Engineering* magazine, he is a former editor of *Transport Times*.

The introduction in London of Oyster and then contactless ticketing is widely considered a world first. The Government has explicitly set out its ambition to make the UK a leader in autonomous and connected vehicles, and has established the Centre for Connected and Autonomous Vehicles (CCAV) to invest £150m in the development of autonomous vehicles (AVs) over five years.

Recent research undertaken by technology and innovation centre Transport Systems Catapult and Deloitte found that the intelligent mobility industry could be worth £1.4 trillion globally by 2030. It identified several areas where the UK had a strong opportunity to make an impact: in connected and autonomous vehicles, 'new mobility' services such as ride hailing and smart ticketing, and in the use of open data.

However, the TSC also warned that investment and R&D models needed to change if these opportunities were to be grasped. And other ideas, such as Mobility as a Service, have been pioneered outside the UK. So, is the UK genuinely at the cutting edge of technology, or are there areas where other countries are further advanced or about to overtake?

Of the three technologies mentioned by the TSC research, it saw connected and autonomous transport as the largest global opportunity; new mobility services as providing potential for the fastest growth; and the use of open data as the area where the UK is currently strongest.

Transport Systems Catapult's Principal Strategy Analyst Ron Oren says there were opportunities for autonomous mobility not just in roads but in air, rail and marine transport as well. The market for roads, however, is expected to be by far the biggest, at £800bn to the others' combined £80bn by 2030, because the other modes have more onerous resilience and safety requirements.

Regarding smart ticketing, Oren says there are significant other dimensions to smart ticketing beyond contactless: for example, ticketless ticketing in which the system detects a passenger and takes payment automatically, for example via a mobile phone app - along the lines of the Amazon store. "The idea is that you as a passenger don't have to do anything," he says.

The next phase of evolution is likely to be dynamic charging, in which pricing can be varied to provide an incentive to people to travel off-peak. Artificial intelligence could work out that your normal pattern is to catch a train at 0900, and to provide an offer of a free coffee, for example, if you travel later.

Oren points out that the Netherlands has an Oyster-like system which covers a large proportion of the country, for travel between cities as well as within them, and Sweden is heading the same way.

In the exploitation of data, the UK has the advantage of the Open Data Institute, set up by World Wide Web inventor Sir Tim Berners-Lee and artificial intelligence expert Sir Nigel Shadbolt in 2012, to work with companies and governments to build an open and trustworthy data ecosystem. It helped to develop the open banking arrangements which allowed the creation of smartphone-based bank Monzo.

Citymapper, developed and headquartered in the UK, is a prime example of the UK's strength not only in sharing data but also in developing interfaces and software to exploit it. The open data platforms Transport API and Zipabout are other good examples of harvesting open-source data, cleaning it up and providing a single service. "The trick lies in how to monetise the data," says Oren. "Most of the value lies with the data aggregators."

Algorithms are now being developed to search through social media data and detect, for example, people tweeting about a delayed train, and then working out where it is and what is going on and sharing the information.

In connected and autonomous vehicles, the US has led, but Germany and Japan are also expected to be strong contenders because they are home to many of the big car makers.

None of the large car makers is UK-owned, but the country has other skills. "The UK's strength lies not in building the car, but in algorithms, artificial intelligence and to some extent sensors," says Oren. Organisations such as the Alan Turing Institute have helped put the UK in the top echelon worldwide in artificial intelligence.

"Part of what the Government is trying to do by encouraging tests of AVs is to use these strengths to attract some of the more traditional engineering into the country

The Alan Turing Institute was founded in 2015 as the UK's national institution for data science and artificial intelligence. Members include the University of Manchester, where this building was competed in 2007 to house its schools of Mathematics and Astrophysics. The institute is named after the famous mathematician and founder of computer science. ALAMY.

> "The UK's strength lies not in building the car, but in algorithms, artificial intelligence and to some extent sensors."
>
> **Ron Oren,** Principal Strategy Analyst ,Transport Systems Catapult

on the basis of being able to access the UK's AI skills." Similarly, the Government has sought to give the UK an advantage by developing a consistent regulatory framework to facilitate testing of AVs.

"A shift in mindset is needed concerning R&D and investment. The UK R&D model is focused on developing products rather than services. Developing a new product such as a train requires an upfront one-off cost, whereas developing a new way of buying tickets is more likely to require continuing costs to develop the service over time. The emerging market opportunities in smart transport - even the introduction of autonomous vehicles - will be mainly service-based.

"We need to think about how we can develop a model that works for services," says Oren. "Where the Government and TSC can help is in supporting large-scale demonstrations."

Is the Government over-focusing on the potential of AVs? Oren says: "There is a risk, but there's a reason for this, because we believe we can steal a march. The size of the UK is good as a trial market. Between the Government and the various catapults, we're trying to mitigate the risk."

TSC's Chief Executive has encouraged people to think more about mission-led innovation - for example how to commute from A to B in 30 minutes - and allowing innovation to take its course. "We're aware of the risk and we're trying to mitigate it by lifting our gaze: put the goal out and see how we get there," says Oren.

Andy Graham is Managing Director of transport consultant White Willow and an adviser to the Transport Technology Forum, a group which exists to encourage the adoption of innovative technical solutions for the improvement of traffic. He believes that rather than focusing on high-profile but not yet proven technology such as autonomous vehicles, the UK should "fix the basics". First, it should make better use of the technology it already has installed. Second, it should focus more on an area where it is strong - in using connected data in simple but cost-effective ways.

As an example of the first he cites the traffic signal control system SCOOT, which synchronises traffic lights at groups of junctions as well as changing signal phasing in real time in response to traffic levels. In many parts of the UK, SCOOT isn't working properly because many of the induction loops used to detect vehicles are faulty, and there is no money to mend them. It is estimated that every defective loop costs £9,000 annually in extra congestion, and adds 120 tonnes of carbon dioxide emissions.

In the US and Canada, where SCOOT has also been used and in some cases recently introduced, authorities are amazed by the 13% reduction in journey times that are resulting. Yet in the UK, where SCOOT has been in use for 30 years, the benefits are being lost.

For the second point, Graham points to numerous uses of connected data to make a series of small, incremental improvements. In Croydon, where extensive redevelopment of the town centre is under way, construction vehicles are being fitted with cameras to detect automatically the incidence of mud on the road, which poses a risk to cyclists.

Pay-as-you-go insurance, in which the car is fitted with a black box device which transmits data to the insurance company recording how and when the car is driven, is reducing deaths and injuries among young people while making car insurance affordable,

Having previously partnered with TfL, Cubic Transportation will now install an advanced transport management system in Sydney. CUBIC TRANSPORTATION SYSTEMS.

The Green Light Optimal Speed Advisory System (GLOSA) is one of several new and innovative technologies aimed at improving traffic to be pioneered in the UK. GLOSA.

and accumulating data about where and when bad driving is occurring.

In Harrogate, following trials, a smart parking scheme was set for official launch in January in which 1,600 on-street and surface level parking spaces have been fitted with Bluetooth sensors to detect when the space is occupied. Drivers using the AppyParking app no longer have to predict how long they will be staying and buy a ticket accordingly - instead, their vehicle is detected automatically and they are charged by the minute.

In Birmingham, Transport for West Midlands led a small-scale trial of the Green Light Optimal Speed Advisory system (GLOSA) on the A45 Coventry road, in which a smartphone app was used to advise drivers of what speed to travel to pass through the next green light. Vehicles in the trial there experienced a 10% to 14% reduction in stop-starts over the 6km route, and their journey times were cut by up to 7%. TfWM is now seeking to work with partners to scale GLOSA up and introduce it more widely.

Graham points out that even if AVs were available tomorrow, it would take around eight years before they formed half of the UK car fleet, whereas even a Model T Ford is connected if it is carrying a smartphone.

"We're not as good as other countries at telling people about successes in connecting vehicles to help local policies which would be considered great breakthroughs elsewhere in the world," he says.

Andy Taylor, Director of Strategy for Cubic Transportation Systems, Transport for London's partner in London's ticketing system, believes TfL's work on contactless payment is a genuinely groundbreaking. It has reduced the cost of revenue collection and opened up the public transport system to many new customers, and is generating enquiries from cities around the world. The system is being adopted in New York City, initially on buses and the subway with options to extend to the Long Island Railroad and commuter rail. New South Wales is the first state in Australia to adopt contactless payments for transport, which are being introduced alongside the Opal card, its equivalent to London's Oyster.

TfL's system has attracted some criticism for not being open to allow integration of cycle hire, car clubs and taxi hailing, for example. Taylor says: "When you look at London and many other cities, they have such an integrated transport system already that to layer on other modes in the central area could be counter productive - it could actually create more confusion and congestion. The approach TfL is looking at now, to bring in private transportation services to augment the transportation network on the periphery and bring people to their network, is probably the best approach to take."

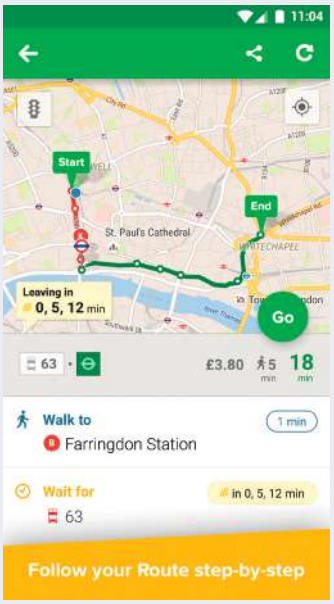
Such private organisations could include, for example, ride sharing, bike sharing and demand responsive transport services. Taylor cites how MaaS is being introduced in Birmingham as "a great test bed" to show how public authorities and private companies can work together.

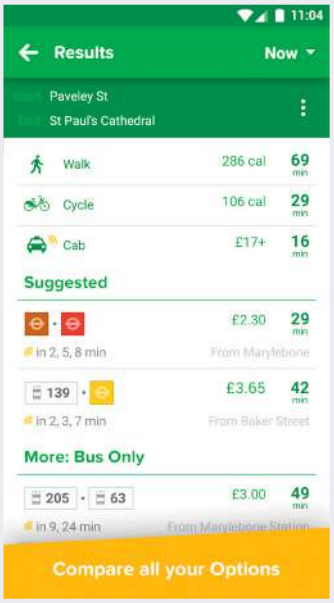
Elsewhere in the world, valuable work has been done on demand responsive transport in Australia, and in Sydney MaaS has sought numerous providers to take part in a series of trials throughout 2019 under its Innovation Challenge.

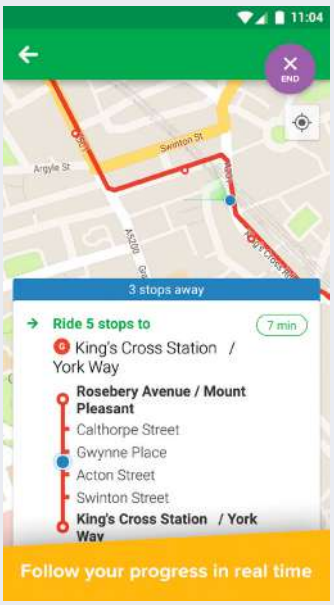
Taylor adds that intra-urban connections in the UK are generally well managed, but a growing concern worldwide is congestion around urban centres, adversely affecting public transport, private cars and freight. Cubic Transportation has been awarded a $35m, five-year contract by Transport for New South Wales to provide Sydney with what is expected to be one of the world's most advanced transport management systems, the Intelligent Congestion Management Program.

The new system will improve monitoring and management of the New South Wales (NSW) road network, coordinate all modes of public transport, improve planning

> "To bring in private transportation services to augment the transportation network on the periphery and bring people to their network, is probably the best approach to take."
>
> **Andy Taylor,** Director of Strategy for Cubic Transportation Systems







of major events and improve incident clearance times, as well as providing real-time information and advice to the public about disruption.

Many observers believe the most significant development in how transport is used and paid for in the imminent future will be Mobility as a Service. Following the UbiGo trial in Gothenburg in the early 2010s, the running has been made by Finland's MaaS Global, which successfully launched a full implementation in Helsinki. It has also launched the service in Antwerp. The UK is not missing out, and MaaS Global has launched its Whim package here, working with and encouraged by Transport for West Midlands.

MaaS Global founder and Chief Executive Sampo Hietanen spoke to *Smart Transport* during a recent visit to London on a capital-raising tour which would also take in the US and Asia, for what he sees as a bid to take on the dominance of car ownership.

Finland remains in the lead in this area so far, Hietanen says. Whim is marketed as providing an alternative to car ownership, allowing people through a single mobile phone app to use public transport, bike share, taxi and car hire on either a pay as you go or monthly subscription basis.

Out of a population of half a million in Helsinki's central metropolitan area, 70,000 are using Whim. Following the full launch in November 2017, the milestone of a million rides using the app was reached within nine months. The second million followed in less than three months and by its first anniversary the service was well on the way to the three million mark.

Hietanen says an advantage of launching in Finland was that it had a suitable regulatory framework. As a market, it is relatively small - the population of Helsinki is similar to that of a Tokyo suburb. "But it's a really good testing lab to show how MaaS will evolve, with limited risk." Another advantage is that everything is completely mobile - all travel planning and payment for all modes can be carried out completely by mobile phone.

In Antwerp, where Whim was launched in autumn 2018 and is competing with three other MaaS providers, take-up has been "really fast", says Hietanen, with 10,000 users by the end of November. "It's ahead of the West Midlands because it's completely mobile, allowing easy access to bike share and taxis as well as public transport over the whole of Flanders." He admits there is still work to do to expand its offering of car clubs and car rental, important because Antwerp is a car-oriented city.

In the West Midlands, Whim underwent a limited scale launch in April. This revealed some teething problems. For a [planned] larger-scale launch in December, The Trainline was to replace SilverRail as the partner for rail booking. A drawback, Hietanen says, is that some elements still require a smartcard for payment, which goes against the aim of simplicity for the user.

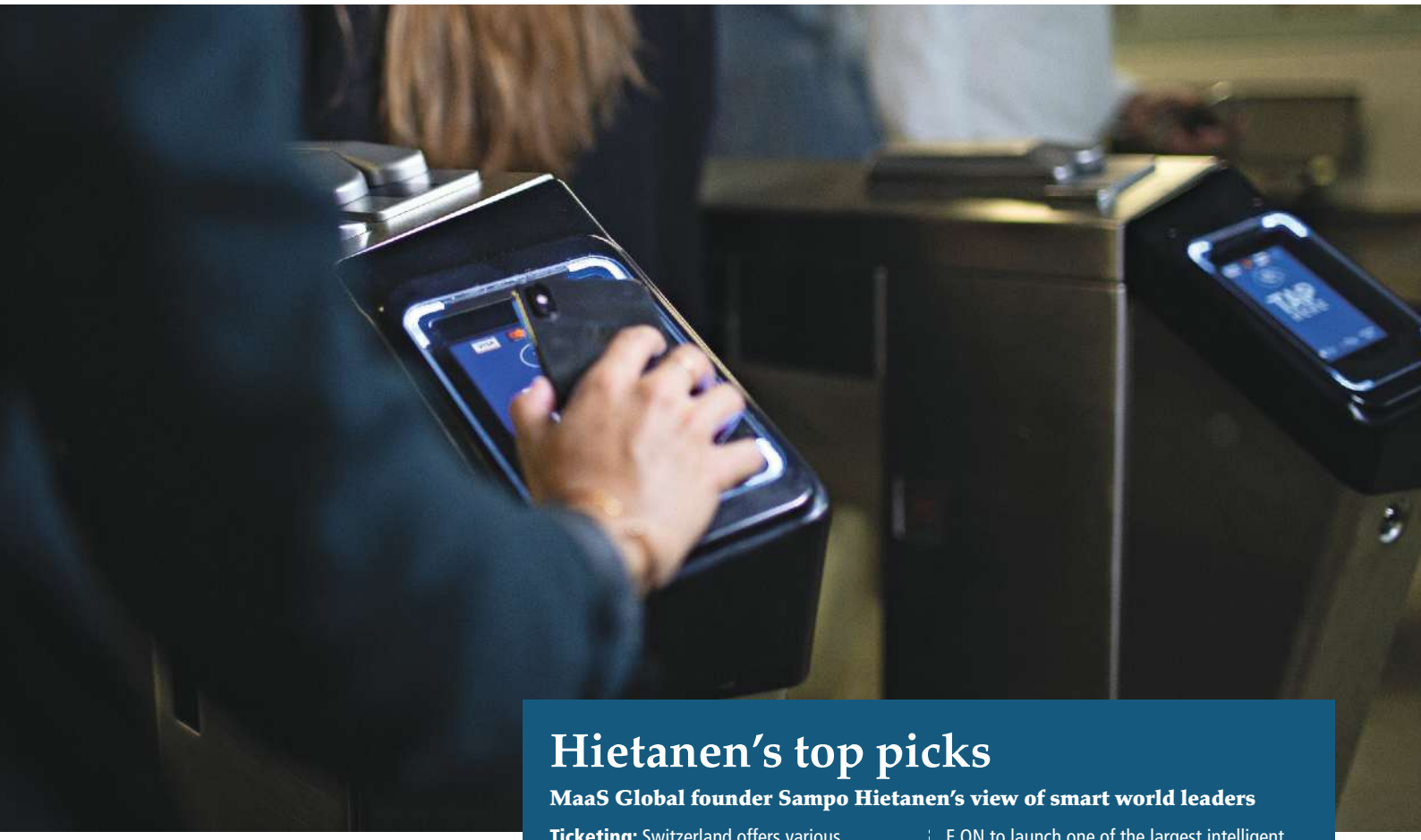
> "In the UK people hardly take the car outside the country. To compete with the car in Antwerp there are four or five countries you have to operate in."
>
> **Sampo Hietanen,** Chief Executive, MaaS Global

The philosophy behind UK legislation for reselling rail tickets is also not ideal: it is a requirement to offer all providers and all the different ticket options, again working against the idea of simplicity. "Our view is that if you buy a monthly subscription giving you unlimited travel, then you don't need to be able to see and compare all the individual tickets," he says.

Nonetheless the aim is to extend Whim UK-wide in the first half of 2019. Hietanen believes the UK is a good market for several reasons: he sees the privatised rail market as a positive, providing a variety of ticket offers ("it's close to being the best in the world," he says); the Government is already quite well informed on transport issues; and the size of the market is neither too big nor too small. An additional advantage from the point of view of "going up against the car" is the fact that Britain is an island."In the UK people hardly take the car outside the country. To compete with the car in Antwerp there are four or five countries you have to operate in," Hietanen says.

He has also been surprised by the number of enquiries from companies about Whim's top level subscription model as an alternative to a company car. At €499 monthly, for the price of owning a car this package provides

Developed in the UK, Citymapper integrates data for all urban transport by using data that is either open-sourced, or user generated. Started in London, the free mobile app now covers cities in every continent except Africa and Antarctica. CITYMAPPER.



Cities including New York and Sydney have followed London's lead on contactless payment and are adopting similar systems of their own. CUBIC TRANSPORTATION SYSTEMS.

unlimited access to public transport, taxi or a car according to the user's requirements. A barrier is that in the UK company cars attract tax concessions, whereas Whim would be fully taxed.

His message to politicians is that it's important for MaaS to be at least at the same level as the car. "The minute that starts to happen, MaaS will take off," says Hietanen.

The concept of MaaS is that it forms an extra layer above existing planning and payment systems, aggregating or integrating. In any given market, it needs to be able to tap into pre-existing travel information platforms. "Travel information usually exists," says Hietanen. "What's lacking normally is payment and validation."

He admits: "You need a whole ecosystem or you don't have a product.

"For this reason, he encouraged the foundation (and was a director until recently) of the MaaS Alliance, a non-profit organisation designed to bring stakeholders including technology providers together internationally "to look after the whole ecosystem".

Hietanen's top picks

MaaS Global founder Sampo Hietanen's view of smart world leaders

Ticketing: Switzerland offers various smartcards covering public transport throughout the country – around 250 operators.

Intelligent Transport Systems: Rotterdam has an 'anti-toll' system whereby transport users can earn money, via various service providers, by avoiding congestion. An example is free gym membership worth 180 euros monthly if you bike to work.

Electric vehicles: Finnish electric vehicle charging company Virta has developed technology to optimise energy flow through charging stations, allowing for volatility in the supply, as well as managing billing. It has formed a partnership with electricity company E.ON to launch one of the largest intelligent and interoperable EV charging networks in Europe.

Autonomous vehicles: Hietanen argues that the way technology is used is key, and points out that the Organisation for Economic Co-operation and Development (OECD) reported that if AVs are used in a door-to-door model they could add considerably to vehicle miles. If they are used mainly for travel to stations and other transport hubs they will reduce congestion. He cites Hamburg's Switchh, in which car club cars, bicycles and e-scooters are integrated at selected interchanges around the city, as the model to follow.

Another global non-profit organisation, TravelSpirit, is also helping to drive the whole industry forward. It is a network of small and medium companies, academics, city authorities and larger companies and organisations, with the aim of creating an open infrastructure for MaaS - or, in Chief Executive Giles Bailey's preferred term, new mobility.

He says: "In a sense transport is global. Everybody's in front and everybody's behind in some way. Even though it's a global industry there are very local issues."

The UK has advantages as a market. Diversity in the rail industry means there is a wide range of views about how heavy rail can be provided, and this allows scope for innovation. The UK is good at fostering an entrepreneurial culture. The fact that congestion is a problem "makes finding solutions all the more important, for all the modes". And the UK, and London in particular, is seen by businesses as a focus for innovation and a good place to test and develop new solutions.

He cautions against seeing transport as a competition, with a winner, and a 'winner takes all' mentality. "You need to think very carefully about the ecosystem and don't get into the position where the best funded or first to market dominates the delivery of transport." ST

Sam Li

Senior Innovation Officer, Transport for Greater Manchester

We are living in exciting times in the world of mobility innovation. David Fowler's article highlights trials occurring all around the country, and demonstrates UK desire to be a world leader in mobility innovation, both in the public and the private sectors. But it also underlines the potentially disruptive areas of the future of payments, on-demand mobility, and Mobility as a Service (MaaS).

The concern is that all this could lead to increasingly fragmented systems development, resulting in inconsistency for customers and creating a challenging environment for regulation and management. There could, however, be an opportunity for the UK to frame new global standards on mobility, ensuring interoperability between commercial companies and public sector partners. For example, creating an open ecosystem with a low barrier of entry has enabled mobility innovations such as Citymapper to thrive.

Increasingly, public sector organisations are exploring the value of improving mobility capacity via digital means rather than traditional investment in physical infrastructure - development of back-office control systems is working towards the future of smart cities. But while mobile phones have changed the way in which mobility is provided, by switching to a more personalised and customer centric offerings, we need to rethink how people travel.

The UK has historically been leader in intelligent transport systems (ITS) technology, yet innovations such as SCOOT and GLOSA showcase the next steps in the cooperative-ITS (C-ITS) journey. Many developing countries are investing in this area to accommodate the growth of their economies and populations. And with China laying out plans to create an artificial intelligence (AI) industry worth $150 billion in the next 15 years, how should the UK position itself for future foreign competition?

The UK Government has created a unique opportunity with Local Industrial Strategies and a number of sector deals to help answer part of these challenging questions. We now need to look at mobility beyond its own eco-system and explore how the innovation impact on area such as health, clean growth and future of work. Could MaaS be the fundamental mobility innovation that joins all of these themes together? And how should the UK support the education and development of the next generation of mobility professionals?

Exciting times, indeed. ST

Martin Higgitt

Independent consultant

David Fowler's summary of how the world of new mobility is evolving and where the UK is positioned highlights the breadth of areas being touched on by innovation and the pace at which things are changing. But with so much innovation happening in so many areas, where should our priorities be?

There is so much investment and interest in connected and autonomous vehicles (CAVs) that this area cannot be ignored, though tactically perhaps, the UK has a stronger unique selling point in the algorithms and artificial intelligence rather than the vehicles themselves.

The concept and development of Mobility as a Service (MaaS) has shown incredible progress over a short time. The ultimate MaaS philosophy of seamless end-to-end journeys and a mobility offer that is better than owning a car is compelling. Regardless of how or when a MaaS service comes to town, it would seem prudent to get ourselves MaaS-ready. Making existing information and ticketing systems more user-friendly, encouraging the development or expansion of services such as car share or bike share, and physically improving interchange hubs - which are likely to become far more important in a MaaS world- are things we could be doing right now which are of benefit in their own right.

But rather than fixating solely on future technologies, it is important to retain a focus on the here and now, and ensuring that we are exploiting existing technologies to their optimum. As Andy Graham points out, technologies such as SCOOT are widespread and have the potential to improve traffic flow and reduce congestion if properly maintained and deployed. Cubic's work in New South Wales shows how new approaches to data management and communications can be integrated into existing transport management systems to provide better real time management of the transport system, as well as better real-time and disruption communications with users.

As is always the case with high-paced innovation, the world of policy and regulation is playing catch-up. Last year, the Government launched its *Future of Mobility Grand Challenge* and invited consultation responses, as well as chairing a Parliamentary Sub-Committee on Mobility as a Service.

So that we don't lose sight of the end goal and become fixated on technology for technology's sake, a restatement of national transport policy objectives - and how these new technologies and services will contribute towards this - would be helpful. Presumably, this will include enhancing safety, decarbonising transport, and, fundamentally, ensuring that these new technologies and services are accessible to all - in terms of geographic coverage, affordability and physical accessibility. It is imperative that we avoid a situation where new services and technologies are accessible only to a portion of the population and a new form of 'mobility inequality' develops. DfT should be publishing its *Future of Urban Mobility Strategy* soon.

TravelSpirit's response to the *Future of Mobility* consultation provided a good articulation of what needs to happen regarding open-source technologies. Legislation and regulation to open data and to enable these new service models to operate on a level playing field would be helpful, perhaps emulating some of the ideas from the Finnish Transport Code (sometimes regulation is frustrating innovation by providing hurdles to new service models, and sometimes new entrants can dodge regulatory requirements that apply to existing transport modes). There is likely to be a legislative and regulatory backlog, due to the Government's current focus on other issues.

So, in the meantime, continuing to pilot new technologies and service models in a "regulatory sandbox environment" (to use TravelSpirit's phrase) would seem a priority in helping the UK to innovate in the world of new mobility. ST

Ben Lawson

Vice-President of Strategy and Mobility for the UK and Ireland, Enterprise Holdings

The role that technology will play in the evolution of mobility is a fascinating topic. Given that systems such as the Oyster card show the UK has been ahead in mobility-related technology in the past and questioning how the UK may take the lead on this dynamic global journey is an important aspect of the future solution.

The innovations this article highlights are at the heart of how we will address our biggest challenges of a growing urban population, congestion and air quality. All three challenges have an impact on mobility, so that should engage each one of us to find solutions.

So, is now the right time for the UK to take the lead and can it be done? The short answer is yes - the UK simply has far too much to gain not to take the lead.

If improved air quality and reduced congestion isn't enough to grab attention, then the estimated £800 billion value of the autonomous mobility industry by 2030 surely does. David Fowler's article highlights many of these opportunities and those who are shaping the new mobility landscape.

For the first time, it is widely acknowledged that the cost of doing nothing now exceeds the cost of change. This is because the EU has ruled that the majority of UK cities either have or are projected to have areas that exceed legal nitrogen oxide (NOx) limits. The UK Government has responded by pushing forward with Clean Air Zones that are to be implemented by local authorities. As our cities search for answers to help meet new mobility regulation we must also keep the individual consumer at the heart of what we do.

Increased taxation and costs for the private motorist have taken many forms over the years and few have proved to have any impact on private consumers' thirst for vehicle ownership. So, can technology help us change the model and influence consumer demand for mobility as well as make mobility more efficient when it is essential? This is another aspect of technology that needs to be addressed and which is currently being evolved through car clubs and initial Mobility as a Service (MaaS) pilots.

To truly influence consumer demand, we need to learn from what has worked well and what hasn't and evaluate if technology can provide answers. Increasing the cost of motoring hasn't worked. Even dynamic pricing, which already exists in many formats across the market, hasn't prevented the consumer from holding on to their private vehicle. In a world where convenience rules, consumers need real choices that provide them with better options. They need to save time and enjoy an improved experience.

The article cites the need to use private transportation services to give people access to public transport. However, given people within the public transport network still own a car, this can only be a partial solution. A truly integrated multi-modal transport network that provides the right choices for consumers for each of their mobility needs will help to optimise transport choices and use by offering the best convenience and choice for all journey types. From the commute to the family day out, the school run to the shopping trip, each journey may need a different mode of transport or combination of many modes

The article points out many of the innovations MaaS applications can bring if the environment is created for them to succeed. They have the potential to add visibility and convenience to an integrated transport solution together with access to car clubs or car rental for more bespoke travel requirements.

So, although the UK did not invent MaaS, do we now have an opportunity to lead the way? There are still challenges to overcome with MaaS, as the article demonstrates. Showing thousands of permutations on journey types on a smartphone does not necessarily help the consumer to evaluate price, speed, emissions or other measures required to make the best choice for a trip.

If the UK is to lead the way, then it requires collaboration and a new way of thinking about transport. The answer has to be multi-modal (mass transit and shared mobility) and include a new partnership between national and local government with private and public transport providers to ensure the consumer has the full suite of mobility options. In the short term, the UK Government should make it clear this is a country to test, innovate, pilot and pioneer new mobility solutions. ST

ALAMY

Cars: uninstall, re-install, reboot

CoMoUK executive director **Alistair Kirkbride** invites you take a few minutes to redesign the motor car and rethink its role in society

To some, cars are either the bane of society or the embodiment of freedom. But for many, they are just a tool - used to varying degrees of enthusiasm or reluctance. Overlay on this the allure or horror (cast your vote) of the shift to autonomy, and the threads of the arguments of 'goodness' of cars in modern mobility are tightly woven and seemingly impossible to untangle.

This is a bit of a problem for various reasons, no matter where you stand. Is it even possible to have a fairly objective assessment on whether and how cars best fit into modern mobility?

We are travelling less and using cars less; younger people are using them a lot less. This plays out in the bumpy decline in car sales; January new car registrations have reduced by about 25% over the last 20 years, for example.

The list of explanations used by the motor industry for the dips in sales is wearing a bit thin, and the investment in the global giants in cars-as-service in various guises is testament to an acknowledgment that we are moving towards a post (privately-owned) car mobility world.

So for the next ten minutes, let's uninvent the car, re-invent it, consider its benefits and drawbacks, and work out whether and how it best fits in to modern mobility. It's like updating your operating system and doing a re-boot for the changes to take effect.

If we did this, I'd suggest that the system would look a bit different to that of today. I accept that uninventing something is like making yourself 'unsee' or forget something, but let's just play the game and see where we get to.

What we aren't going to do is wallow in the promised worlds of self-driving cars; I am more interested in the pragmatics of most peoples' everyday lives for the foreseeable future using services and technology that exist.

> "There may be a role for private cars in places where geography does not lend itself to efficient public transport; it is likely that these would be in shared ownership."

About the author

Alistair Kirkbride is Executive Director at CoMoUK, the research consultancy playing a leading role in the UK's transition to integrated mobility solutions.

Stripping back the politics and agendas - the car is a pretty good invention. They allow people to move themselves and a certain amount of other people and/or luggage pretty much from wherever to wherever, whenever. They are the ultimate demand-responsive transport. In the new world of personal trainers, shoppers, just-in-time/next-day/on-demand living, the car slots in pretty well.

But if the car was invented today - as a disruptor like Uber or urban bikeshare - how would we slot it in to our lives? For a start, it would be difficult to own one and expensive.

Let's assume that most of the 609km^2 that has been estimated is dedicated to car parking in the UK (9,104km^2 in the USA) would not be available. This would partly be because we just wouldn't want to dedicate such valuable space to parking metal boxes that stay still - and therefore have no functional value - for 94% of the time. Moovel's "What the Street?!" creates some pretty compelling interactive data-driven visualisations of what could be done with the urban space that is currently dedicated to cars.

And would we be prepared to dedicate such a significant chunk of our household income to car use? Transport costs represent the largest single item of household expenditure in the UK (14.3%), and the majority of this for most households is on private car use. Over 40 years ago, amid the oil crisis in the USA, Ivan Illich worked out that if we took into account all the time dedicated to car ownership (use of the car plus time worked to afford to buy, fuel, tax, insure park etc), then the average speed is about 3.7mph. We can take the detail of this apart as much as we like, but if the car was invented today, would we choose to behave like this?

I'd therefore wager that in the rebooted mobility system, we wouldn't own cars. We'd use them when they were the right choice (a utility) or when we wanted to do so for leisure reasons (eg 'Sunday driving'). Michael Glotz-Richter's oft-used analogy with a shopping trolley makes a lot of sense; shopping trolleys are (like cars) really useful demand-responsive mobility tools, but we don't think about owning them.

In the rebooted system, let's consider how cars might slot in to three contexts: urban family life, tourism areas and rural living.

Take a typical family (whatever this means). They would be living located relative to being able to access the places they need to go - mainly work and school. The main breadwinner would be able to commute, probably using scheduled urban transit - train, metro or bus. This might involve a bit of cycling or bikeshare to access the transit. Journeys for work would be by public transport, or by car that is available out of a pool.

The British Vehicle Rental and Leasing Association's 2016 research on Grey Fleet

outlines neatly the roles of different types of shared car use in the workplace, all framed by the imperative and shift away from private car use. The car pool would probably be available to a range of local businesses plus residents at evenings and weekends, and would probably be used for about 30% of the time (compared with about 6% for most private cars). The second adult might work part time and their mobility lifestyle would be more mixed – some similar commuting and more local travel by bike. They'd probably also use taxis (shared or on their own) or neighbourhood car clubs for tricky journeys. If anyone did shiftwork or worked unsociable hours, they might use a rideshare scheme or dedicated works shuttle. The children would walk or cycle to their local schools or colleges. Trips away at weekends would be multi-modal, probably based around first-mile to scheduled transport, and more flexible last mile, possibly including car club cars to explore or access the destination. Luggage may be forwarded to the destination by courier.

So cars would have a role, but only as part of a more balanced, pragmatic mobility package.

And what about when we are visitors? The standard offer of rural tourism areas such as national parks would be integrated travel cards akin to ski passes. These would provide access to scheduled transport networks which are overlain by demand-responsive services. Cars would exist as locally based taxi services and pay-as-you-go car club vehicles, allowing for independent exploration. Mobility would be part of the quality of the visitor experience; 'mobility freedom' would mean being able to access places easily and at reasonable cost. Some services would be more novel, including boats, ebike fleets and pedicabs. In the Lake District, Brecon Beacons & elsewhere, 'flocks' of Twizy EVs have been available for rental for a few years, blurring the boundaries between transport and visitor experience. AV pilots serving visitor areas would expose the general public to new technologies.

> "I'd wager that in the rebooted mobility system, we wouldn't own cars. We'd use them when they were the right choice (a utility) or when we wanted to do so for leisure reasons."

Visit England's recent research into the changing demands of visitors points to a car-irrelevant visitor economy. Visitors are increasingly demanding genuine experiences that are discoverable, being connected and customisable among other things. Being tied to a private car just doesn't figure in such projections, but cars would slot in – again for tricky journeys.

Rebooted rural mobility gets interesting. There would be an effective framework of scheduled and demand responsive bus services. Cars would figure in three ways - as locally-rooted taxi services, car-based volunteer driver services and settlement based car clubs. These would serve journeys of complex routings beyond the reach of public transport and specific needs, such as access for vulnerable people in more isolated areas. There may be a role for private cars in places where geography does not lend itself to efficient public transport; it is likely that these would be in shared ownership - among neighbours - and often used communally or for ride sharing.

In the rebooted mobility system, cars would still exist, but the idea of a private car just wouldn't figure like it does today. Most of the mechanisms through which cars would be accessed already exist - car clubs, rental, pools etc. Regulation would need a serious rethink - so that a car could flip between being a car club vehicle, taxi, rental or micro-bus. We'd need to dust off, update and implement the Commission for Integrated Transport's 2008 work on 'taxi-plus' services too. It would be great to think that the global car industry's focus on marketing ownership would be replaced by mobility 'service envy' within which cars (via shared access models) would be a component alongside other modes. This is starting to happen, and it is good that new agendas such as the Shared Use Principles for Liveable Cities are emerging to ensure that public benefit and better places are prioritised.

Terms such as 'Smarter Travel' and 'Intelligent Transport' usually refer to the role of technology in transport. Rebooting the mobility system following an uninstall and reinstall of the car allows us to use these terms differently; it's about making intelligent decisions about modes for journeys - and cars play different roles in different contexts - but it is just a role alongside and equal to other modes. We can already deliver what is needed using existing technology and tried-and-tested services.

The shift from mode-focussed 'transport' to 'mobility' means that we are re-thinking the role of the car. But are we going far enough fast enough? Extracting cars and re-inserting them into today's mobility may be a way of thinking about how to be a bit smarter now rather than being blinded by the promises of the future. Modern mobility could be fantastic based on what we already have. We just need to be smarter and braver re-configuring how it all fits together. ST

▼ **A club car utilises a priority parking space in London.** ALAMY.

Swift, smart solutions

By focusing on shaping tomorrow's world, it is easy to lose sight of the more immediate challenges. Transport planner **Martin Higgitt** asks what three things you would do right now if you had the power

About the author

Martin Higgitt is a transport planner with 20 years' consultancy experience with SYSTRA, JMP Consultants and Steer Davies Gleave. He formed Martin Higgitt Associates in 2017 to provide independent consultancy advice to clients wanting to promote sustainable travel. He is a member of the Transport Planning Society and Act Travelwide and was previously a board member for CoMo UK.

In a period of rapid innovation, with new players coming into the industry and promises of transformation, lots of bold promises and enticing visions are being made about the future of mobility. And these utopian new worlds are just a few years away according to many advocates.

But what could be done now to enable these new services to take off while delivering benefits in the interim? Given all the uncertainty surrounding this period of disruption in the transport industry, not to mention broader political uncertainty, just what policies and investments make sound sense?

Smart Transport asked five senior professionals from the corporate sector - and on the Editorial Board - the three things they would do now. The question was left deliberately open-ended, so as not 'lead the witnesses'! However, there was a striking similarity in the views expressed by the respondents, who were from a technology company, an energy business, a vehicle fleet manager, a lease operator and a core global cities representative.

In broader public debate, there is often a rather simplistic dichotomy presented between the private sector (entrepreneurs) and the public sector (regulators). What was clear from our interviewees was that navigating the route to better future mobility requires a strong partnership between private and public sectors. The private sector wants and needs strong policy leadership and craves certainty, consistency (across policy areas), and, crucially, long-term commitment.

Despite a perceived dichotomy in opinion between protecting the economy or the environment, the need to decarbonise transport remains a unanimous imperative for both the public and private sectors. ALAMY.

Another dichotomy often presented in public debate is the supposed tension between the economy and the environment, with measures to protect the environment often portrayed as adding extra cost. Again, there was great clarity from our interviewees. All of them saw the critically important objective of decarbonising the transport sector, in terms of climate change and also in terms of tackling air pollution within towns and cities. "Climate change is no longer a long-term issue, it is an immediate one," says Caroline Watson from climate leadership group C40 Cities.

But they also saw major economic benefits and opportunity in moving quickly and decisively towards electric and alternatively-powered vehicles. BP - which many might think of as being a bastion of conventional fuels - recognises and embraces this change. Its Advanced Mobility Unit is working across a range of areas to reposition itself for an all-electric world.

"We want to offer the most convenient network of charging at forecourts, destinations and at home," says Jo Dally, BP's Global Cities Strategic Partnerships Manager, Advanced Mobility. The oil company's ambition is for ultra-fast charging at its network of forecourts - which it reckons serves the vast majority of the UK population within 20 minutes. Ultra-fast charging will allow people to charge cars within ten minutes, making the 50% of households without off-street parking or the ability to charge at home able to contemplate electric vehicles, as well as enabling commercial fleets and taxis to make the shift.

Anglian Water is embracing the electric world. While this aligns perfectly alongside its corporate ambition to become carbon neutral, as the biggest energy consumer in the East of England, it is starting to realise the economic sense. It is generating its own renewable energy at its sites and building its own charging infrastructure, developing a circular economy.

Vehicle fleet managers and fleet providers also enthuse about the move to electric. "With 60% of new vehicles being purchased by fleet, we have the spending power to alter the market, driving down the production costs of electric and then creating a large second-hand market for the public to tap into," says Stewart Lightbody, Anglian Water's Head of Fleet.

What this range of players wants most from the Government is certainty and commitment. While the policies say the right things, this needs to be supported by actions over the long-term to enable industry to invest with confidence. The constant changes to EV grants and incentive schemes make it more difficult for fleet managers to plan ahead. "The benefits-in-kind tax position on plug-ins and electric vehicles needs to be clarified for the next five years," says Matt Dale of ALD Automotive. "This will allow people to invest in electric with confidence, knowing that it makes sound economic sense."

There was also unanimous agreement that electrification of the fleet is integral to the development and roll-out of connected autonomous vehicles or for service models such as Mobility as a Service (MaaS). So, electrification of the fleet, alongside the development of charging infrastructure at the national and local level, would seem to be a rock-solid investment, beneficial in its own right, but opening up a whole range of opportunities.

A further area that industry looks to the Government for support is in regulation of data, in relation to accessibility, legal protections and cybersecurity. "There is currently a massive diversity in strategy and implementation across the UK, which is down to inconsistent leadership and understanding of the technology," says Daniel Ruiz, Chief Executive of Meridian Mobility UK. He adds that having a consistent approach towards data standards and to intelligent transport systems

infrastructures across the UK would help industry to develop and scale up solutions more quickly and efficiently.

Unifying many of these themes is the need to move forward in partnership. Ruiz proposes a Mobility Council, similar to the Automotive Council, to set a common, co-ordinated agenda for the future of mobility. BP's Dally is keen on a forum for bringing together the corporate and public sectors to align industry development and investment with public policy.

In a world of disruption and uncertainty, there is a striking level of agreement between our interviewees, as well as a strong alignment between private sector interests and public sector policy outcomes for decarbonising transport. They share a hope that a strong shared vision for future mobility can be developed - perhaps the Department for Transport's future of mobility strategy will go some way to articulating this. But alongside this, they want pragmatic and shorter-term policies and action plans to enable beneficial actions to be taken right now.

Despite the majority of our panel having some sort of stake in the car industry (as technical developers, fleet managers or fuel providers), there was also a concern that government and society doesn't lose sight of broader policy objectives and outcomes. They all recognised the need for transport to address and respond to broader policy objectives, such as around health and creating attractive, vibrant cities.

Dale wants to see stronger attempts to encourage non-car-based mobility where possible. Watson reminds us that technology is an enabler and, within cities, the focus should be first and foremost on making cities liveable. While electrification of the fleet will make an important contribution to reducing emissions and improving air quality, this needs to be accompanied by supporting appropriate mobility. Watson points to Copenhagen's investment in cycling and walking over the decades, such that 62% of journeys to work and to school are now undertaken by foot or by bike. She concludes: "Our cities are showing us that change is possible. We just need the will and the leadership from business and policymakers to make that change."

The three things we'd do now

Caroline Watson, C40 Cities

Caroline Watson is Programme Director for Transport and Urban Planning at C40 Cities Climate Leadership Group. C40 is a network of the world's mega cities taking action on climate change.

She says: "The recent IPCC [UN Intergovernmental Panel on Climate Change] report calls for urgent and radical action on climate change to keep global warming below 1.5 degrees [see graph, p33]. The world's most renowned scientists are now saying that decisive action is needed between now and 2030 if we are to avoid runaway climate change.

"Climate change is no longer a long-term issue, it is an immediate one. On top of this we have a global air pollution crisis, with many cities regularly exceeding air quality standards on particulates and nitrous oxides. Moving towards zero emissions as quickly as possible will benefit both these agendas."

To facilitate this move towards zero emissions, Watson says C40 Cities would do the following three things:

- Refocus every policymaker and business investor's minds on the definition of smart: Smart transport must mean a transport network that is transitioning to zero emission now, and is robust in the face of a changing climate.
- Encourage every city to sign the Green and Healthy Streets (Fossil Fuel Free Streets) Declaration: in which cities commit to procure only zero emissions buses from 2025, and to ensure a major area of their city is zero emissions by 2030. Twenty-six global cities including London, Greater Manchester, Birmingham and Oxford have already signed the declaration. Many of these declaration cities are already exceeding the commitments. All new buses in Seattle will be zero emissions from 2020 and run on renewable electricity, and the City of London is introducing a zero emissions zone in 2022. If every city made these commitments we would be well on our way to a sustainable future.
- Prioritise people over vehicles (and provide city authorities with the necessary powers to do this). If the first consideration is how to make our cities liveable and our citizens healthy, we'd recognise the need to reduce emissions, increase physical activity and reduce time on long commutes in congested traffic. Prioritising road space for walking and cycling makes roads safer so people can feel confident and safe to choose such modes. In Copenhagen, 62% of people walk and cycle to work and study, showing that when investments are made in infrastructure, and planning considers bicycles as equal to cars, major changes in the use of different modes can be achieved – at the same time as enhancing the quality of space and liveability of cities."Our cities are showing us change is possible. We just need the will and the leadership from business and policymakers to make the change."

Jo Dally, BP

Jo Dally is BP's Global Cities Strategic Partnerships Manager within BP's Advanced Mobility unit. Its work areas are electrification, mobility services and city partnerships. Jo leads work with cities and city networks on the latter.

"BP's vision is for ubiquitous ultra-fast charging as part of a broader ecosystem, including home and destination-based charging," she says. It believes this will help remove the nervousness that the public currently has about taking up electric vehicles, including range anxiety, the inconvenience of diverting a journey and significant delays to recharge.

The oil company has a network of forecourts within 20 minutes of the majority of the UK population, so this is potentially a real asset in providing locally-available ultra-fast charging. This could benefit consumers as well as taxi and fleet vehicle users that can't afford to have significant downtime, and the 50% of households that do not have off-street parking to facilitate charging at home. BP has recently acquired Chargemaster and invested in FreeWire, a manufacturer of mobile rapid charging systems for electric vehicles.

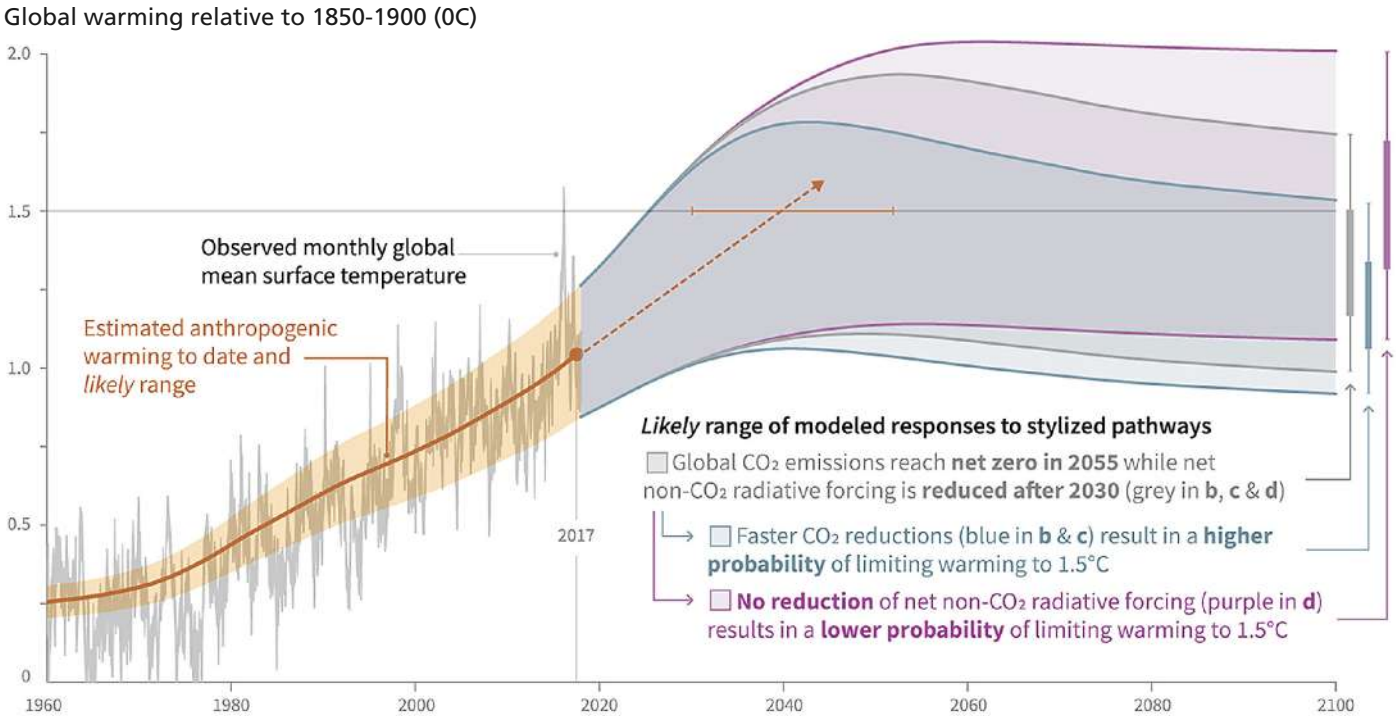
To facilitate this vision, the three things BP would like to see happen are:

- A forum to bring partners together: "There's a need to bring together policy and investment, and the public and private sector communities," says Dally. "To deliver that future ecosystem, there is a need to invest ahead of the market in the infrastructure that would enable it. We need to understand what that investment model is, what the roles of the public and private sectors are, and what the challenges could be."
- Researching and developing new business opportunities: "When this ultra-fast charging network has been developed and all cars are connected, there will be a host of new mobility services and business models emerging. There is a need now for the private sector, cities, government, investors and the start-up community to come together to explore these opportunities.

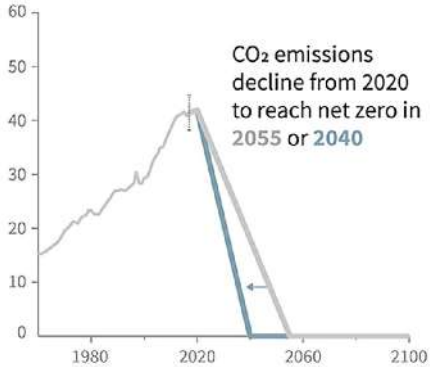
"How do we capitalise on this early

Cumulative emissions of CO² and future npn-CO² radiative forcing determine the probability of limiting warming to 1.5°C

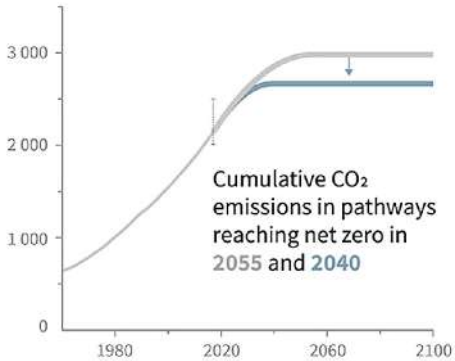
a) Observed global temperature change and modeled responses to stylized anthropogenic emission and forcing pathways



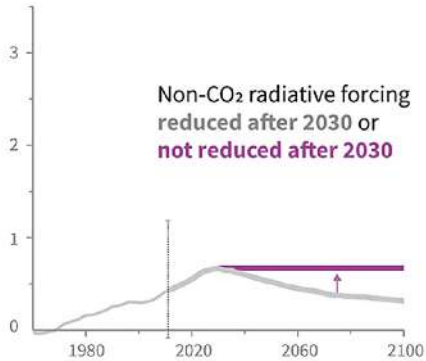
b) Stylised net global CO_2 emission pathways
Billion tonnes CO_2 per year ($GtCO_2$/yr)



c) Cumulative net CO_2 emissions
Billion tonnes CO_2 ($GtCO_2$)



d) Non-CO_2 radiative forcing pathways
Watts per square metre (W/m^2)



Faster immediate CO_2 emission reductions limit cumulative CO_2 emissions shown in panel (c).

Maximum temperature rise is determined by cumulative net CO_2 emissions and net non-CO_2 radiative forcing due to methane, nitrous oxide, aerosols and other anthropogenic forcing agents.

Source: ***IPCC Special Report 2018 on the impacts of global warming of 1.5c above pre-industrial levels.***

thinking to put the UK at the forefront of future mobility ecosystems?" asks Dally. "We need to reimagine the forecourt experience, like being able to recharge vehicles in ten minutes and asking what other roles the forecourt of the future could play?"

■ A convenient and accessible charging network: "People still have lots of concerns about EVs, including range and queuing anxiety and what the charging experience will be like. Ensuring everyone can access the right charging solutions for them, in the right place and at the right time will be important to underpinning future EV adoption."

Stewart Lightbody, Anglian Water

Stewart Lightbody is Anglian Water's Head of Fleet Services. He has responsibility for the fleet management of the company's 1,800 light commercial vehicles, 750 cars and 100 HGVs. Anglian Water's organisational strategy is seeking to become carbon neutral by 2050. The company is increasingly generating power on its estate - through solar and through gas from sewerage treatment. This energy is being used to support the charging infrastructure it has been developing on its sites to support its growing number of electric vehicles.

What Anglian Water would like to see to strengthen the uptake of electric vehicles is:

■ A clear commitment to a bold Clean Air Strategy: showing strong support for ultra-low emission vehicles (ULEV's) over the long-term, to enable appropriate investments to be planned, delivered and measured. While the strategy says many of the right things, there is room to strengthen implementation plans and provide long-term commitment. "The constant changes in the level of subsidy and support for adopting ULEV's and the lack of a long-term plan adds

62% of journeys to school or work are made by bike or foot in Denmark's capital city Copenhagen. This is a prime example of what can be achieved globally through strong leadership, says Caroline Watson of C40 Cities. ALAMY.

uncertainty to the fleet manager's role in long-term planning of an appropriate fleet. The goalposts keep moving, or sometimes disappear completely," says Stewart.

■ Acknowledgement of the pivotal role of the fleet industry in accelerating the switch to low emission vehicles: The fleet industry accounts for 60% of new vehicle sales, so if it is incentivised to purchase ULEVs, this will help achieve a critical mass in vehicle sales and drive down prices to achieve parity with conventionally-fuelled vehicles. At this point, these vehicles become more affordable to the public, as well as developing a market of second-hand ex-company cars.

■ A clear line of sight on benefits-in-kind levels for a minimum of four years and preferably five years to enable drivers to have clarity on the costs associated with the lifetime of that vehicle in order to make an informed choice.

Matt Dale, ALD Automotive

Matt Dale is Head of Consultancy at ALD Automotive, the largest leasing company in Europe with more than 1.5 milliion vehicles operating in 43 countries across the world.

ALD Automotive would like to accelerate the uptake of battery and plug-in hybrid electric vehicles within its lease fleets. For this to happen, the priority is to:

■ Clarify the benefits-in-kind tax position on plug in vehicles for the next five years: "There is a massive opportunity to drive adoption of PHEV and BEV [plug-in hybrid electric vehicles and battery electric vehicles] through the fleet industry and this is also the quickest way to develop the used vehicle market for these products. The car is going to remain a primary mode of transport for many years to come, but if we want to encourage drivers into electric vehicles, we have to give them clarity on what it's going to cost them," says Dale.

In a personal capacity, he also enthuses about people being encouraged to travel more sustainably in their day-to-day lives and has some suggestions on how to achieve this:

■ Reduce weekend train pricing: "Train travel can be expensive. For example, a super off-peak train return from Bristol to London Paddington costs £59.50 per person – £119 for a couple going to London for the weekend," Dale says. "To take the car and park at the Paddington station car park would cost less than £50 including fuel. So how do you get somebody out of the car when it's cheaper and probably more convenient? Reducing weekend train pricing could help break the pattern of regular car users always driving and may make them think a bit more about how they travel all the time."

■ Restrict parking and drop off around schools. Like many, Dale observes the significantly worse traffic conditions during school term time compared with other times. "As well as the traffic fumes and road danger around the school gate caused by drop-offs, what sort of behaviours are we teaching our children by always taking them by car right to the door-step?" he asks, adding that there's evidence that travel habits from our childhood are carried on into our adult lives.

Daniel Ruiz, Meridian Mobility UK

Daniel Ruiz is Chief Executive for Meridian Mobility UK, an organisation that brings together government, academia, innovators and developers of intelligent mobility solutions in collaborative partnerships. It facilitates and supports the acceleration of the UK's emerging connected and autonomous vehicle (CAV) sector within the global transport ecosystem with resources to enable profitable growth. Most tangibly, Meridian is responsible for scoping the cluster of physical and virtual facilities and capabilities that form the UK's world-class CAV testbed.

What Meridian would like to see to help achieve its future mobility goals are:

■ Local and National Infrastructure: "Set up a national body to channel funds efficiently and consistently into the development of UK-wide connected intelligent transport systems (infrastructure) across all the UK's local authorities. It has been shown that the return on investment on intelligent infrastructure is at least five times that of other solutions to traffic flow and congestion issues such as road widening and other 'unintelligent infrastructure", argues Ruiz. "There is currently a massive diversity in strategy and implementation across the UK which is down to inconsistent leadership and understanding of the technology and the possible business models", he contends. A joined up, informed and decisive approach will accelerate the transformation of our road networks and unlock the collective potential from connected vehicles.

■ Developing trust through security, legal protection and accessibility protocols: There is a need to embark on a wide-ranging multi-modal development programme to address the immense challenges facing our increasingly connected transport systems in relation to cybersecurity.

The concept of trust - which includes legal issues and human factors (acceptability and accessibility) as well as safety and security - needs to be addressed for end-to-end connected journeys. This should be done for road, rail, maritime and, if possible, aviation at the same time, using common principles and standards.

■ Mobility Council: Ruiz wonders whether there should be some sort of 'Mobility Council' on a par with the highly successful Auto Council to set a common, coordinated agenda for the future of mobility. "This can help align goals and strategic plans for government and industry, thereby reducing risk, increasing return on investments and ensuring that new infrastructure and service models address public sector outcomes" he concludes. ST

Ali Clabburn
Chief Executive, Liftshare.com

Deadly toxic fumes shroud our cities. We can't afford to wait for tomorrow's solutions to be developed. We need to embrace the quick-win, data-driven, sustainable transport solutions that are here, and act now.

The transport sector is failing society on our watch. We are not acting fast enough to improve air quality and reduce greenhouse gas emissions. While other sectors have been doing their bit and cutting emissions by 16%-73% since 1990, transport has achieved just a 3% reduction. Between 2013 and 2016 emissions from transport in the UK actually went up 5% while the other sectors reduced emissions by 15%. Transport (23%) is the second largest emitting sector after energy (31%).

It makes sense to start by looking at the biggest source of emissions - 55% of all transport emissions come from our cars. Current policies are not working as emissions from cars are increasing. Sales of electric cars are finally gaining momentum, but it will take decades for mass adoption and time is not on our side.

So why are emissions from cars increasing? I believe there was one critical policy mistake made in June 2012 when the Government decided not to include transport emissions in the list of mandatory items that all 1,100 of the UK's largest listed companies had to report on. Commuting - the single largest generator of greenhouse gas (GHG) transport emissions -fell into the 'optional scope 3' bucket and overnight focus shifted to the list of things that companies did have to report on.

If it became mandatory for companies to report on their employee commuting emissions then we would see rapid adoption of solutions that achieved the biggest gains as quickly as possible. There is already reporting guidance in place (*https://ghgprotocol.org/sites/default/files/standards_supporting/Chapter7.pdf*) - all it needs is one small policy change and the largest employers in cities across the UK would start investing and emissions would fall fast.

By pressing five senior professionals to say what three things they would do today to make significant progress to transport's greatest challenges, Martin Higgitt sought to uncover some of the quickest wins in town. It's a great approach and I enjoyed reading the 15 solutions presented. One challenge I had was how many of the 15 would help solve the crisis right now, tomorrow, next week, the next 12 months or the next 10 years? I'd put most of them in the next 10 years bucket.

The speed of adoption of new disruptive solutions like Uber and Tesla shows that rapid change in transport is not only possible but is achievable without significant public sector investment. For many years, the gap/gulf between consumer demand for services and the transport sector's ability to meet that demand has been increasing. There remains huge latent demand for personalised, convenient, and affordable services - the question is which entities will meet that consumer demand and will their solutions be sustainable, equitable and shared?

The rapid move into electric charging by BP is very welcome and gives confidence that charging will not be a problem for those lucky enough to be able to afford and get hold of an electric car. We ordered one nearly two years ago and are still waiting. Most new electric cars already have a six-month waiting list. So, while there is clearly demand for them, and now charging for them, it will be many years, perhaps 15 to 20, before the whole fleet could be EVs - and where will the electricity capacity come from? Will they be affordable?

Jo Dally's suggestions would put some great foundations in place to expediate the roll-out and take up of EVs but there are simply not yet enough EVs available to make a significant difference to the immediate crises we face. Caroline Watson makes a strong case for focussing on moving to zero emissions and has three good suggestions for stepping stones to help us get there.

However, getting commitments is one thing, implementing solutions is another, and there is a danger that by focussing solely on the 'zero emission' solutions such as EVs we may overlook some simple measures, such as having more than one person in every car - that could cut emissions by 50% for a fraction of the cost and could be done very quickly.

Stewart Lightbody shows how businesses like Anglian Water can mobilise quickly to take the lead on pressing ahead with introducing new solutions and makes some good suggestions on policies that will help encourage other employers to do the same.

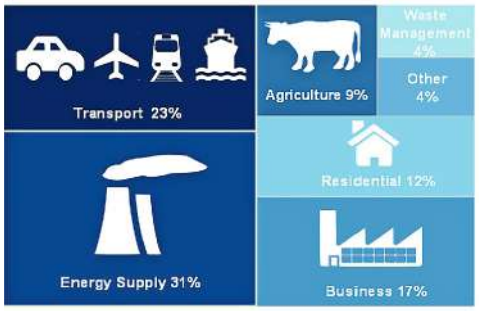
I feel that employers are the most important stakeholder in tackling this crisis quickly. If solutions make business sense then employers will adopt them. If they adopt them, then so will their teams. This takes me back to the key policy change that would rapidly make all large employers sit up and listen: I believe it should be compulsory for employers to report on all their transport emissions, not just their own fleet, but also the emissions from their staff commuting and their grey fleet business miles.

For the last decade, the focus has been on how technology will reduce emissions. But this quote from the 2008 Term Report (*https://www.eea.europa.eu/publications/eea_report_2008_1/at_download/file*) highlighted that: "To achieve emission reductions, measures and policy instruments must also address the demand for transport in a serious way.

"Passenger transport continues to grow, particularly in aviation and cars. Increased car usage and a reduced number of passengers per car negate the improvements gained from improvements in vehicle efficiency.

"In addition to technological

Energy Supply remains the largest emitting sector of UK 2014 Greenhouse gas emissions



Residential and Energy Supply sectors experienced the largest reductions in emissions from 2013 to 2014

Other includes Public and Industrial Process sectors (the Land Use, Land Use Change and Forestry (LULUCF) sector is excluded from the sector statistics above as it acted as a net sink of emissions)

Source: Department of Energy and Climate Change.

Stephen Joseph

Transport Policy Advisor and former Chief Executive, Campaign for Better Transport

Reading these contributions, I was struck, as Martin Higgitt was, by the level of consensus and consistency between people from very different backgrounds. They all want consistency, certainty and leadership from the Government in action on climate change and air pollution. There is also a desire for regulation and common standards, notably on data. Far from stifling innovation, Government involvement and leadership is essential to enable it, by setting clear parameters.

In all these views, there is also an interesting undercurrent of dissent on the future of cities from the very technology-driven viewpoint we hear a lot. This suggests that autonomous vehicles are just around the corner and that the future of urban mobility is about a lot of shared, smart, electric, driverless vehicles taking people door to door. However, these professionals see things differently - a greater emphasis on walking and cycling for short journeys, as in Copenhagen, to create liveable and attractive cities. About 60% of car trips are under five miles, so walking and cycling could be good alternatives for these.

This leads to another common point - focusing on those generating travel as a means of changing travel behaviour. Matt Dale cites schools as places ripe for travel change, and we are seeing authorities creating car-free zones around schools with walking buses or "park and stride" schemes to encourage walking and cut pollution. Stewart Lightbody highlights fleet managers as agents of change to electric vehicles. Caroline Watson looks at the high levels of bike commuting to work and study in Copenhagen. There is good evidence that work with travel generators, especially employers and schools, can help cut single-occupancy car use - the previous Local Sustainable Transport Fund and other initiatives like Sustainable Travel Towns have shown this.

However, it seems to me that this requires a different and more flexible attitude from the Government towards transport investment priorities. Daniel Ruiz points out that the return on investment in intelligent infrastructure is five times better than that from other solutions to dealing with traffic and congestion, such as road widening, yet politicians and mainstream commentators see road building as the main answer to traffic bottlenecks and the Government has just committed £25 billion to investing in big new strategic roads and is dedicating its new National Roads Fund to this and other major road building.

This suggests that the consensus implied in Higgitt's piece has not yet persuaded politicians to look beyond old-fashioned approaches to traffic and congestion and to back their words on smart transport and the future of mobility with their investment priorities. There isn't, at present, the funding stream that Ruiz calls for which would enable local authorities to invest in connected and intelligent transport systems across the UK. The Government has invested in the Transforming Cities fund, which is starting to provide the investment in urban cycling and walking that Watson calls for - the Greater Manchester Beeline network, for example - but this is limited in scope and funding. And as Dale points out, other policies add to car use, such as the high price of even off-peak walk-on rail fares.

All the commentators see city authorities as key players, leaders and partners. However, there is a tension here, between national consistency and local initiatives. Private sector companies like Anglian Water and ALD want consistent standards across different cities in terms of air quality and emissions. On the other hand, as Watson says, there is a lot of innovation and initiative from cities, and it would be wrong to choke that off and stop cities becoming leaders in low carbon and smart transport by insisting on consistency. Maybe protocols and declarations like the Fossil-Fuel-Free Streets Declaration mentioned by Watson can bridge this gap, by giving a common set of aims and objectives for cities to sign up to while letting them retain freedom of action on the detailed implementation. Forums and councils bringing different players together are mentioned in many of these contributors' lists of actions, and there is a lot to be said for this approach, especially in making progress on electric vehicles.

There will, however, be choices to be made, and local and national politicians are best placed to make them. Roads and parking spaces are scarce resources and need to be managed accordingly, even though this won't necessarily be popular. Some cities have managed this successfully - Nottingham has a levy on parking spaces at work and uses the revenue to fund public transport investment. As a result, it has found it needs to take only limited further action to meet air quality standards in the city.

But underneath all of this is the need for Government leadership. The tax system can play a big role here - consistent messages sent through vehicle and company car taxation can drive business decisions and investment. Public investment and regulation of data matter too. Partnerships between the private and public sectors need this Government leadership if they are to be truly effective. ST

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improvements, polices to ensure better capacity utilisation within each mode may result in substantial additional reductions of emissions of CO_2."

Every morning on the commute there are more than 30 million empty seats in cars. Just one in every 12 cars on the commute has a passenger. The good news is that there is growing public demand for sharing with 50% of commuters now saying they would consider sharing their journey to work.

There is the online technology needed to help people find their perfect match - either from within their own company's Liftshare scheme or from the free public site Liftshare.com. Most importantly, we have learnt how best to engage with individuals to encourage them to share their journeys to work. Our events teams have been on site at hundreds of companies to help ramp up the number of people sharing.

Minster Law now has 37% of its 430 staff sharing cars to work, saving one million car miles a year. Wolseley in Warwickshire only launched its Liftshare scheme in November and already has 40% of its 360 staff sharing journeys to work. Staff at Wolseley get allocated parking if they use the Liftshare app to authenticate when they share their journey. More than one million journeys are shared each month across the Liftshare network.

With rising populations and rising consumption, we face exponential challenges. These need exponential solutions. Making better use of what we already have by sharing more gives us access to huge latent capacity and the potential to solve today's challenges today. ST

Opportunities for global investors in smart transport technologies have taken a sharp rise with analysts predicting that the autonomous vehicle (AV) market alone could be worth up to £28 billion by 2035. ALAMY.

Investment opportunities and challenges

Graeme Pickering looks at the doors being opened by innovative mobility solutions, from car and bike share to connected and autonomous vehicles

The mobility market is going through major changes. In contrast to their niche beginnings, car and bicycle sharing schemes are becoming firmly mainstream. CoMoUK, which works to support the development of integrated mobility solutions, says that nationally an average of over 52,000 trips a day are made using shared pushbikes.

Over the next seven years, analysts Frost & Sullivan predict a more than three-fold increase in car-sharing globally, rising from around ten million users to 36 million. There has also been a dramatic rise in the number of new electric cars (EVs) being registered in the UK. Figures from the Society of Motor Manufacturers and Traders show an increase from an average of 500 a month in early 2014 to just under 5,000 a month for January to October 2018.

And autonomous vehicles (AVs) look set to be a familiar sight on some city streets within the next five years. Plans have already been announced to use them for ride sharing in London by 2021.

As EVs and AVs evolve, the opportunities for investors range from putting money into fleet management and the technology inside the car to electric charging networks, development of new toll and traffic systems - even connectivity and data security, as it becomes more commonplace for vehicles to communicate with infrastructure and each other.

London-based Octopus Group saw potential in offering a complete one-stop solution for businesses faced with the challenge of replacing their existing fleets with cleaner and more efficient vehicles. Founded in 2000, it started out purely as an investor, but has diversified into areas such as creating and managing healthcare premises, owning and operating solar panels and wind farms, and supplying energy.

Investment Director Simon Pickett says that given the high carbon emissions from transport, it seemed obvious as the group's next major focus. "I think there are something in the order of 400,000 fully electric buses running in China and we've got in the region of 100 in London and that doesn't feel good enough from a sustainability and air quality perspective. It seems like a really important opportunity for innovative business models and private sector capital to come in and accelerate that transition. As a group, we're trying to help support this transition with multiple tentacles.

"We set about talking to corporates, owners of fleets of vehicles, bus operators up and down the country and saying 'what problems are you facing?' Pretty much unanimously they came up with two key things, capital and complexity, replacing tens of thousands of vans or hundreds of buses within your operations.

"It's not just a question of ordering a new vehicle, it's also a question of charging infrastructure, and asking what impact that has on the grid and how to go about it. Octopus comes in and says to an operator 'we'll finance the vehicles, we'll finance the charging infrastructure and we'll finance any grid and network reinforcements'. We can deliver that back to you as the customer as a pay-per-mile service offering."

Octopus is in discussions with bus, taxi and logistics firms. It's already working in partnership with travel services company WeKnowGroup, funding a fleet of 200 electric Jaguar I-Pace vehicles which will operate chauffeur services from Heathrow Airport. The first 25 of these have recently been delivered.

> "There are about 400,000 fully electric buses running in China and we've got in the region of 100 in London. That doesn't feel good enough from a sustainability and air quality perspective."

Simon Pickett, Investment Director, Octopus Group

About the author

Graeme Pickering is a former BBC journalist and News Editor for ITV Tyne Tees. He has more than 20 years' experience covering news stories across the north of England and has a keen interest in transport issues, and railway history in particular.

There is also significant interest in new mobility from many well-known big businesses. Charlie Simpson, Head of Mobility at KPMG, points to BP's agreement in June to purchase Chargemaster, the UK's largest electric vehicle charging company; Shell's interest in charge point operators, including its takeover of NewMotion; and the involvement of EDF, National Grid and Centrica as examples of how firms with a background in traditional fuel and energy supply are gaining a foothold.

At the other end of the scale, smaller companies established more recently with new mobility as their main focus have secured financial backing to push further into their markets. Capital from the banking and asset management firm Investec has allowed Engenie, which specialises in rapid charging infrastructure, to reach its network target of 1,500 charging points in the UK. Meanwhile, Paris-based peer-to-peer car share service Drivy, which launched in the UK last year, raised £28m from venture capital funds including London's IndexVentures.

Adds Simpson: "The really interesting play from our point of view is what the three big Chinese firms are doing, Geely [owner of Volvo Cars, the London Electric Vehicle Company and majority shareholder in Lotus], SAIC [MG owner] and BYD

> We are in the process of introducing 325 shared Volkswagen e-Golfs to London and they have gone down very well. Londoners are increasingly environmentally minded and concerned about the pollution levels in their city.

Jonathan Hampson, General Manager, Zipcar UK

[car, bus and van manufacturer]. We'll see more coming in from those three. Then we've got what you'd describe as the wider transport bucket. That includes the big hire car companies, Enterprise, Europcar and then also Uber, DiDi, ALD Automotive."

Enterprise bought into UK car sharing in 2015 with the acquisition of City Car Club, renaming it Enterprise Car Club. Similarly, Europcar purchased Ubeeqo, and Hertz established its own car sharing brand Hertz 24/7, while Avis Budget Group bought Zipcar in 2013. Zipcar UK's General Manager Jonathan Hampson says car sharing has been the subject of growing attention from organisations realising the size of the opportunity: "Interest in the sector has come particularly from car rental companies buying into the sector and from car manufacturers investing in either partnerships with existing providers or in setting up their own schemes."

Although Ford's GoDrive and Daimler's car2go have come and gone from the London market, BMW's DriveNow has expanded into nine of the capital's boroughs, with floating hire and pay per minute options. Hampson describes mobility as a "fast changing space" and cites the launch last year of its floating rental service Zipcar Flex, which also offers users pay per minute, as one of several ways in which his firm is responding to customer needs.

"More recently we've challenged ourselves on electric vehicles. We are in the process of introducing 325 shared Volkswagen e-Golfs to London and they have gone down very well. Londoners are increasingly environmentally minded and concerned about the pollution levels in their city," says Hampson.

Although this demonstrates the comparative ease with which global operations can adapt what they offer, Paul Balmont, Managing Director and co-founder of Co-Wheels, doesn't believe it's a threat to social enterprises such as his. The seeds of Co-Wheels were sewn 11 years ago with an operation utilising two secondhand cars in Durham. It is now the biggest independent car club in the UK, operating in 60 locations.

"We do overlap, particularly with the 'car rental' car share solutions," he acknowledges, "but our approach has always been very much about collaborative working, particularly with the public sector. I think because we're still a relatively small organisation we have the ability to be a bit more reactive to what a particular circumstance or a particular opportunity is."

Balmont agrees that there are certain advantages for firms used to working on a bigger scale, who can use a model they've already developed elsewhere to tap into big city markets, but says Co-Wheels can instead offer something more tailored to the individual needs of each particular area. In some locations, that's been taken a step further, with local groups operating as a Co-Wheels franchise. It has also diversified to offer pool cars for business use, which as a spin-off can be hired by the public outside office hours. City Councils in Salford and Aberdeen are among those who have made the switch.

"We kind of pioneered that solution in the UK," he adds. "It's actually quite important to us to offer both of those solutions now because where one can match up with the other it really speeds up development of the car club solution in that area. We're looking at how we keep innovating in that and keep developing that model because it all comes down to the core of why we set up which is about the more efficient use of vehicles as assets."

For big businesses who were previously unconnected with car hire and sharing, one of the key motives for entering the market was to gain knowledge to shape future investment decisions. On winding-up its GoDrive pilot in London, Ford said it had given it insights into the best ways to address mobility and transport challenges. It's now planning to launch its own autonomous car-sharing scheme in 2021.

In the last two years, the UK's bicycle sharing sector has seen rapid expansion, followed by significant contraction from some of the biggest new commercial players. In 2017, dockless bike providers Mobike and Ofo arrived in the UK. The rival Chinese firms are both vying for the biggest stake in the global market and have billions of dollars in financial backing from two of

China's biggest internet firms, Tencent investing in Mobike and Alibaba in Ofo.

During September, Mobike announced it was withdrawing from Manchester, just over a year after the city became its first European location. It put the decision down to an increase in theft and vandalism of its bikes, but still operates in London, Oxford, Cambridge and Newcastle (where it doubled the number of bikes available earlier this year). Ofo has pulled out of Sheffield and Norwich, also abandoning plans to set up in Leeds, although it continues to have a presence in Oxford, Cambridge and London.

"Yes, they suffered lots of vandalism on the street and that then caused issues in terms of the sustainability of the model, but actually it was also about the fact that they spread themselves too thin, too quickly,"

An average of 52,000 trips a day are being made using shared pushbikes, according to CoMoUK. The UK's bicycle sharing network has grown rapidly in recent years following large scale commercial and public support. JACK BOSKETT/*SMART TRANSPORT*.

says CoMoUK Director Antonia Roberts. "It wasn't sustainable to have that many staff spread across the country without having spent a bit more time building up the business. The advice we're giving to local authorities at the moment is to be very careful and ask lots of questions about what the business model is and what the plans are, but also make sure that they're being realistic."

Mobike said it learned a lot from operating in Manchester and intends to submit a proposal for an alternative future model for bike sharing that could be re-launched in partnership with the local authorities.

Roberts believes it's important to realise the distinction between the commercial business models of Mobike and Ofo and operations such as Nextbike and Transport for London's scheme, sponsored by Santander, which rely on a combination of public sector and commercial support. She adds that a key attraction for backers such as Alibaba and Tencent, is the app-based hire system: "Having control of online retail and the packages behind mobility are both huge sectors which will have a benefit in themselves. The likes of Uber is an obvious example of the fact they want to diversify but they see themselves as hoovering-up lots of different aspects of mobility to be that one-stop player and aggregator of all those different services."

While there are clear positives to self-financing private sector mobility solutions and working with companies eager to offer them, Roberts says this can pose a problem if local needs can't be accommodated within wider commercial interests: "Decisions that affect what happens on the ground in the UK are being made a long way away based on what the overall investment plans are and whether Europe is being seen as an important part of that plan at the moment or less so. That leaves what's happening here very fragile to decisions being made a long way away."

As the focus draws towards Mobility as a Service (MaaS) and the use of online journey planners to establish the best

way to make it, ride-sharing and shuttle services could also become a more common option. In October, Oxbotica, a UK-based developer of autonomous vehicle software, entered into partnership with London-based transport firm Addison Lee with the aim of providing self-driving cars to its customers by 2021. They see the driverless vehicle as a way to offer more affordable services.

"Urban transport will change beyond recognition in the next five to ten years," predicts Graeme Smith, Oxbotica's Chief Executive. He adds that developing driverless cars in this country provides a "huge strategic advantage" compared to US competitors: "Google and Uber are testing vehicles in Arizona, where they have hours and hours of sunlight and their roads are perfect. In contrast, the UK's challenging climate and tougher road conditions mean our technology is more robust and versatile, making it a more attractive solution for other countries in Europe and around the world that are exploring the potential of autonomous vehicles."

The Market Forecast for Connected and Autonomous Vehicles (CAVs) published in July last year by the Transport Systems Catapult predicted that the UK market for such technology could be worth £28bn by 2035. However, the report itself acknowledges that "an industry consensus around factors such as costs and consumer attitudes has yet to emerge, "making it difficult to provide an accurate forecast due to uncertainties about how quickly CAVs will be adopted by businesses and consumers and the associated costs and labour intensities involved.

But Smith argues that the potential of CAVs to transform mobility is becoming progressively clearer. "The UK is one of the most advanced countries in the world for recognising the possibilities of autonomous vehicles to transform the way we travel, as well as a range of practical applications within industries such as manufacturing and agriculture," he says.

"The Government's Industrial Strategy highlights this potential and we have already received backing from Innovate UK to further the advancement of self-driving technology in Britain. DRIVEN is a consortium of companies - led by Oxbotica and funded with an £8 million grant from Innovate UK - that have come together to deliver a ground-breaking project that will see a fleet of six fully autonomous driverless cars complete an end-to-end journey from London to Oxford in 2019."

The Automated and Electric Vehicles Act, which passed through Parliament in July, set out new measures for insurance coverage of automated vehicles, along with powers to ensure the provision of electric vehicle charging at motorway and other large service stations and standards for compatibility with vehicles, payment and reliability. £90m has been allocated to create 'Future Mobility Zones'. The West Midlands is the first area to receive the designation. The zones will trial innovations in shared and on-demand travel and autonomous shuttle services.

There is however a widespread feeling that the Government needs to have greater input. October 2018's *Powering Ahead* report, produced by PwC in association with Energy UK says ministers should be more ambitious and bring forward the ban on new petrol and diesel vehicles from 2040 to 2035. It says this "will enable the UK to continue in its ambition to be a leader in 21st century transport". Among its other recommendations are the continuation of upfront subsidies for electric vehicles and charge points until at least 2020, as well as increasing funding for local ways of encouraging EV use and using public funding to install charging facilities in areas where there is no business case for private sector involvement.

Also highlighted in the report is a need to ensure that electric car users can charge when they want. Paul Balmont believes that's just one of the infrastructure hurdles and that there are others for car sharing in general.

"We now have 'you must join each of our individual schemes, go through our application processes'. As a consumer, you don't want to have to keep doing that. So we need to join things up," he says. "That's an added complication with moving car share fleets towards electric vehicles as well. You've got multiple EV charging infrastructure companies. So again depending on geographically where you are, are you registered with one scheme or are you registered with another? Can you use that charge post or can you not? That's another unfortunate barrier we seem to have created.

"We do have to be quite radical at some point and I do think that comes down to central government, but it would be great to think that the service providers have got their act together in terms of simplifying and joining it all up. We genuinely need to think more collaboratively than competitively as a sector."

Society of Motor Manufacturers and Traders Chief Executive Mike Hawes is also concerned that the right preparations are made for CAVs. "Full mobile coverage across the country will also be vital to get fully connected vehicles rolled-out across the UK," he says. "Seventy-one per cent of British roads currently have 3G coverage and this must be further improved if the UK is to be competitive."

Charlie Simpson of KPMG says competition and innovation need to be encouraged, but it needs an agreed broad framework aligned between public and private sector around things like data standards, recharging standards.

"Hot potatoes such as road pricing are going to come into the mix," he says. "We know they're already starting to think this through but some of the political choices are going to be very tough, particularly as it starts getting to variable road pricing and then you've got the whole social inclusion agenda which I think can be looked at very differently, particularly around the autonomous vehicle side.

"Our view is that we've probably got a 12-month window of opportunity if the Government starts framing the structures in a more joined-up way or we'll end-up taking solutions developed elsewhere."

Glenn Lyons, Mott MacDonald Professor of Future Mobility at the University of the West of England, Bristol warns that the Government must consider carefully the role of the private sector: "If they are providing competition that stands to bring about behaviour change in favour of more sustainable transport, electrified public transport alongside walking, cycling and other micro-mobilities, then this seems like a positive contribution," he says. "If they are encouraging sustained or deepened dependence upon the private car then this looks set to be problematic. So we have two forms of MaaS – Mobility aimed at Sustainability, and Mobility aimed at Shareholders." ST

"Our view is that we've probably got a 12-month window of opportunity if the Government starts framing the structures in a more joined-up way or we'll end-up taking solutions developed elsewhere."

Charlie Simpson, Head of Mobility, KPMG

Ben Lawson

Vice President of Strategy and Mobility for the UK and Ireland, Enterprise Holdings

As innovation in the mobility sector continues to increase, the opportunities for investment are plentiful - along with the associated rewards and challenges. The technologies and business models that meet consumer needs will thrive while those that don't will wither.

Graeme Pickering's article provides many good examples of the number and range of organisations looking to capitalise on the investment opportunities inherent in developing future mobility. It demonstrates some of the ups and downs of investing in new business models by examining the outcomes of some of the early entrants to the market. It's clear that progress is neither a linear nor easy journey.

There are lessons to be learned from the bike sharing sector. Although providing shared access to bikes will be an essential part of any integrated transport network, there appears to be evidence that this sector has had initial challenges in the UK marketplace.

The electric vehicle market also provides lessons. There are some great EVs available, and despite residual consumer concerns around pricing and charging, interest in them is growing. In the business world fleet managers are experimenting with how best to use EVs as part of an employee mobility strategy. However, hybrids are now widespread and play a key role in helping organisations reduce emissions. Progress is often an evolution as opposed to a wholesale revolution.

At the same time, our cities are looking to mobility providers and their investors to support the creation of healthier, more sustainable communities. The introduction of clean air and low emission zones is a first step and creates a framework for future mobility models.

In an uncertain or changing landscape, flexibility can also be key to success. Any business looking to operate trucks in London's Ultra-Low Emission Zone from this April will have to make sure those vehicles are Euro 6 compliant or face hefty charges. Therefore, the ability to switch to a compliant vehicle via a flexible contract may provide some insulation against such changes.

Alignment with consumer preferences and government priorities is especially important because mobility is a vital community service and has an environmental impact. In this context, there needs to be a close alignment between government policy and mobility that provides the consumer with what they need, enables greater sustainability and provides opportunities for investors to benefit.

Investec's investment in Engenie in April to build 1,500 EV rapid charging points in the UK demonstrates the growing confidence of venture capitalists, specialist banks and asset managers in new mobility technologies and business models. ALAMY.

Parked in on-street bays or integrated to existing travel hubs, such as train stations, car clubs are also part of the existing civic transport infrastructure. By offering automated rental, they are the next evolution of the wider car rental market. From a single subscription, members can access vehicles anywhere across the country. However, each car club is bespoke to each community. The number, type and location of each vehicle is carefully planned and adapted based on real usage data.

Adjustment is another point that is key to successful investment. Not everything works at the first attempt and it is important to learn and fine tune along the way. As a business that has invested 2.4 billion euros over the last 10 years in a range of technology and mobility companies we are aware of the complexities involved. Therefore, we put the consumer at the heart of each investment decision we make. Are we investing in what people actually want? Will this new service or innovation help to facilitate their access to mobility today? Will it improve the customer experience? Is it in line with local and central government priorities?

It is important that the Government can match the enthusiasm from within the private sector by investing significantly in pilot projects and schemes that future proof urban areas from many of the environmental and public health challenges that they now face. Solutions that have the consumer at their heart, that are consistent with the goals and policies of the communities they serve and that are closely integrated with existing infrastructure and networks will have the greatest chance of succeeding. ST

Matt Dale

Head of Mobility, ALD Automotive

The investment landscape for smart transport is so vast it is almost impossible to dissect the intricacies of the sector in a single paper. While investment is vital, there is a risk that the money follows the wrong projects or arrives at the wrong time, stifling growth while vital support areas remain under-funded.

The key to understanding the investment needs and opportunities is to ask 'is this what the customer really wants'? The development of new forms of mobility will be a long process with the need for changes in society to encourage us to use new forms of transport.

It is encouraging that sales of plug-in vehicles are growing, but they are dependent on the number of vehicles that manufacturers produce. They have been slow to react to the desire for cost-effective electric vehicles with a range in excess of 300 miles.

There has been much discussion around the role of the public charging network and the need for rapid chargers for all. However, in this time of changing mobility, the way we fuel our vehicles is also likely to change. The investment by fuel companies into the UK charging providers is welcome, but I question whether we will need the forecourt refuel mentality in the future. Research has shown that 87% of EV charging is done at home, with a further 12% being charged at work or another destination, leaving just 1% of charging being carried out en-route.

Destination battery charging is more convenient than having to make a scheduled stop for fuel, because it can be carried out while the vehicle is not being used, in the same way that most people charge their mobile phones overnight. Therefore, investment in home and destination charging is perhaps more appropriate.

The development and growth in the car club sector is interesting, with most being either purchased or created by the daily rental companies. Their investment proves that they see a future in the car club model, especially in major cities, but the introduction of EVs into this sector is proving problematic. With the lack of a public charging network, and a possible flaw in that model, operators are not as eager to invest in fitting charge points into depots and rental locations.

There is no doubt that usership via pay-on-use and subscription models is set to increase over the coming years across all forms of transport. But true MaaS has a long way to go in the UK and while we are starting to see MOD (Mobility on Demand) aggregators grow and develop, the transport behind them already exists today.

The development and implementation of a truly autonomous car is still a long way off, with automated cars being a likely first step. A fully autonomous car needs to be able to communicate at all levels and the world around it also needs to be able to adapt and react accordingly. While autonomy is bringing safety into all new vehicles, I am not convinced that society and technology are ready for the massive step into this new world of transport.

The impact of bringing the petrol/diesel ban forward to 2035 is dependent on where vehicles are produced and who wants them. UK-based vehicle manufacturers aren't going to step up development and manufacturing to meet this need. The move to Plug-In vehicles is global, not local.

Finally, with so many unknowns, how brave are the private investors willing to be? With the growth in our digital world accelerating, transport could get left behind. And we still have to ask, what does the customer actually want? ST

Stewart Lightbody

Head of Fleet Services, Anglian Water

Like most things in life - well, my life, anyway, the devil is in the detail. While there is an unprecedented interest in developing the next big thing, and indeed some great examples have been identified and discussed here, there is still a fundamental missing piece of the jigsaw. The much loved human being.

Most start-ups and creative organisations set out to make the life of the individual easier and more convenient that it currently is. It is acknowledged that we all need to be doing more to lighten the load on the transport network, but few know how to, even if they wanted to, as decisions being made are not necessarily around making it easier for the individual - and that's a key element of the secret to mobility itself.

Mobility as a Service is a corporate term used to describe a multitude of options, most of which are centred around corporate hubs and within large conurbations largely based around city life. Moving groups of people locally seems more achievable than moving individuals geographically - and here lies the problem.

To make mobility easy, it has to reflect not only the masses, but every level down to the individual so that it feels fair, equitable and relevant to all. Squeezing everyone into buses may well solve commuting in town but is not going to get someone from home to the health centre when they need it most.

The flexibility of the motor car has been the secret of its long success - to the point of becoming a victim of that success. Affordability has come through mass volume, and with the ability to travel when and where we want to, with our own music, at a temperature we're comfortable with is hard to replicate in public transport - we are, after all, all different.

We are in a hybrid stage of moving around. Moving to EVs is one solution - it will have a net effect on air quality, but failing to manage the single occupancy issue will still see the same number of cars in queues. At least we'll be in cleaner air and arguably have cleaner consciences, but is that enough?

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Maybe we have to go back to the detail question - what actually are we trying to resolve here? If we want to break the back of the congestion issue, we need society to change, at a time when lack of knowledge and awareness is probably the biggest barrier to change. If the issue is air quality, then EVs are a logical solution - just at the time when there isn't a solution for all, whether that's an affordability issue or a lifestyle or commercial carrying need.

Like most things in life, it's down to a timing issue when not everything can be dealt with in isolation …well, my life, anyway. ST

Lorna McAteer

Head of Supply & Internal Accounts, Royal Mail

ALAMY

It is time to think differently. We had an industrial revolution, and we are now living in the digital age. Perhaps we should redefine it to reflect the need to focus and clean up the environment.

We have the green agenda but should it not be seen as a revolution, something that is no longer to be discussed at a formal meeting but taken into our lives and acted upon instinctively and immediately? How will that then shape our attitude towards investment? It's about doing what is right for our children rather than what makes money today.

As Greta Thunberg, the 15-year-old Swede who refused to go to school until her country's Government committed to do something about climate change, said at the recent Environment summit: "Everyone believes we can solve the crisis without effort, without sacrifice. Our civilisation is being sacrificed for the opportunity of a very small number of people to continue making enormous amounts of money. It is the sufferings of the many which pay for the luxuries of the few."

Is she right? Day in, day out, we rationalise cost - how much does it cost to get that delivered at home, and can I get it tomorrow? How much is that train ticket for that meeting, do I still have to get a taxi and a bus at the other end? What is my total cost of ownership of that vehicle? Most of us live in the here and now and rarely look to the next five or 10 years, let alone the next 25 to 30.

The article here cites many great examples of companies acquiring or merging with others and looking strategically at investment opportunities. Some new products will help answer some of those daily challenges, but we need to remember that fundamentally we still have a desire for convenience and the basic need to move something from point A to point B. Stewart Lightbody touches on it in his comments - the much-loved human being and the devil in the detail.

Take established institutions like Royal Mail. It may have the largest commercial vehicle fleet in the UK at 48,000 units but it also has the largest feet-on-street delivery network, delivering six days a week, to 30 million business and home addresses. As an organisation, it needs to consider not only how business is conducted but also how the employees get to and from work 24 hours a day as well as their health and wellbeing. It needs to consider the impact of the weather; snow, rain, wind and heat.

It is the practicalities of the day-to-day and the how-to that can make or break investment opportunities. E-Cargo bikes, great, but will they get through the snow like a van or person can? Investment has to be targeted - it is about the right solution for the task at hand.

There are some quick-win investment opportunities out there but there are also some woefully inadequate areas that still need addressing. Most of the car share clubs are great for people living and working in cities where the total cost of ownership stacks up. Ofo pulling out of some cities highlights this, but what is there nationally?

If you are moving around the country, how easy is it to adopt each of those services on offer and how do you pay for them? It's a long time since corporate credit cards were readily available. When I informed a colleague of my recent purchase of my first Oyster card, the response I got was: "Why are you buying old-hat technology? Use your phone. "The Oyster card, archaic as some may believe, is still a great example of joined- up mobility, so why can't that be applied in other parts of the country?

Not only are travel schemes inherently different between the entrepreneurial companies offering them but so are the levies and penalties applied by cities and councils for 'bad behaviour' in not adopting cleaner modes of transportation. Clean air zones absolutely have a place but devolving the responsibility has unintended consequences. While it creates local empowerment and local investment opportunities it also raises barriers for people who don't live in those areas or provide national services.

So where is the investment in aggregating those services so that as an individual I only pay once and someone else can manage it all for me? Where is the investment that includes night-time workers, as we know public services are often non-existent at night? Where are the standards that allow me to take up an electric vehicle - be it my own or a car share - and with confidence drive it up and down our motorway network knowing I can plug it in at any universal charging point? We can do it with other services, why not these?

When was the last time you walked up to an ATM machine and had to ensure it was the right bank to match your card before you could take any money out? The investment needs to be national, including rural communities and not just where it is cost effective in the city.

Taking that one stage further, connected autonomous vehicles (CAVs) and innovative travel solutions using fantastic interactive apps are great but as the Society of Motor Manufacturers and Traders points out, not all our road network has coverage. Likewise not all of our 32.9 million driving licence holders are willing to give up their convenience of travel to rely on apps and alternative modes of transport. Many because they simply can't.

They don't live in an area where there is mobile network coverage, or they are of an age where they don't want and don't use the internet. Some simply can't see the screen on a mobile phone to tap the right button on the app. Siri and Alexa may go some way to help with this and when we talk about investment in AVs we should also look at much more inclusive and interactive ways for people to use services. You cannot ignore the social inclusion to which Charlie Simpson refers. Understandably investment has to have some payback but in order to effect greater change on a much wider scale - the revolution - it needs to be as inclusive as possible.

Ideally, we want to be like Greta and make our planet a safer and cleaner place, but if we get the investment wrong and penalise those willing but unable to pay we'll end up with more situations like the recent ones in France. ST

What's 'smart' - and what's definitely *not* 'smart'

Darren Shirley, Chief Executive, Campaign for Better Transport

About the author

Darren Shirley joined Campaign for Better Transport on August 8 2018 having led the *Which?* campaign in regulated and retail markets. He came to CBT with more than a decade of experience in the environmental sector, having worked for WWF, Greenpeace UK and National Energy Action.

Smart transport; it's a term that's regularly bandied around the transport sector. It's an overused one that is employed to make virtually anything sound modern or vaguely in touch with the technological revolution that has led to significant changes in our society in the last 20 years.

But it is an overuse that has emptied the term of any meaning, and given reductive, counter-productive and short-term decision-making a free ride.

We all know that smart transport is not a single thing. It's a mass of overlapping technologies and approaches. It's about a system. As this is the first issue of *Smart Transport*, it seems appropriate to challenge some of the perceptions of what 'smart transport' is. So, here are some behaviours, technologies and policies which present themselves as smart transport, but which on their own are definitely not.

1 Making all the journeys you currently do, just in an electric car

The stark warning from the Intergovernmental Panel on Climate Change in October is that the challenge of limiting global warming to 1.5°C requires "rapid, far-reaching and unprecedented changes in all aspects of society". It reinforces how carbon emissions are a major problem. With transport being the largest emitting sector of UK greenhouse gas emissions, and emissions still rising, it clearly is a priority for the UK to solve.

Air pollution is an equally concerning problem. Road traffic, particularly through diesel fumes, is the most significant cause of poor air quality. It is estimated that 29,000 premature deaths in the UK are caused every year by poor air quality. This is a public health crisis, disproportionately affecting those who are vulnerable or on low incomes.

Switching from a car that runs on petrol or diesel to an electric car will undoubtedly help solve some of the problems with air pollution and carbon emissions. The uptake of electric vehicles should undoubtedly be accelerated. But in isolation, this isn't smart transport. If we are to truly reduce the negative impacts of the way we travel, we will need to choose the right mode for each journey. The default of relying on the private car is not the answer, regardless of how it is powered.

Smart transport is supporting increased use of public transport, introducing clean buses, accelerating electric vehicle uptake, cutting traffic and electrifying the railways. A concerted national effort would transform the UK's transport system to meet the challenge of preventing the looming climate crisis and encourage people to make a choice of a more appropriate and sustainable form of transport for each journey.

Smart transport is about reducing the environmental impact of transport and making how people move around and between our towns, cities and villages more sustainable and less damaging to our natural environment.

2 Building new motorways which have excellent WiFi

It sounds smart, right? Better connectivity while driving. We will of course need excellent WiFi and 5G connections in preparation for connected and autonomous vehicles. We will need connected roads.

But that needs to be decoupled from 'predict and provide' policies that lead to significant sums of money being spent on building new roads. Old-school thinking on road building from the '70s, '80s and '90s is not smart. You can't build your way out of congestion.

Instead, better planning of how transport networks are used through utilising big data, and improvements to the wider transport system are smarter. By making public transport easier to use, more attractive, better value for money and more efficient the arguments to build our way out of congestion look more and more nonsensical.

Smart transport is about using the existing capacity as efficiently as possible first. Make the most of the infrastructure we already have, and ensure we use technology to improve it, rather than building a new bypass, motorway, or expanding the roads.

3 Smartphone apps that find you free parking - two miles from where you need to be

Smart transport is not about making the best of diminishing returns, or helping individuals get around broken systems. The first 'solution' that many reach for when wanting to be part of 'smart transport' is an app. Who doesn't want their own snazzy new app so they can demonstrate their organisation is a part of the technological revolution, and so their customers use only their channels to engage with the service?

In reality some of these organisations are breaking our transport system just a little more by succumbing to the urge to be seen as 'advanced' with their own app and keeping a close hold on their data. Smart transport is people being able to plan their journey across modes in real time. It is transport providers releasing data so that this is possible across a range of channels, tools and apps. It is being transparent, open and free with information and data.

4 Smart public transport tickets that only work on one operator's services

London's Oyster card was introduced more than 15 years ago. Contactless payments were introduced four years ago and are now used for half of all London's pay-as-you go Tube and rail journeys. This is technology that has been sold to cities around the world. But as soon as you're outside the boundaries of London's network you enter something that frankly resembles the dark ages where this form of integrated ticketing solution is lacking.

It is laughable that paper tickets, which can only be used on one operator's service, still

The shift from petrol or diesel to electric cars will go a long way to tackling carbon emissions but does not, in isolation, represent smart transport, says Darren Shirley. SHUTTERSTOCK.

make up the majority of ticket sales across most of the country. And it's a sorry state of affairs when attempts made to introduce 'smart transport' have resulted in commuters needing multiple smart cards and tickets to make their journey to work as each operator uses their own proprietary system. This leaves the passenger with an unwieldy range of different cards to carry just to travel.

Operators and transport authorities trying to reinvent the wheel by designing their own smart card or contactless payment system are missing a trick. These are rarely interoperable or beneficial to the user. Despite having a system that has been proven to work sitting on the shelf - one we're exporting to cities around the world - why is so much time, energy and public money expended in trying to reinvent what already exists? It's not smart.

Smart transport is a future ticketing system you can use across both public and private transport, which works across networks and operators. A system that is designed with how people use the transport system in mind.

5 A world where driverless cars replace public transport

Smart transport does not sound the death knell for public transport - quite the opposite. There has been much speculation and doom-mongering about autonomous vehicles.

The widespread application of driverless cars is still some way in the future. They will come though. As the technology matures and challenges are overcome they will be a part of our transport mix. However, a transport future made up of just driverless cars isn't smart. Yet nor is a present in which we ignore the opportunities or the role that autonomous vehicles will play in the future.

In places such as our towns and cities we will need high-capacity transport to move people from where they live to work and to leisure activities, and to access public services. High-capacity transport will be needed to solve the congestion problem and to keep people moving.

While there are challenges for transport authorities and communities from the introduction of autonomous vehicles, the real challenge to overcome is how to use technology to make public transport better and more attractive.

Smart transport is putting in place the right framework to ensure we harness the benefits of new technology to improve the transport system available to communities. This, alongside ensuring it works within our transport system rather than displaces it, and we make the best use of new technology to solve problems.

Truly smart solutions

Smart transport is many things but it will continue to be empty of meaning if we don't take hold of the agenda and ensure that spurious examples that are tagged as smart are called out for their limitations, and we promote the solutions that are truly smart.

Smart transport is about:

- Limiting congestion, particularly during peak travel periods;
- Reducing car ownership, car usage and the number of vehicles on roads;
- Using existing infrastructure more effectively and creating economies of scale;
- Easing pressure on the transport network;
- Enabling better traffic and capacity management;
- Improving customer access to an integrated transport network;
- Catering to all travellers, including all ages, all abilities and all income groups;
- Creating a model that supports the funding of infrastructure;
- Lessening transport's overall environmental impact; and
- Working in both driver-controlled and autonomous environments.

Let's reclaim smart transport for what it should be and challenge those schemes that are called smart but are nothing of the sort.

For Campaign for Better Transport, smart transport means a fundamental shift for our transport system. We aim to be at the forefront of driving this evolution and revolution, and we want to work with all who wish to bring about a smart transport system to make this happen. ST

Road congestion is estimated to cost the UK economy £35 billion a year.
JACK BOSKETT/*SMART TRANSPORT*.

Location, location, communication

The fight against road congestion and rail under capacity goes way beyond transport, says **Darryl Chamberlain.** The smartest weapon is reducing the need to travel in the first place

The transport world is full of smooth-tongued salespeople predicting a future of clean, driverless vehicles, zipping around efficiently from place to place. No pollution, no getting lost, no congestion, no worries.

But nothing's ever that simple. Just recently an Australian economist predicted congestion would get worse in the short term, with a surge of automated vehicles jostling for space with those still driven by humans. "Roads will become real estate," Brian Haratsis, executive chairman of MacroPlan, told the *Australian Financial Review*.

In Britain, congestion already costs the economy more than £35 billion per year, with the National Infrastructure Commission predicting "substantial pressures" to come as both population and demand rises. Building new infrastructure takes time - particularly in the UK - London won't see its first Crossrail trains until late 2019, some 45 years after the project was first mooted. So, what can be done to reduce demand - to help people travel less, and to keep vital traffic moving?

For Stephen Joseph, the former chairman of the Campaign for Better Transport, the new world is already here, but many decision-makers have yet to catch up.

"Technology's already changing demand," he says, pointing to the recent report from the Commission on Travel Demand, based at the University of Leeds. Its authors were surprised to find that in the UK, we make 16% fewer trips than 1996, travel 10% fewer miles than in 2002 and spend 22 hours less travelling than we did a decade ago - although it says the trends predate recent technological advances that allow people to work and shop from home more.

About the author

Darryl Chamberlain is an experienced freelance journalist and sub-editor whose previous roles include working for innovation charity Nesta on its Civil Exchange project, *MoneySavingExpert.com* and the BBC News website.

Joseph sees evidence for this in changing patterns of rail travel. "Sales of full-time season tickets are falling, as people work a day a week at home and operate more flexibly, and so on," he says. "That tells you demand is already changing, and that is overwhelmingly down to technology. With shopping, white vans are replacing shopping trips, accelerating the death of the high street, so that takes you in the direction of there being changes which are already reducing travel."

But patterns of development haven't quite caught up yet. Another recent report, from the Transport for New Homes project, found that while "the Government was anxious to get homes built, the targets given to local authorities to build these homes do not take into account public transport or indeed proximity to services and employment".

"In essence, the targets are devised without geography," it said, adding: "The result is that a rural or semi-rural authority may have to locate thousands of new homes, year upon year, in relatively isolated locations away from large urban centres, away from a network of good public transport, and away from the places that people need to travel to."

James Harris at the Royal Town Planning Institute says it's hard to point the finger at any one piece of the process. "There's a whole complex cacophony of reasons why things turned out that way," he adds. But he agrees that locating new developments in the right place is key - simply building on a vacant plot or green field and extending a road to meet it is asking for trouble in the long term.

"We bang on about this at the RTPI because others don't think about it so much - the choice of strategic location, where the housing goes in the first place, comes first. Then the mixed-use development, urban design, and quality of infrastructure flows better once you've got your location right."

Instead, Harris says there is "a whole bunch of slightly perverse incentives"in the planning system which are leading to car-dependent developments. "You're penalised less as a local authority if you identify enough land to meet a five-year housing supply," he explains.

"You might have a really great piece of land that you could put a whole ton of housing on, but it might take ten or 15 years to do all the work - so you'd get blasted for not hitting your short-term targets, and that encourages quick and easy site selection."

Cuts to local authority planning departments haven't helped either, Harris adds. "If we want to do this properly, you've got to resource it properly and the cuts make it really hard for the planning departments to do the really important bit, which is the early engagement between the planners and transport providers like the bus companies, who also need

> "Sales of full-time season tickets are falling, as people work one day a week at home and operate more flexibly. Demand is already changing, and that is overwhelmingly down to technology."

Stephen Joseph, former chairman of the Campaign for Better Transport

resourcing help to do this as well.

"What you really need is the planners, landowners and transport people to sit down at a really early stage, look at the housing demand, look at the available land and then draw up joint plans for where the housing's going to go and where the transport infrastructure's going to go. It needs to be done right at the beginning rather than the current approach where the local authority is handed a bunch of housing numbers and the market suggests land - and transport is almost an afterthought."

The issue goes beyond transport, Stephen Joseph says. "What's really noticeable - and this generation of politicians hasn't caught up with it - is that ten or even five years ago, the demand from the average village or town was for a bypass. Now it's for superfast broadband. It's a really interesting change."

He suggests looking at the way the rural lobby is going. More and more, the demand is for superfast broadband, because that's seen as the way business is done.

"I was hearing the other day from Openreach that a lot of new houses still don't have fibre. They have gas and water, but they don't have fibre, even though it's a new utility," says Joseph. "Demand will carry on changing as new forms of communications become so much easier. I appeared on the BBC's *Victoria Derbyshire* show recently: I was in a studio while they had three different people on via Skype from different parts of the country. That was unimaginable even two or three years ago."

Even where people do need to travel, one element of the driverless-car future is already here, he says. "There's a vision of autonomous vehicles where everybody will be able to get into a car and not worry about driving so they can work in the car. Well, we're a long way from that, but it's something we can now do on public transport.

"Installing free wifi on public transport - it's not transport policy, it's communications policy really."

Joseph also points to smart ticketing, aggregating freight travel - and even coach travel though apps such as Snap, which links up passengers which spare space on intercity coaches - and being able to book car parking spaces in advance.

"Somebody found that between a quarter and a third of city and town centre travel is people looking for car parking spaces. So you can do things like booking parking spaces so people know there's a space, and that's completely feasible," he says. "It will affect travel demand because people will notice it when they travel into a particular area."

For an example of how to approach development, James Harris points to Poundbury, the Prince of Wales's development in Dorset, which is praised in the Transport for New Homes report. "You need housing to be close to an area with sufficient mass to have a good range of jobs and services - the first lesson is to build your new housing in or around your largest settlements first. You want to reduce the need for people to leave their settlements. Most people, when they leave their settlements, do that by car.

"The interesting thing about Poundbury is that within the redline of the development they went for a fairly mixed-use scheme. It wasn't just a housing estate - you can build one of those but people have to leave on a daily basis. So they put in a GP's surgery and a school, and held back some space for local employment and manufacturing."

Then after you've thought about the size of the settlement, Harris says, you've got to get your urban design right. "It's got to encourage walking and cycling, and it's got to be delivered at that point. Otherwise, you finish the housing and then the bus network doesn't get connected up for a month or two and by then people have already formed their travel habits."

Keeping mixed uses in communities is vital, Harris believes, adding that the Government needs to look again on its policy of allowing landowners to turn redundant office space into residential accommodation. "It works well in some areas, not in others," he says. "The Government recently launched a consultation about turning redundant retail space into residential - we're not a fan of having a blanket national policy on that.

"We're fine with local areas having the power to do that if they wanted to but the Government wants the opposite approach - to allow it, and then task local authorities to say they don't want it in a certain area."

Harris warns that policies allowing retail or office space to be converted to residential could be open to abuse. "What is redundant office space or retail? You could easily jack up the rent so tenants move out. Everyone kicked up a fuss about pubs, but you don't want to only realise what you've got once you've started losing it."

It's not just about giving planners more money and power, Stephen Joseph adds, pointing out that air pollution worries have pushed city planners into looking at strategies to cut demand. "Transport for Greater Manchester (TfGM) and others could do with more power.

Developed by the Prince of Wales, the new settlement of Poundbury in Dorset has earned great praise among town planners for its integrated community of shops, homes and businesses, which has significantly reduced residents' need to travel great distances. ALAMY.

They have some, but most of it would simply be about the Government letting go and trusting them to do things.

"Transport Secretary Chris Grayling has been very well known for being against letting Transport for London control Southeastern's metro trains, but more importantly he rejected TfGM's bid to manage railway stations.

"This is about using stations as hubs for people to be able to work and meet at; the idea of stations being development hubs."

Joseph says Transport Scotland was doing that, having redeveloped Dundee and Aberdeen stations to make them central to the town centre. "You can imagine how suburban railway stations in cities could be made into workspaces - even being able to cycle to Maze Hill station [in southeast London] three days a week and then commute to London Bridge two days a week. The Dutch do a lot of that. That's an example of the powers they might expect to have. Being able to manage and include the fares is part of that."

He praises Greater Manchester mayor Andy Burnham's strategies for walking and cycling as being "more ambitious than London's", but says the metro mayor's powers are still not as strong as their counterpart in the capital - hampering the development of policies to cut demand.

"The London mayor has his own authority in TfL and sets three overlapping and complementary strategies: transport,

> We've had some decent investment in public transport but it's been balanced against nothing to make driving a less attractive option. The only things that make driving less attractive are the externalities like congestion.

James Harris, Policy and Networks Manager, Royal Town Planning Institute

London Plan, the environment - they all feed off each other," says Joseph."The other cities don't have that; there's a combined authority of other council leaders, which would be like the leader of Greenwich being Sadiq Khan's transport leader. They're more dependent on the local councillors and don't have the same revenue streams.

"The more powers you have at city region level, the more you will have decisions that will manage demand. For example, London has the power to enforce yellow box junctions - those powers haven't been devolved outside London."

Having the right data to back up those powers is essential – and the most important factor in being able to reduce demand for travel, Joseph feels. "Aggregating data and managing it gives you clear signs of actual travel, and that's a new thing. Most cities, led by TfL, understand that better than the Department for Transport. You can find out what travel is and manage it," he explains.

"At the Campaign for Better Transport we did a small exercise with the University of Northampton where we collected postcode data on staff, students and clients at colleges, the county council and hospitals - we got data on 40% of trips in the county.

"We had 100,000 car trips, of which a good number would be cycled or walked, or switched for car-sharing or reworked bus routes. If you provided a bus route for a group of nurses and gave them a discount, you'd make money. And you could use that to manage demand. The use of data like that, all anonymised, and aggregated - this is where big data really means something."

At the RTPI, James Harris feels that as high streets suffer, big box retail may also suffer - but provide a new opportunity. "We're stuck with the situation because we let it all happen, but there's an interesting discussion around how the owners of those retail spaces can work with the local council - could these be areas for mixed-use communities?

"Bring some housing into the mix, link them up with public transport so you're not just providing big box retail space but other live/work space, and employment as well. I can see that being a useful use for retail space that may become redundant because of changing consumption patterns."

On road pricing, Joseph says: "We're going to move away from internal combustion engines by 2040. Either we're going to have to tax electricity massively - which brings its own problems - or we're going to have to bring in road pricing, and that's already a live debate."

Referring to the controversial Silvertown Tunnel scheme, which is aimed at relieving Blackwall Tunnel congestion, Joseph adds: "I think TfL recognises you can't toll the Silvertown crossing and leave everything else untolled. So, the [London] mayor has at least started to talk about it. There have got to be incentives to move in that direction."

Harris picks up the theme saying there needs to be sensible costing of all the different transport options. Road pricing is "the old-fashioned way of talking about it", but advanced technology offers smart ways of internalising the cost of different types of transport.

"The main things are actually making road transport account for the externalities such as pollution - not as a classic 'war on the motorist' tax but making sure the revenue goes into providing people with real alternatives," he says.

"That's what we haven't had a for a while - we've had some decent investment in public transport but it's been balanced against nothing to make driving really a less attractive option. The only things that make driving less attractive are the externalities like congestion."

A future of stronger powers for planners, local and city authorities coupled with better data and more technological innovation could be the key to reducing demand. Is congestion a good thing in reminding us that we need to change?

The RTPI's James Harris says no. "Not at the level that we already have," he says. "I don't think we need to let it get so far just to show we're having an impact; I'd rather see congested buses and tube carriages and cycle lanes as evidence of economic progress." ST

Scott Witchalls
Director, Transport and Infrastructure, Peterbrett

The fundamental point about travel is that it's a direct reflection of lifestyle need and choice, influenced by land use planning, design, technology and cost, but also other social factors that are harder to model or predict.

Economic and population growth are bound to bring a need for movement of people, goods and services. However, there are too many examples where the potential volume and type of movement needed has been an afterthought that has hardly influenced location, land use mix or design.

We have a plan-led system that requires planning authorities to meet economic and housing need, but the process often leads to the allocation of sites for predominantly single land uses (eg housing) where the overall accessibility picture has carried limited weight in site selection. This, in many cases, is self-defeating in terms of any aspiration to reduce the need to travel, or to travel more sustainably, since the jobs, goods and services needed are in other locations, and the easiest and most convenient way to access these sites has been to connect to existing roads based on the predication that the majority of people will use cars. In turn, this leads to technical assessments that tell us we need to build more parking and road capacity to accommodate more car trips. Is it any surprise that the cumulative impact of this is more traffic and more congestion?

However, some of the interesting emerging travel trend data suggests that overall travel is reducing and, particularly for the younger demographic. Car ownership and use is on a downward trend. There could be many reasons, but two of the key influencing factors are cost of car ownership, and ability to travel as required without the need to own a car.

There is clearly an opportunity to capitalise on this trend in future development planning which we must embrace now. But we also have to be realistic about how development is delivered in a competitive, mainly market led manner, coupled with the need to demonstrate viable and deliverable development plans. In addition, we need to take account of the wide range of lifestyle factors of all demographic groups.

People tend to react negatively to being told to behave in a certain way, so we need to ensure needs can be met locally and make walk, cycle and passenger transport travel options more convenient than cars and/or

A Great Western Railway Intercity Express Train crosses the M5 at Badgeworth (near Cheltenham) on January 10. Making public transport more convenient will help to capitalise on falling levels of car ownership, argues Scott Witchalls. JACK BOSKETT.

lower in terms of cost.

There has been some recent movement in site allocation recommendations based on overall sustainability rather than a complete block, for example, on Green Belt release, on the basis of 'exception tests' being met, ie no suitable alternative sites. It has long been argued by many practitioners that some Green Belt sites immediately adjacent to existing towns and cities could offer a more sustainable solution for new homes than building in remote, non-Green Belt areas, where the only practical means of access is by car.

For example, the recent consultation draft South Oxfordshire District Council Local Plan now includes sites in the Green Belt to help meet Oxford City's need. This is partly a result of recognition that a non-Green Belt airfield site could not deliver the housing numbers needed in the plan period. The Green Belt sites adjacent to Oxford City that are more sustainable in terms of access to existing jobs, facilities and services could help deliver a better outcome in transport terms.

However, new development planning in isolation is only part of the solution. The key challenge is to tackle existing trips made as well. We need to take the opportunity for new developments to improve accessibility for existing communities by providing new schools, jobs, healthcare, retail and leisure as well as extending and improving walking and cycling networks and public transport services to better integrate with existing areas.

Similarly, anything passenger transport operators can do to improve the convenience of use and access to services is to be welcomed and indeed is often invested in unilaterally by operators aiming to increase market share. This includes changing routes and services, ticketless payment systems, real time information and WiFi on buses and trains. But such initiatives shouldn't happen in isolation - there needs to be an ongoing dialogue with planning, transport authorities and developers to work towards a combined overall level of service that reduces private car trip reliance.

The wider use of data and information technology has already had a significant impact on both the need and the way we travel and use our transport systems, all of which lead to more efficient use of the available infrastructure capacity. This is positive but there is some way to go to maximise the benefits of data integration, more remote working, shopping etc.

The roll-out of more flexible working arrangements, enabled by improved communications to homes or more remote communal working hubs, perhaps focused at stations, offers potential to gain more benefit from the infrastructure we already have, but we mustn't forget the need for social interaction and face-to-face communication.

One thing is clear - we need to get better at reducing the number of existing and new car dependent developments by better land use planning and maximising the use of existing infrastructure by exploiting data and technology solutions. ST

To collaborate or not to collaborate?

It's time to ask the smart questions, says **Rachel Skinner**, UK Head of Development at global professional services consultant WSP

About the author

Rachel Skinner is WSP's Head of Development for its UK Planning and Advisory business and is also an Institution of Civil Engineers vice-president.

In just a handful of years, we've moved from discussions about whether we will ever see fundamental change, to a debate around when and how. The questions we ask, and the choices we make about how to work together, will be pivotal. Get it right and we can generate new revenues and solve many of today's transport challenges. Get it wrong and we will spend the next 100 years paying the price.

Electric vehicles are increasingly in demand. Governments around the world are stating that by 2040 (and sometimes earlier) they will not permit the sales of new petrol or diesel vehicles. Why? Because nearly all of the major motor manufacturers will have stopped making them by then.

Walking past the flagship salesroom of a motor manufacturer on London's Park Lane recently, I was struck by the fact it had chosen to dedicate more than 50% of its valuable glass frontage to electric cars. The demand for these models is undeniable and, in the UK, the National Infrastructure Commission is encouraging the Government to bring forward the deadline for 100% electric car and van sales to 2032. This is less than the average lifespan of a modern car from new to scrap, and around the time it takes for a child to reach secondary school.

From a shared mobility angle, the pace of change is staggering. Shared hire bikes no longer need docking stations, leading to a proliferation of them across many of our towns and cities. Car share schemes also continue to evolve and diversify. Two core business models form the majority: schemes where individual car owners opt to offer their own car for use by others in exchange for a fee, and those where vehicle manufacturers supply a fleet of vehicles for use within a defined area by those who opt to join their club. In parallel, the emergence of Uber and similar app-based private hire vehicles is now embedded as a part of daily life for many.

One of the critical aspects of these shared mobility options is that it helps us all to get used to the idea that car ownership can be decoupled from car use. Similarly, there is major change in the connected and automated space. Each week brings news about trials and vehicle launches, and nearly all new vehicles (light and freight) are now connected. This is the tip of the iceberg; we have not yet scratched the surface of the data-led intelligence gathered or the ways in which it can be applied.

A few weeks ago, I was at a motor industry event. Listening to a range of people speaking about new developments in data analytics, it became obvious that the worlds of road transport planning and motor manufacturers are beginning to collide. Never before have the motor manufacturers had quite such an overt or acute interest in city-shaping, air quality or congestion-busting.

Why? There is a growing recognition that with the multitude of mobility options on offer and the relentless long-run march towards an increasingly driverless future, personal car ownership may become less essential. This is not a sudden burst of civic-minded duty by vehicle manufacturers but a very serious piece of the jigsaw for onward survival and future growth.

So where does collaboration come into all of this? The key challenge is how to embrace all of this change in order to get a great set of solutions and outcomes. With so many axes of change in play, the mobility landscape is seriously complicated and changing fast. And with change comes serious opportunity: it's a cliché, but everyone should win.

In my view, there has not been a bigger opportunity for a brand-new mobility business model - or to drive for positive change from all points of view - since the first Ford Model Ts rolled off the production line in 1913. Beyond the monetised opportunity itself, which will be large if we play our collective cards right, there are two other key differences for us a century later. First, we have 100 years of road and place-making history learning on our side and, second, we now have some very real challenges around air quality, congestion and road safety that are ripe for urgent resolution. In the UK alone, the total negative costs of these three are in the order of £100 billion per year. This is a serious and sobering figure.

> "We need to realise we will never have all the answers at our fingertips. What we can do is grasp the pieces of the future mobility puzzle that are under our control and seek to make progress."

The previously discrete worlds of road transport planners and motor manufacturers have moved much closer together in today's shifting mobility landscape, says Skinner. SHUTTERSTOCK.

Common sense, however, tells us that multiple competing interests tend not to be the best recipe for good long-run outcomes. This is where there is enormous potential for real collaboration which can serve all of our interests. Unfortunately, we are edging into that competing-interests territory right now.

We have a host of technology providers seeking places to bring solutions to market and test out new ideas on the ground. This means new options and trials across towns and cities around the country and beyond. They're finding a warm welcome in some places but they are often being met with mild confusion or a lack of interest elsewhere. It is often the case that the solutions being tested on the ground are often the ones thrust to the front of the market for individual commercial gain, rather than solutions that have been specifically shaped to address real live issues on the ground. Better collaboration has the potential transform these outcomes - and increase returns.

Then we have local government. There is some very progressive thinking in a handful of places around the country. New roles focused on future mobility are bubbling through and long-range growth strategies that take account of the potential impacts of

> The worlds of road transport planning and motor manufacturers are beginning to collide. Never before have the motor manufacturers had quite such an acute interest in city-shaping, air quality or congestion-busting.

electric, shared, connected and automated futures are beginning to emerge.

Some trials are being done with the benefit of detailed thought about the most appropriate local solutions needed for the long run. Unfortunately, these examples are few and far between. The majority of local authorities are choosing (or having) to play a waiting game, pending a firm new mobility mandate from above. Again, better collaboration would help and, done well, could allow local authorities to engage and generate new revenue streams.

At national level, there is a huge amount of effort and thought focused on the future of mobility. The Industrial Strategy's recognition of mobility as one of the grand challenge areas has helped move the debate along, and encouraged the desire to unpick and understand potential solutions and responses across the technical, social, legal and political spectrum. It is also understood, increasingly, that our existing and future physical transport and urban infrastructure will need to flex to cater for multiple iterations of digital systems over the years to come, and that it will fall to national government to draw up these rules of engagement. There is a visible effort to engage and collaborate but there is much more to be done.

So how do we best take this forward? First, we need to realise we will never have all the answers at our fingertips. And waiting until we do is a fool's game. What we can do is grasp the pieces of the future mobility puzzle that are under our control and seek to make progress.

One immediate option is the potential for some serious and meaningful collaboration at a local level where the bundle of mobility solutions is tailored for a specific place or small group of places. Between these stakeholders, we have all the essential ingredients: we understand the real problems on the ground, we can see the potential solutions and seek a good match to maximise benefits, and we can put some political and strategic 'oomph' behind the emerging plans.

What if the technology providers turned their minds to providing a set of locally specific system solutions that between them attacked the real roads-related challenges of the day: air quality, congestion, safety, connectivity, adaptability and new revenues for the provider and the road network operator? What if we stopped worrying about whether this solution would be the EveryTown or EveryRoute solution? What if we stopped to consider the fact that a single, great solution for one type of place - one where the network operators, fleet owners and technology providers all agreed that things were working - would naturally propagate? What if those same solutions were crafted with wider social objectives in mind beyond the commercial: a fair, affordable, safe, accessible and equitable multi-modal transport system that has the best chance of being (and remaining) popular? What if this was done in an environment where public and private sector recognised their differing challenges yet looked for a way for both to benefit as needed?

What if we could? That sounds like smart transport - through smart collaboration - to me. ST

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Finding the technological tipping point

A century from now all road transport will be electric and autonomous. But when the public will really start to buy into these technologies is still subject to great debate, says **Jonathan Manning**

Back at the turn of the millenium the journalist and author Malcom Gladwell wrote a book called *The Tipping Point*. The bestseller built on ideas from medicine, anthropology and business to analyse the processes as society adjusts to and then adopts a major change. Whether it's the spread of disease, the flight of communities from a neighbourhood as its ethnic mix changes, or the uptake of new technology, once the tipping point is reached, "ideas and products and messages and behaviours spread just like viruses do," Gladwell wrote.

Across the boardrooms and factories of vehicle manufacturers and technology firms, executives are waiting for this type of contagious behaviour to take hold of customers in the adoption of electric vehicles and the acceptance of autonomous driving systems.

A glance at the current sales data would indicate there's still a long way for the scales to shift before the electric vehicle tipping point is reached, while driverless technology has multiple consumer, infrastructure and political barriers to surmount before passengers can put their feet up and let computers take control of the steering wheel.

The showroom performance of electric vehicles reveals how their motor show limelight has yet to translate to anything but negligible sales. For the first ten months of 2018, sales of electric vehicles in the UK totalled just 12,526 units, up 6% on the same period of 2017 in an overall new car market down 7.2%, but acounting for an underwhelming 0.6% market share.

Sales of hybrid and plug-in hybrid vehicles, both capable of at least a few zero emission miles, boosted this alternatively-fuelled vehicle market share to 5.9%, up 22% year-on-year, but few commentators see the belt and braces approach of combining an electric motor with a petrol- or diesel-powered engine as an efficient, long-term solution.

This is clear in the Government's stated ambition to outlaw the sale of cars with internal combustion engines by 2040, and its favour for a pure electric future is clear to see in the changes made to environmental grants. Since October, grants are only available to vehicles capable of a range of at least 70 miles in battery mode, spelling the end of subsidies to the most popular hybrid cars, such as the Mitsubishi Outlander and Toyota Prius.

Cities are looking to go even further, amid serious concerns over the role played by exhaust emissions in air pollution and the impact this has on public health.

Birmingham, London, Greater Manchester and Oxford have already made commitments to introduce not simply low emission zones, but zero emission zones, albeit with few absolute deadlines beyond the capital.

About the author

Jonathan Manning is a freelance writer and editor. He is a former editor of *Fleet News*, and is now responsible for writing its *Fleet Connected* section which focuses on mobility, connectivity, urban issues and last mile solutions.

> "There are four things that are necessary for the electric revolution to happen – retail, range, recharging and residual values."

Steve Gooding, Director of the RAC Foundation

This political push towards electric power is only one of the factors that will drive electric vehicle sales, according to Steve Gooding, Director of the RAC Foundation, who cites 'the four Rs' as the key criteria for mass uptake.

"We have always said that there are four things that are necessary for this electric revolution to happen; retail, range, recharging and residual values," he said.

Each of these criteria currently lags behind where it needs to be to persuade new car buyers to change their driving and buying habits from petrol and diesel. In terms of retail, for instance, the glitz and excitement of motor show concept cars have yet to make their way to showrooms, where the selection of pure electric cars remains extremely limited – only 19 models are presently eligible for government grants.

"If we are going to have an electric revolution the number of cars available in showrooms would have to be significantly higher and the prices would have to come down and be attractive enough to the mass market, to people who earn an average salary," says Gooding. "That's when we'll see higher volumes of cars sold."

Even with a maximum grant of £3,500 towards the price of the vehicle, the acquisition cost remains well above equivalent models with an internal combustion engine. Volkswagen's battery-powered e-up! city car, for example, costs from £25,640, whereas the five-door petrol version starts at £9,725. The VW e-Golf retails from £32,730 compared with a starting price of £18,995 for the petrol five-door model.

A report by Bloomberg New Energy Finance earlier this year forecast that electric cars could become cheaper than their petrol equivalents by 2025, although there are so many variables in the mix, from the price of lithium for the batteries to the opportunity to amortise development costs across millions of vehicles, that it's a movable feast.

Price parity between electric and fossil-fuelled cars was a key factor in the one market, Norway, where battery-powered ▸▸

cars have genuinely passed a tipping point, achieving a 39.2% market share of new car sales in 2017. While new car buyers in Norway face the highest retail prices in Europe, the Norwegian government's decision to waive heavy purchase taxes and exempt the vehicles from 25% VAT, played a key role in driving demand.

To ice the cake further, drivers of electric cars in Norway also benefit from a low annual road tax, no charges on toll roads or ferries, and free parking in municipal car parks.

"Norway is leading the way for the transition to zero emission electric cars. This is first and foremost due to a substantial package of incentives developed to promote zero emission cars," says a spokesman for Norsk elbilforening, the Norwegian Electric Vehicle Association.

There is, though, an argument that the UK may be slightly less price sensitive, at least in the acquisition cost of electric vehicles.

Current lengthy waiting lists for battery-powered cars indicate that price parity with petrol or diesel equivalents may not be necessary, at least among early adopters. Furthermore, savings from cheap recharges, compared to a tank of petrol or diesel, should provide lower per mile running costs for electric vehicles, although sceptics will question how long the Government can afford to wave goodbye to the £28.2 billion it raises annually in road fuel duty; petrol and diesel incur duty of about 70%, whereas electricity is taxed at 5%, so e-power can expect to see its duty rise eventually.

Arguably the most significant electric vehicle savings are for commuters and fleets that operate in soon-to-be-introduced clean air zones. The opportunity to avoid daily charges - London, for instance, will charge non-compliant vehicles £12.50 per day to enter its ultra low emission zone - and escape access bans when air pollution reaches critical levels, could prove to be a gamechanger. In the short-term, however, it's worth noting that the latest generation Euro 6 diesel engines will avoid London's charge.

> We need some pretty intensive thinking about where publicly available charge points need to be in order to make people feel as relaxed about recharging as they currently are about being within range of a petrol station.

Steve Gooding, Director of the RAC Foundation

Company car drivers, too, stand to gain substantially from selecting an electric car from 2020-21, as the percentage of the car's list price used to calculate the benefit charge tumbles.

"The benefit-in-kind tax charge will rise for 2019-20 to 16% and then fall dramatically to just 2% for 2020-21," says Clare Clifford, director and tax partner of Baldwins. "From a tax perspective, electric vehicles will be the cheapest type of vehicle to provide to employees."

The practical implications of running an electric vehicle as a company car, however, expose two of the principal barriers to the technology's uptake, namely their range and the time it takes to recharge the batteries.

A survey of more than 10,000 drivers conducted by the AA in the summer found that 76% think electric vehicles can't travel far enough on a single charge, while 67% believe the batteries take too long to charge.

Edmund King, AA president, argues that in many cases public perceptions reflected myths rather than reality, adding that more needs to be done to

Sales of electric vehicles represented almost 40% of the new car market in Norway in 2017, compared to less than 1% in the UK. NISSAN.

Norway's incentives for electric vehicles

- No purchase or import taxes
- Exemption from 25% VAT on purchase
- Low annual road tax
- No charges on toll roads or ferries
- Free municipal parking
- Access to bus lanes
- 50% reduced company car tax
- Exemption from VAT on leasing

Source: Norsk elbilforening (Norwegian Electric Vehicle Association)

sell the benefits of electric vehicles.

"The range, charging speed and charging point infrastructure are all on the increase," he says. "Massive savings can already be made on running and service costs, as well as the tax benefits."

Drill down into the detail of individual driver lives, however, and it's not the headline figure for the size of the UK's recharging infrastructure that matters as much as the opportunity for drivers to recharge their cars overnight and top up the batteries wherever they are during the day. For predictable routes, such as a daily commute, home and workplace charging can satisfy this demand so long as drivers have off-street parking at both ends of their journey. But for drivers who use their vehicles during the day, recharging is an issue.

Green Tomato Cars provides a perfect case in point. It operates London's largest low emission fleet of almost 600 taxis, with a mix of hybrid, plug-in hybrid, hydrogen and pure electric powertrains.

Managing director Jonny Goldstone admits that charging has always been a challenge. The company's drivers are largely self-employed, so all the time they are not taking a fare while their vehicle is recharging, they are not earning an income.

"They drive an average of 120 to 140 miles per day when they are working, so the battery range has to be at least 150 miles in winter [cold weather has a negative impact on range], because charging twice in a day is too much," says Goldstone. "Then you think about the demographics and geography of the drivers and you realise it's very unlikely they will live somewhere with its own off-street parking. If they do have off-street parking they are likely to live in the suburbs, such as Slough, Gatwick or Luton, so they have to drive 20 to 25 miles each way to the 'action', because the majority of our trips are along the Thames corridor between Heathrow and Canary Wharf."

Goldstone's business needs a recharging infrastructure that offers drivers the chance to top up their batteries with a rapid charge without deviating more than three or four minutes from their last passenger drop-off. A drive of two to three miles in congested central London could easily take half an hour, time that neither the drivers nor business can afford.

In Norway, its Government opened up bus lanes to electric vehicles, but as the RAC Foundation's Steve Gooding says: "If you opened up the bus lanes to electric cars in London, the buses would not get through. It would still be a traffic jam, just with different types of vehicle."

He also highlights the need for the Government to harmonise charge point technology so that it's open to all makes of car.

"Charge points are not homogenous. Chargers can charge at different rates and different cars accept charge at different rates. You need a perfect match between car and charge point," says Gooding. "The Government probably needs to do something to standardise charge points. It's important to understand that the car will only accept charge at the rate it's designed to accept it. Politicians talk about rapid chargers and superchargers, which are great, but if you are driving a first generation electric car it's irrelevant, because at best you will be charging at way below the chargepoint's theoretical maximum and all the while you're blocking a charge point that someone else could be using.

"We need some pretty intensive thinking about where publicly available charge points need to be in order to make people feel as relaxed about recharging as they currently are about being within range of a petrol station."

Price conscious buyers, especially fleets governed by a total cost of ownership philosophy, will also want to see more robust residual values for electric vehicles before committing to the technology.

"The car magazines will tell you that nothing depreciates faster than an electric car, but this is a very immature market. Plus in recent months we have seen the secondhand price of some electric cars shooting back up because of a shortage of new models," says Gooding. "Maybe the answer on depreciation sits with the development of the PCP – where we're not buying a car but buying a lease, so once automotive companies have ramped up production maybe they will guarantee used price of an electric vehicle through these deals."

If, for many drivers, the switch from internal combustion engines to battery power remains a leap of faith, it is at least a leap into tried and tested technology. The transition to autonomous, self-driving cars is a leap into science fiction. Gauging public attitudes is difficult because it's asking people to imagine something that is unimaginable and then asking how they feel about it.

This helps to explain why a collision involving a self-driving car lingers in the public consciousness, undermining confidence in the technology. The newsworthy shock of incidents such as the Uber car that killed a pedestrian in Arizona in March 2018 make them easy to recall, and this convinces people that such events are likely to happen more frequently, according to cognitive psychologist Dr Angela Weltman, who has worked with Ford and Nissan. As a result, public attitudes to driverless cars shift rapidly, and as the technology becomes more real, so public fears seem to be mounting.

OpenText, an enterprise information management company, released findings in November that indicated a declining UK public confidence in autonomous technology. Its survey found that 31% of respondents believe there will be more

> "Any technology that involves a physical aspect that could be disruptive with fatal consequences will moderate pick-up, and that's not necessarily a bad thing."

Nathan Marsh, Director of Digital Transformation, Atkins

Although purchasers of electric vehicle models such as the Volkswagon e-Golf can qualify for grants of up to £3,500 towards the purchase price, they remain more than £10,000 more expensive than their petrol variants. ALAMY.

driverless/autonomous cars on the road than 'normal' cars in the next ten to 15 years, compared with 66% who thought this would be the case last year. Moreover, the number of people who said they would feel comfortable in a driverless car declined to 19%, compared to 24% in 2017.

Mark Bridger, Senior Vice-President, Europe of OpenText, says: "We're very much in an era of transition for automotive vehicles. The mix of confusion, fear, optimism and inevitability in the minds of UK citizens shows that whereas some artificial intelligence-enabled technologies have moved seamlessly into our lives, more game-changing offerings like autonomous vehicles will take time to be embraced."

The forerunners of driverless technology, such as the safety features like autonomous emergency braking and lane assist systems on new cars, are gradually introducing the concept of computer control to motorists, but there is a long way to go before drivers say they are happy to relinquish complete control.

Research published by Cox Automotive at the end of the summer found 68% of people saying they would feel 'uncomfortable' riding in a vehicle driven by a computer (compared with 39% who feel uncomfortable in a car driven by a stranger), while an overwhelming 84% said humans should always have the choice to drive themselves, even in an autonomous vehicle.

"As awareness around the development of autonomous technology increases, we're seeing some dramatic shifts in consumer sentiment," says Karl Brauer, Executive Publisher, Cox Automotive. "People now have a deeper understanding of the complexities involved when creating a self-driving car, and that has them reconsidering their comfort level when it comes to handing over control."

So while three-quarters of the people polled by Cox accepted that autonomous vehicles have to be tested in real-world driving conditions, 50% would not want the trials to be conducted on roads where they themselves drive or walk.

Safety is central to this. "Autonomous vehicles have to improve safety, not just be safe," says Michael Hurwitz, Director of Transport Innovation at Transport for London - and while vehicle manufacturers wrestle with the fiendishly difficult technical challenges involved in developing autonomous vehicles, there are also complex ethical issues to resolve in order to reassure the public.

Prof Rupert Stadler, chairman of Audi, frames the debate neatly: "Imagine a situation, where the autonomous car has got three choices: either it steers left and harms an elderly lady. Or it steers right and hits a pregnant woman. Or it drives straight into an obstacle and thus harms its own passenger. In such a situation, human beings have no time for thoughtful decisions. We simply react. But interestingly, we expect the autonomous car to make the right decision. As a society, we will have to find ways how to deal with these topics."

Somewhere in the design chain computer programmers have to code this type of choice into the algorithms of the artificial intelligence systems that will drive autonomous cars. Research published in the journal *Science* found that 76% of the public favoured AI that would choose to save the most lives overall in the type of scenario outlined by Stadler. But those same respondents admitted they would be significantly less likely to buy an autonomous vehicle that sacrificed themselves and their passengers in order to protect other road users.

> "People now have a deeper understanding of the complexities involved when creating a self-driving car, and that has them reconsidering their comfort level when it comes to handing over control."

Karl Brauer, Executive Publisher, Cox Automotive.

Cars that qualify for UK grants

The following models qualify for grants of 35% of their purchase price, up to a maximum of £3,500. To qualify, vehicles must have carbon dioxide emissions below 50g/km and be able to travel at least 70 miles without producing any emissions at all.

- BMW i3 and i3s
- BYD e6
- Citroen CZero
- Hyundai IONIQ Electric
- Hyundai KONA Electric
- Jaguar I-PACE
- Kia Soul EV
- Mercedes-Benz B-Class Electric Drive
- Nissan e-NV200 (five-seater and seven-seater)
- Nissan LEAF
- Peugeot iON
- Renault ZOE
- Smart EQ fortwo
- Smart EQ forfour
- Tesla Model S
- Tesla Model X
- Toyota Mirai
- Volkswagen e-up!
- Volkswagen e-Golf

Source: gov.uk

The 'moral' imperative that machine thinking could eliminate the 90-plus percent of accidents caused by human error - 1,793 road deaths and 24,831 serious injuries on UK roads in 2017 - has yet to take hold.

While all new technology encounters a spectrum ranging from early adopters to late accepters, the dangers inherent in autonomous driving separate it from other game-changing technology, such as smartphones, argues Nathan Marsh, Director of Digital Transformation (UK and Europe) at digital engineering specialist Atkins.

"If an iPhone goes wrong it's either an inconvenience or it's a data breach and you could be defrauded, but it's not going to career off the road," he says.

"Any technology that involves a physical aspect that could be disruptive with fatal consequences (the same goes for artificial intelligence technology in health in the NHS) will moderate pick-up and that's not necessarily a bad thing."

As chair of the Venturer Alliance Board, Marsh oversaw a three-year research and development project that explored the obstaces to the adoption of autonomous vehicles, and how these barriers might be overcome. Key findings included a significant increase in participant trust in autonomous vehicles when the vehicles demonstrate more cautious behaviour than human drivers. In one experiment, trust ratings fell when an autonomous vehicle chose to drive through a gap that only 50% of human drivers would accept, and rose when the vehicle declined such a gap.

Interestingly, the participants in the Venturer project showed no significant difference in their attitudes to autonomous vehicles whether they were pedestrians, cyclists or motorists, although all still favoured the idea of human drivers, especially for taxis and buses.

And it's not simply the safety concerns of handing control to a computer that ring alarm bells among the public.

Tracing the development of autonomous vehicles to their logical conclusion, namely fleets of self-driving taxis replacing private cars, presents the socially awkward scenario of passengers sharing journeys with strangers.

The MERGE Greenwich project, which aims to develop a blueprint for driverless ride-sharing services, identified that travelling in the confined space of a car with strangers prompts different reactions and requires different rules of social engagement to travelling on a bus or train. MERGE's research found that women over the age of 50 are least likely to use a shared autonomous vehicle, while men aged 45 are most likely to accept the shared space.

"This indicates that vehicle design would be key to overcoming barriers to ride-sharing, by ensuring the environment provided personal space, safety and comfort," said MERGE.

It also found greater public acceptance of autonomous vehicles that might follow a set route, rather than roam freely, with knowledge of the route increasing the perception of safety and control among potential passengers.

Resolving each of these concerns and anxieties, whether over the cost, range and recharging time of electric vehicles, or the accident-avoidance decisions made by autonomous vehicles, will be critical to the success of both technologies, but it's not impossible.

As Malcolm Gladwell wrote in *Tipping Point*: "Look at the world around you. It may seem like an immovable, implacable place. It is not. With the slightest push - in just the right place - it can be tipped." ST

Ian Wright

Head of Innovation and Partnerships, Transport Focus

Transport Focus is a consumer body that focuses largely on the needs and experience of transport users, be that on public or private modes. As the article by Jonathan Manning makes clear, there are still relatively few electric vehicles, and - as yet - there are no autonomous private vehicles beyond various trials. Transport Focus has yet to explore electric vehicles (EVs) or connected and autonomous vehicles (CAVs) in any detail with consumers.

There is a dearth of thorough and up-to-date research in the public domain, which Transport Focus aims to address in its future research programmes. However, one thing seems clear; developments in this area have not been driven by consumer demand, but by technology companies, automotive manufacturers and government policies. We appear to be coming full circle from the mass adoption of the internal combustion engine a century or so ago, when Henry Ford is alleged to have said: "If I had asked people what they wanted, they would have said faster horses."

While for governments - national and local - environmental issues, including air pollution, have been key policy drivers Transport Focus research shows that for transport users, environmental concerns do not often determine modal choice. Cost and convenience drive most transport choices, along with comfort and a sense of being in control. While in the Brexit climate, advocating a Norwegian model may be contentious, from a consumer perspective it would be good to see a greater use of carrots than sticks as has been done in Norway to encourage uptake of EVs.

When it comes to autonomous vehicles, safety is key when driver error is a major contributory factor in road accidents. Indeed, road users themselves see this as an area that could be improved. When Transport Focus asked motorists on the Strategic Roads Network about their priorities for improvement, "better behaved drivers" was the third highest improvement requested.

It is likely the technology will not be the major barrier to widespread adoption of CAVs. Regulatory, commercial, legal and user behaviour/acceptance issues will almost certainly be greater barriers. One of the largest problems for current roads users, be they in their own car or in a bus or other form of public transport, is congestion. That problem is unlikely to be solved if everyone replaces a private car with a private autonomous vehicle. Our Future of Transport research a few years ago noted the growing trend for vehicle sharing rather than ownership, but how easily that translates from music and film to transport is a moot point.

Questions such as who owns the vehicle, and who owns the customer if the user does not own the vehicle (as many predicted business models suggest) are important ones to answer.

And as Transport Focus research also noted, the future of transport is as much about the transport of information as it is about physical mobility.

Who owns or has access to the huge amounts of data CAVs will produce - businesses, individuals or authorities - will have major implications.

It may well be that the commercial and freight sectors adopt autonomous vehicles first, as early steps and platooning trials are already in place. However, it will be crucial to observe how other drivers interact in these circumstances, because experience here may well dictate how well the technology gains wider public acceptance. ST

Matthew Eastwood

Head of Transport, Energy Saving Trust

Sales figures alone might suggest that the market is hesitant to embrace electric vehicles, and that EVs have yet to reach a tipping point. However, sales figures alone tell only half the story. As highlighted in the article, vehicle manufacturers need to gear up for the increased demand evidenced by the long lead times experienced for the vehicles currently on the market. It could be argued that customers are waiting for manufacturers to build the vehicles - both existing models currently only available in limited numbers and future, often higher specification ones, promised by manufacturers.

The limited range of models available has no doubt also compounded the modest overall increase in EVs sold to date, but the market potential as some of these supply constraints ease can be seen by the increase in 2018 sales reported by the Society of Motor Manufacturers and Traders year on year in October of 86.9% and November of 69.5% for a 0.8% and 0.9% market share respectively. These represent impressive increases on admittedly low numbers, but the demand is clear to see.

Vehicle purchase costs must and will reduce as production volumes of the vehicles and their batteries increase. Battery cost reductions are already beginning to be evidenced by the significant increases in range with each new model to market. The recently announced Hyundai Kona EV with a 64kWh battery has a quoted list price a little above the Volkswagen Golf EV but it has a range under the new Worldwide Harmonised Light Vehicle Test Procedure (WLTP) of 279 miles compared with 143 for the Golf. Volkswagen is unlikely to be left behind as massive investments have been announced to convert existing factories to electric vehicle production and to secure battery supply to meet increasing forecast demand.

Work does need to be done to engage with the automotive supply chain on EVs and vehicle charging technology. Many dealer staff of both new and used vehicles have yet to experience EVs for themselves, and this lack of product knowledge can lead to potential customers not having the benefits of EV ownership explained to them, or worse, being actively discouraged from purchasing EVs. This may go some way to explaining the poor residual value performance of EVs, until relatively recently. There's lots for the used vehicle supply chain to learn, and with the battery size, charging rate and range differing between outwardly identical vehicles offered for sale, then it's easy to see why prices can disappoint. It's also why we at Energy Saving Trust (EST) have been running sessions with both the new and used car sector including dealers and auctions to help those involved in the industry understand the vehicles better and sell them more effectively.

Although charging points can potentially be a factor limiting consumer confidence, they are being installed at pace. There are Government grants available to local authorities to install infrastructure in residential streets without off-street parking, at businesses and at homes with off-street parking. The private sector is also fully engaged, with many new entrants to the market for the provision on charging infrastructure.

David Bizley

Director, the RAC Foundation

Almost 20 years have elapsed since I was fortunate enough to travel on the London to Brighton Veteran Car Run in a 1902 Waverley, one of the first fully electric cars. And although battery technology has moved on hugely over the last century, arguably not much else has changed. The Waverley was quiet and could out-accelerate its petrol engine peers comfortably. But the range was less than 30 miles and, because we needed to recharge rapidly using DC-to-DC, we had to provide our own charging point.

Researchers for the 2018 RAC *Report on Motoring* asked a cross-section of UK motorists what type of car they expected to buy next time they changed their vehicle. Just 3% said they expected this to be pure electric and 51% told us it would be more than 15 years before they expected to be driving a pure electric vehicle. Two thirds said they would require a minimum range from a single charge of 300 miles and, when recharging their vehicle away from home or work, 50% were looking for a maximum time to recharge of 30 minutes or less. Only 14% were willing to pay more for purchasing or leasing a pure electric vehicle than for conventional petrol or diesel. When recharging en route, only 38% were willing to detour by more than five minutes to reach a charging point. It should not be too surprising, therefore, that we are not yet at the tipping point.

Jonathan's article highlights some of the main challenges (Steve Gooding's 4 Rs) and it is an accurate summary of the current situation. He refers to the Treasury's income from fuel duty, and we must not forget their income from Vehicle Excise Duty and VAT on fuel sales; together, these total over £40 billion per annum and much of this is at risk from the switch to electric vehicles. Arguably, this is the elephant in the room which the Government has been side-stepping.

The introduction of some form of road pricing seems inevitable to fill this revenue gap. Road pricing received the thumbs down in 2007, perhaps because it was seen as an additional tax on vehicle use that would increase costs for businesses and individuals. However, if road charging replaces some existing taxation and is structured to offer incentives to make more efficient use of our road network at times and in locations where capacity is available, then it can also deliver reduced congestion while not increasing overall costs for the majority of road users. It must also be structured to maintain incentives to switch to electric. So, once the Government is no longer preoccupied by Brexit, motoring taxation in a zero emissions world needs to be high on its agenda.

The RAC's research suggests motorists understand the mobility benefits of fully autonomous vehicles, particularly for those with mobility limitations. But the research also showed that motorists regard fully autonomous vehicles as less safe than when a driver is in charge. The article points out the contribution of human error to today's accidents which could be eliminated in a fully autonomous world. But the path to full autonomy is less straightforward and potentially less safe. Evidence is emerging that Level 3 automation, where the driver may be required to take back control, carries its own risks and that some drivers may be incapable of safely resuming control of their vehicle when required to do so.

Tipping points for full electrification and autonomy of our vehicles seem some way off. But tipping points have a habit of arriving sooner than predicted. Just look at the speed with which early automobiles replaced horse-drawn vehicles. So, watch this space! ST

We are also seeing big names in retail installing charge points at supermarkets, most recently Tesco teaming up with Volkswagen and PodPoint to install 2,400 chargepoints across 600 stores and Marston's Inns and Taverns partnering with Engenie to install 400 rapid chargers across their estate. This is all in addition to Shell and BP investing in the industry and installing chargepoints at fuel stations.

It is essential to understand where demand is and EST is working to help local authorities understand where best to install chargepoints and the most appropriate speed of charge for the application. Slower, cheaper charging is most appropriate overnight or for where vehicles may be parked for some time while rapid recharging is essential to keep taxis and private hire cars on the road and to enable longer distance journeys to be completed with the minimum of inconvenience.

It's worth noting that as vehicle range increases so the need to plug-in to recharge every day declines for the average driver, however with technologies such as Vehicle to Grid being developed, it may pay drivers to do so in the near future as they receive payment for their cars becoming part of a sustainable energy network.

Autonomous vehicles (AVs) are an area that is of interest for the future and, as the article states, it's all about the safe and efficient use of valuable but limited road space. We are already seeing the roll out of the enablers of the technology in today's cars with adaptive cruise control and Autonomous Emergency Braking becoming commonplace. Self-parking, active lane change and active speed limiting systems are all available in cars now, as manufactures progressively rollout the technology necessary for full automation. How or when the technology will be widely available is unknown, and may depend more on the speed of legislative process than the availability of the technology, but the option to enjoy a journey where the vehicle handles all the driving is an attractive one.

The use of bus lanes by EV was discussed, however, in order to reduce the overall number of vehicles on the road, and ensure those that remain are as efficient as possible and have a minimal impact on the environment. It is important recognise that it is also necessary to provide dedicated, attractive and convenient transport infrastructure to enable more journeys using active and sustainable modes of transport at the same time that the market embraces EVs, as it undoubtedly will. ST

ALAMY

JACK BOSKETT/SMART TRANSPORT.

Ethics, equality and contactless payments

Smart transport technology has revolutionised travel for thousands of people. This means improved convenience for most. But are others in danger of being short changed? **David Fowler** investigates

From the introduction of Oyster by Transport for London in 2003, progress from bespoke smartcards to contactless payment using EMV bank cards or smartphones has been rapid. TfL now offers pay-as-you go ticketing with automatic capping if your journeys add up to the cost of a daily or, for contactless passengers, a weekly pass. In the last few years the main transport groups have been rushing to install contactless payment on bus services. Transport for the North has gone out to tender for a smart ticketing system to cover the whole of the north of England.

At the same time, transport information and travel planning apps have become a smartphone staple. And in the West Midlands, Mobility as a Service is being introduced, in which a monthly subscription payment gives users unlimited travel by a range of modes, accessed by a smartphone app which includes a journey planner.

It's not just the sizeable section of the population without a bank account or a smartphone, but anyone less confident of their IT or mobile technology skills could be affected. Could more convenient mobility for the majority go hand in hand with exclusion and social isolation for others?

Dai Powell is chief executive of HCT Group, a social enterprise company that grew from Hackney Community Transport. It now runs community and social services transport as well as commercial services around the country, including several London bus routes. Profits from its commercial work is reinvested in further transport services or projects in the communities it serves.

"The percentage without access to a bank account in the low socio-economic quartile is high," says Powell. Moreover, even for those who do have bank accounts, quite a few will have an account which doesn't offer a contactless card he says. The effect on people without bank accounts is the biggest single issue arising from the growth of contactless payment, he argues, but there are others.

Some, particularly older people, may have access to a contactless card. But, says Powell: "They like to know what they've spent on a day-to-day basis. They're not used to debit technology or that lifestyle, and they worry about whether they've overspent."

For others, there is an issue with smartcard technology in which the user loads a given amount of funds or a season ticket on to the card. To buy a monthly travelcard you have to have enough money and that is an inbuilt bias against poorer people.

To some degree, contactless payment or pay-as-you-go with capping has the ability to overcome that disadvantage. "You don't have to buy a travel pass to get the travel pass rate," says Powell. "Rather than having to buy single tickets because that is all the money you've got, contactless gives you the cheaper rate without paying up front."

But outside London capping is rare. He says: "There is still a bias against the single ticket. People on very low incomes, who live week to week, won't be able to buy a monthly ticket or season pass."

He adds that the bottom 40% of the population by income makes the majority of its journeys by bus (and doesn't use trains much) so the issue primarily affects buses. "Smart technology has the ability to make the situation much fairer. It's the biggest single benefit, but you need an approach like Transport for the North is adopting, with a contactless card and a prepaid smartcard."

Powell points out that prepaid smartcards can be topped up by someone other than the user - so a Job Centre, or a new employer, could offer a loan or payment to a new employee towards travel costs in their first month. With a smartcard this can be done without money physically changing hands, "and you know what the money's being used for".

Transport for the North has been given funding by the Department for Transport to develop a multi-operator, multi-modal account-based ticketing system for its whole region. Account-based refers to the use of either a bank account or an account registered to the system to travel, using either contactless or Oyster-style payment. TfN is currently out to tender for Abbot, or Account-Based Back Office for Travel. This will be the shared back office to be used by transport operators.

About the author

David Fowler is a freelance business and technology journalist. In addition to being editor of *Maintenance and Engineering* magazine, he is a former editor of *Transport Times*.

Abbot will collect information on all trips (from multiple operators and modes, initially in the North but with potential for national scope), reconstruct journeys, charge the best price for the completed journeys and distribute revenue to transport operators and local transport authorities. Seven organisations have been invited to bid by the closing date of 14 January 2019.

The OJEU notice for the procurement and TfN's customer proposition for the scheme specify that it will cover bus, rail and light rail in the North. It will offer contactless pay-as-you-go for single and day tickets, paid for after travel, with the price calculated at the end of the day to give the best price for the journeys made (in other words, daily capping). It is intended that weekly capping will follow. Payment will be by a contactless bank card, smartphone or other device such as ApplePay or AndroidPay. Multi-operator capping will also be offered.

For those without the ability to pay by those means, or who want to put a limit on their spending, the option of setting up an account linked to a pre-paid transport smartcard will also be offered. Overall journey pricing will be calculated in the same way as if a bank card had been used. However, for the smartcard, TfN says it ▸▸

will not be clear until bidders' proposals are received whether it will be possible to offer weekly or multi-operator capping.

First Bus, in common with the other main UK transport groups, has been working intensively to introduce contactless payment on its buses. It completed the process of fitting out its entire 5,800 strong fleet in September 2018. First Bus managing director Giles Fearnley says: "Our position is clear - it's about giving people choice and making bus travel more attractive. There are no plans to phase cash transactions out. We want to encourage as many customers as possible to use contactless or mobile phone payments, to speed up boarding times, but we're acutely aware that a number of our customers need or prefer to use cash, and we're not in any way discontinuing cash payments."

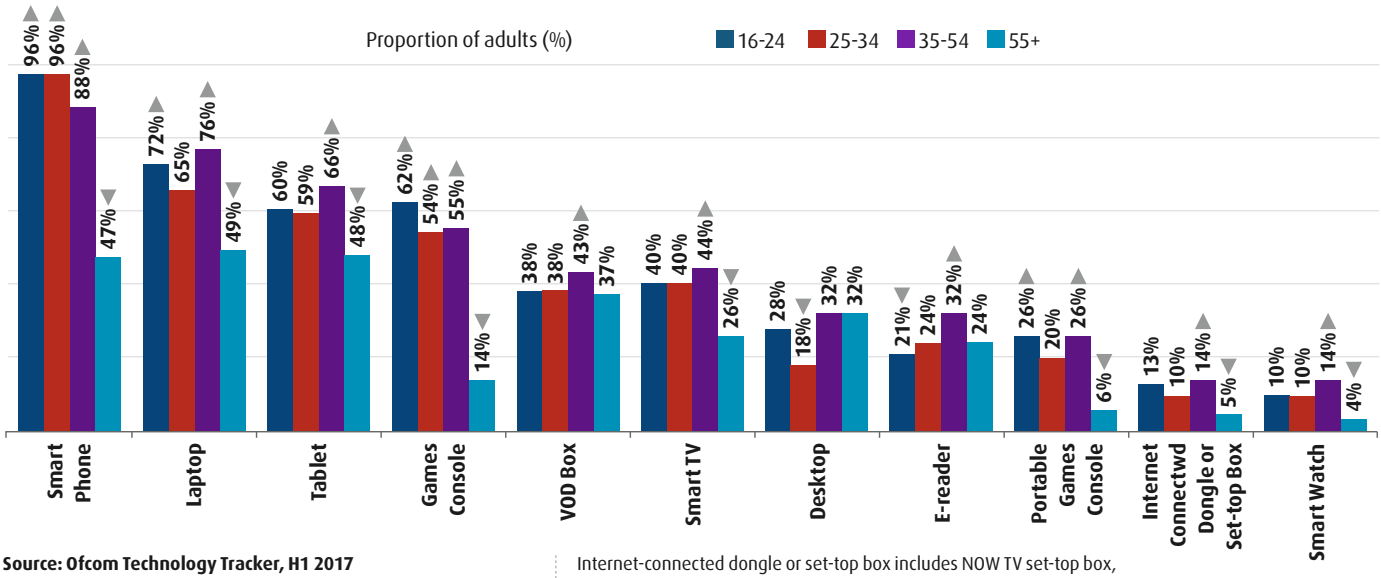
Under First's approach, contactless payment is a straight replacement for cash, offering single fares at the same price but with the convenience of contactless. For the best value tickets, passengers need to use First's mTickets mobile app, where they can get daily or weekly tickets or carnets at a discount to the normal single fare.

Yorcard is a company limited by guarantee set up by South Yorkshire Passenger Transport Executive and West Yorkshire Combined Authority to fulfil the smart ticketing needs of public transport users in the Yorkshire Region.

Its general manager Mike Duncombe believes the main bus operators are pushing quite strongly to get ticketing off the bus, preferring contactless payment or barcodes on smartphones, without giving sufficient consideration to the third of passengers - including people on lower incomes and children - who pay by cash. Installing the capability to accept contactless payment is quite low cost for the operators, not requiring extensive infrastructure other than readers on the bus.

Yorcard works with the West Yorkshire Ticketing Company Limited, a joint venture between the bus and rail operators of West Yorkshire and its delivery partner, the West

Take-up of internet-enabled devices, by age



Source: Ofcom Technology Tracker, H1 2017
Base: Adults aged 16+, 16-24 n = 512, 25-34 n = 544, 35-54 n = 1202, 55+ n = 1485
Note: Ranked by overall household ownership

Internet-connected dongle or set-top box includes NOW TV set-top box, Roku, Google Chrome, Amazon Fire TV, Apple TV
Significance testing: Arrows indicate any significant differences at the 99% confidence level between UK adults overall'and each age group

Transport technology and barriers to employment

THE advent of smart ticketing has been paralleled by an explosion of travel information and journey planning apps on mobile devices.

The Joseph Rowntree Foundation report, *Tackling transport-related barriers to employment in low-income neighbourhoods*, published in August 2018, examined the transport issues facing out-of-work residents in six low-income neighbourhoods in England and Scotland, and interviewed 70 residents in the study areas.

Many of its findings centred on the fact that reliable and affordable public transport links to places of work were inadequate or non-existent. However, it also made some comments on transport fares and information.

"The ability of individuals to commute to work depends, in part, on understanding travel options, and the quickest and cheapest modes of transport to any given location," the report said. Some interviewees had extensive knowledge of local transport network travel choices, and seemed confident in accessing travel information online or through smartphone apps, including Google Maps and National Rail Enquiries. However, others less proficient with, or without access to, appropriate technology were more reliant on information from service providers such as local employment support organisations, transport hubs or schedules provided at bus stops.

A minority of interviewees had no access to, or confidence in using, smartphones, which is an important consideration in developing new smart ticketing options. An important finding was that travel information was rarely presented in a way that enabled individuals to understand commuting options in terms of travel times to a range of potential locations of employment. Some interviewees commented that the travel time maps shown during interviews made them realise there were more options than they had been aware of.

The study's recommendations included: "Make public transport more accessible and more accountable through technology - particularly through open data (including fares) and real-time data on public transport - to understand issues, develop solutions and communicate information to users" and "implement lower-cost, multi-operator tickets or smartcard/contactless systems that cap fares automatically".

▲ **More than 86 million Oyster cards have been used since the electronic smartcards were launched in 2003.** TRANSPORT FOR LONDON.

Yorkshire Combined Authority, to offer multi-operator smart tickets under the MCard brand. Currently daily, weekly, monthly, and young person's cards are offered on ITSO smartcards. In West Yorkshire a pay-as-you-go card, without a cap, is also offered.

Overall, Duncombe believes, this is "better than nothing but a long way short of the best".

"One area where there remains an opportunity to sere the unbanked is a pre-paid multi-operator pass," he says, adding: "Yorcard is very keen to attack the contactless bank card situation."

When TfN's Abbot scheme becomes operational it is likely that the capping capabilities of the contactless offer will be more extensive than those of the smartcard to be introduced alongside it. "At that point the best offer for ticketing will be to use your bank card," Duncombe says. "People on contactless will have a better deal than those who aren't."

In response, Yorcard is planning to introduce a contactless bank card specifically aimed at people who don't currently have a bank account. It is working with the Community First Credit Union, the UK's largest credit union, covering an area from South Yorkshire to Hartlepool, and banking and payments provider Contis.

Duncombe says: "In the north, around 700,000 people don't have a bank account. Adding young people takes the total to over a million who won't be served by a contactless bank card."

Yorcard and WYTCL have agreed in principle that the new card, which will be pre-paid, will offer not just multi-operator capping, but also a level of cashback based on how much it is used, like some credit cards. Some details are still to be worked out and regulatory hurdles overcome but Duncombe is confident the card will be launched in 2019.

Prospective users will have to become members of the credit union, which brings other benefits such as an account that allows direct debits to be paid, and an app and software to help with managing money. Although the card will be marketed primarily as a travel card, it will be "open loop", allowing it to be used anywhere where contactless cards are accepted.

Yorcard has two objectives. First, to give people living on low incomes or Universal Credit or other benefits the same offer as those who are better off. Duncombe points out that the Financial Inclusion Commission in its 2015 report quoted that people excluded from the financial mainstream pay a "poverty premium" of £1,300 each year. Community First Credit Union chief executive Gary Simpson says: "There is certainly a need for this, and if we can offer it, it will complement a lot of other things we do."

Second, Yorcard will also help smaller, under-resourced bus operators. These are the sort of companies who bid to local authorities to run subsidised services at off-peak times, when they are unprofitable and not of interest to the mainstream operators. "To complete the customer proposition they've got to take contactless, but the equipment is quite expensive for smaller operators," says Duncombe. Yorcard will help via soft ▶▶

How TfL removed cash from buses

WITH the introduction of contactless payment, in 2014 Transport for London was able to stop taking cash payments on buses, a long-held ambition aimed at making boarding times quicker as well as having the security advantage of not carrying cash on the bus. This might have been expected to disadvantage some passengers, but was achieved with a minimum of controversy.

Shashi Verma, TfL chief technology officer and director of customer experience, says: "There has been an intention to remove cash fares since 2007. I was the one who kept objecting. When people started talking about it, 6-7% of journeys were made using cash fares - that's half a million a day. I took the view that we couldn't do it when there were that many journeys. It was a different story after the launch of contactless when the level of cash fares came down to 0.5%."

TfL undertook research which showed that it was not the poor or disadvantaged who were using cash: it was infrequent users, who hadn't bothered to get on Oyster card.

"So we said we're giving you an alternative," says Verma. TfL also put in safeguards, with bus drivers instructed not to leave a child or other vulnerable person behind (including adults late at night) even if they had no money. "That's why it went smoothly," he says.

Before the move, TfL received three or four complaints a day because the bus driver didn't have change. Afterwards, it still received three or four complaints daily, because the bus would not accept cash. There was no sudden upsurge.

leasing arrangements, as it did previously to help with installing ITSO equipment.

It is also working with WYTCL to introduce a multi-operator barcode ticketing app, something currently not available, which is expected to be launched next summer. It will be designed to run on even the oldest Android or iPhone.

Transport for London has been at the forefront of introducing smart technology, from the Oyster smartcard to contactless payment. Shashi Verma, TfL chief technology officer and director of customer experience, says that some of the arguments against contactless were also levelled at Oyster originally, for example that it would be too complicated for the elderly. "We take this in our stride," he says."Our response is to make it so simple that the learning curve is minimal, as far as possible."

He continues: "When we got to contactless, there were two big issues: people who didn't have contactless bank cards, and people who did have contactless cards but didn't want to use them because of concerns either about security or, for those on low incomes, about money being taken from their bank account."

When Oyster was introduced people were encouraged to switch from cash by making single bus fares cheaper on Oyster than the equivalent cash fare. For contactless, he says, "from the beginning in 2007 it was clear we couldn't use differentiated fares to promote contactless over Oyster."

One area where there is a difference is that contactless offers weekly as well as daily capping. Weekly capping is about to be introduced on Oyster: Oyster transactions will be reprocessed through the contactless bank office, whereupon a refund will be issued if applicable. But Verma argues it would have been illogical to hold weekly capping on contactless back because at the outset it couldn't be offered to everyone.

The success of contactless has led to suggestions that TfL might withdraw Oyster. The claim that contactless means the end of Oyster is an allegation made all the time, he says. "We are on record as saying Oyster is not going anywhere," says Verma."That was a design principle from day one. Contactless is a fantastic product, but not for everyone." ST

Smartphone ownership

THE *Ofcom Communications Market Report 2017* found that 86% of adults in socio-economic group AB owned a smartphone, dropping to 66% among DE adults. 96% of people in both the 16-24 and 25-34 age groups owned a smartphone, but only 45% aged 55 or over.

The spread of Mobility as a Service

A MUCH-heralded new development is Mobility as a Service, whereby a single provider will offer, thorough a periodic subscription and via a smartphone app, access to a wide range of transport modes - not just bus, rail and tram but taxi, car clubs, and so on. Rather than integrating the ticketing system, this approach aims to integrate services from different transport providers under a single umbrella. The concept is being trialled in the West Midlands, Helsinki and Antwerp.

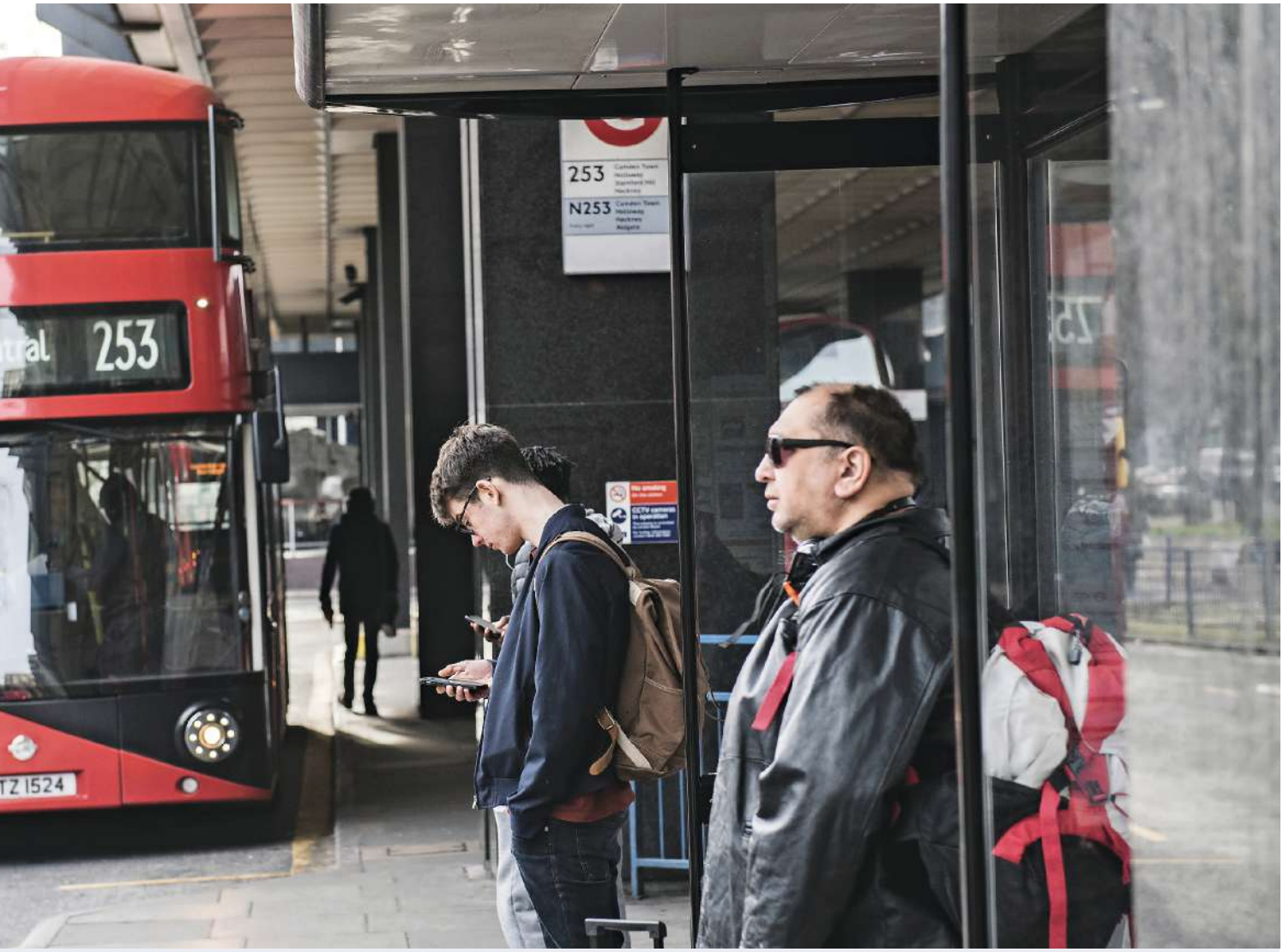
Transport for the West Midlands head of transport innovation Chris Lane said that TfWM identified MaaS as an opportunity "to make a difference to the way people travel, and change behaviour".

TfWM approached Finland's MaaS Global and invited the company to launch its Whim service in the region. This meant that the service could be set up quickly and without large public sector investment. By acting as a partner and facilitating links between MaaS Global and the region's transport providers TfWM was also able to influence the service.

Whim was launched in April 2018 with partners National Express West Midlands, Gett, Enterprise and Sixt to offer transport by bus, tram, taxi and car hire. Train tickets are offered via rail aggregator OnTrack, and Nextbike cycle hire will be added when the service becomes available. For the initial year the experience of up to 500 users will be monitored to allow the service to be fine-tuned.

The Whim app integrates travel planning and payment in a single smartphone app, and currently offers three plans: pay as you go; Whim Everyday, which provides unlimited public transport use for £99 a month; and Whim Unlimited, which for £349 monthly also includes extensive car hire and taxi use. Further packages are due to be added by the end of 2018.

Being app-based, Whim is not available to non-smartphone users. To cater for these users, Lane says TfWM is continuing to develop its Swift smartcard, which currently covers bus, tram and rail. To these will be added car parking, taxi services (being piloted in the Black Country) and, again, cycle hire. Lane explains that Whim, and particularly its top-end package, is aimed more at habitual car users; by providing easy access to car hire it hopes to persuade them to use a Whim package in place of a car (or second car) and thus also to use public transport more. To mirror this, Swift is expanding the range of services offered



JACK BOSKETT/SMART TRANSPORT.

to a customer base which is primarily made up of habitual public transport users.

TfWM has also collaborated with ESP Group to run a pilot called Car Freedom, a service aimed at people over 60 who had given up driving or no longer had a licence, which included a phone-based door to door journey planning service for people who would prefer to speak to someone than use a website. The results of the pilot are currently being evaluated to see whether the service can be launched commercially, or whether aspects can be adopted and integrated by other providers- West Midlands Trains and ESP are currently running a journey planning trial called Ask Annie.

HCT's Powell believes Mobility as a Service raises similar issues to transport information concerning smartphone ownership or lack of confidence with the technology, but also has potential positives.

"We should get away from the idea that older people can't use smart technology, but it has to be quite clear and straightforward. Older people need things to be uncluttered and with larger print, but app designers can accommodate that."

He adds: "MaaS, if you get it right, will take away a level of anxiety among older people about the last legs of journeys by bringing in taxis." He believes the ability to book a whole journey straight through, including a taxi at the end, will be a huge benefit particularly for the elderly if the app is well designed.

Transport for London's chief technology officer Shama Verma believes MaaS has a fatal flaw. "If it offers unlimited travel of any kind, why would I use a bus rather than a limousine? So you have to limit limousine use, which adds complexity."

He adds: "Our view is that a high degree of integration is desirable but it can be done by integrating the means of payment. As long as you've got contactless and Oyster you're OK. You can argue about including taxi, private hire, cycle hire and so on but the cost of doing that are quite high." Moreover, he argues, there would be little to be gained by doing this when, in any case, you can link a contactless card to Uber.

As technology develops, how should transport authorities and operators guard against social exclusion? HCT's Powell says: "The biggest thing is to consult the people who will be using the system. Trial it with older people. Involve the lower quartile to generate more awareness. Include them on steering groups. Be aware they're in the most need of public transport. Designing inclusivity in at the start is easier than changing the architecture afterwards."

He adds that for transport information, the big thing is to push for open data, like TfL. If the data is available, he says, there will be people who will design apps aimed at particular groups such as the elderly.

Verma argues that when introducing or withdrawing a service - such as closing ticket offices to free staff to be available on the concourse or platform - the key is to work methodically through all the functions being served to make sure that they will remain available, even if provided in an alternative form.

He sums up TfL's philosophy, which applies from ticketing to travel information to step-free access: "The fact of our existence is to serve everyone and make as much effort as physically possible to make sure we are serving everyone."

Professor Nick Reed

Head of Mobility R&D, Bosch

Mobility is critical to the ways in which we meet our economic, social, educational and healthcare objectives. From the invention of the wheel, technology has continually evolved the ways in which this mobility is achieved.

Our experiences of the evolution of UK transport systems, especially in urban environments, can provoke a mixture of emotions. Maybe frustration at networks that appear hamstrung by legacy infrastructure and processes. Possibly confusion at where, how and how much to pay for a particular journey. Perhaps bewilderment at the proliferation of mobility apps that present sometimes conflicting guidance.

By contrast, the promise of universal high-speed connectivity, artificially intelligent systems and automated vehicles offer the basis for sometimes Utopian visions of safe, affordable, reliable and flexible transportation put forward by technology developers.

Reality, of course, is messier - and how the potential benefits of new technologies are distributed leads to concerns over equality.

Some of this mess stems from changes in urban design priorities. A criticism often levelled at city transport systems is that they are too car-centric and should be more people-centric. I disagree with this framing of the issue. My view is that transport systems have always been people-centric but, whereas in the 1950s, transport planners aimed to facilitate car travel as the preferred mode; we have since learned that to manage the required volume of movement and to reach air quality, environmental and aesthetic aims, different approaches are required.

Urban design can have dramatic social impacts on neighbourhoods. For example, highways built in West Oakland, California in the 1950s barrelled through low income neighbourhoods, leaving the immigrant and African-American communities that remained blighted by decay, pollution and crime for decades thereafter.

Recent examples of reactions to transport developments were apparent in significant protests on either side of the English Channel.

In December 2018, regular weekend protests at the imposition of a fuel tax by the *gilet jaunes* movement caused widespread disruption in Paris. Although these actions seem to be for opposing reasons, they appear to share a common thread - a perception that, by their actions or inaction, ruling authorities favour one group disproportionately over another, with protests organised in response.

Similarly, and as expertly explored in this article, the introduction of new payment systems can disproportionately favour some and disenfranchise others. This is reinforced by preliminary findings from a UK Government study called *Access to Cash* - due to be published in Spring 2019. It shows 47% of British citizens would find living without cash problematic while those on lower incomes who have a greater dependence on cash transactions face higher prices by not being able to shop online and being less able to access credit facilities. As transport systems tend towards smart ticketing and cashless operation, this group could be disproportionately affected.

Progress is defined as developments towards an improved condition. New technologies certainly have the potential to deliver progress.

With technology reaching into our lives in increasingly profound ways, issues of equality will become increasingly prominent. Our responses to it may need to be similarly profound. ST

Jon Foley

Director, In the Round Communications

The on-going grappling with the unintended consequences on society of the current transformation in travel and transport is intriguing. The relentless march of new mobility solutions comes with a not yet fully understood series of impacts which will, in my opinion, be far more wide-reaching than when Henry T Ford's first motor car was unveiled just over 100 years ago.

The transformations taking place are numerous and diverse. Whether it is smart-ticketing and journey planning platforms, the increased uptake in e-rideables (you heard it here first… I think) such as electric bikes and scooters, society's obsession with on-demand everything and the share-economy or the fascination with autonomous motorised vehicles, the transport profession is confronted with a potentially mind-blowing mix of social issues. I would like to reflect on just a few:

- The sensitivities associated with cashless payment for travel.
- Privacy concerns associated with smartphone location services.
- Skewed convenience of on-demand motorised travel.

Cashless ticketing solutions such as contactless payment and smartcards can be good. But if they reinforce social isolation and exclusion then they are bad. To be equitable and customer-centric it should be possible to purchase travel both in person and remotely. It should also be possible to purchase travel in advance, in bundles (season tickets) or as you go, and it should be possible for all sectors of society to do so without feeling disadvantaged. There will always be people not able to pay larger sums in advance for things, or for to whom banks can't offer contactless payment. There are many who are not comfortable using technology and some of us just like the simple reassurance of human contact in a potentially complex transaction. A hybrid solution of contactless payment and smartcard technology looks to provide the user flexibility required but only if payment options exist.

Turning to the location-based smartphone technology often found in travel and other apps, many are concerned they represent an invasion of privacy. This surely comes down to individuals being able to make informed judgements on whether the upside of this technology outweighs the downside. In a world where the user's handheld device location is known, possible advantages are:

- Knowing exactly which route to take from where you are to where you want to be rather than leaving anything to chance must be good.
- Being made aware of an issue with your intended route before leaving home or office must be good particularly if backed up with advice on a good alternative.
- Receiving advice that instead of taking your on-demand trip by car that the same journey could be quicker on-foot, cheaper and quicker by the shared bike that's just around the corner but hidden from view or cheaper by public transport.

An important disadvantage is perceived infringement of civil liberty. What matters is that good sense prevails, and operational requirements ensure the user is able to activate or de-activate the locational element.

Finally, turning to the potential unintended social consequences of future travel options, in Mobility as a Service (MaaS) there is what at first glance appears to be a fantastic multi-modal solution. It is not too difficult to imagine that as it becomes easier for on-demand motorised vehicles to be hailed

Christian Wolmar

Transport writer and broadcaster

How two aims of transport policy can conflict with one another and lead to difficult decisions having to be made by providers is highlighted by David Fowler.

On the one hand, there is an understandable desire to keep costs to a minimum in order to make public transport more affordable and less of a burden on the taxpayer. On the other, there are many users who may not be able to cope with new methods of payment. That's either because they are unable to obtain access to the right sort of bank accounts or because there is a reluctance to use payment methods that may lead to future debt. Not everyone can simply flash their contactless card without knowing how much they are spending.

Many service providers in other industries have gone down the path of cutting costs to the detriment of the standard of service they offer. Does anyone really prefer having to sort out their own shopping at a till while a machine barks sometimes incomprehensible orders at them? Is it not a pain to have to print off your own luggage label instead of getting a pleasant check-in person to do it for you and put your bag on the conveyor belt? And surely no-one likes those robot answering machines which start off "to get you to the right operator, we want to ask you a few questions" when, after 10 minutes, it is fortunate that the handset has not been thrown through a window.

So there is a clear dividing line between decisions on the adoption of technology that are made which clearly reduce the standard of service being delivered and those which offer an unequivocal improvement to users. Oyster is a case in point. Few regular users would want to go back to the old days of paper tickets which often had to be bought from crowded ticket offices. However, Transport for London clearly went too far by closing all the ticket offices, as demonstrated by the irate crowds that regularly appear at the St Pancras entrance to the Underground.

Certainly, I have heard bus users in London make similar complaints about the fact that drivers can no longer accept fares. However, in that case, unlike with the closure of all the ticket offices, I think the decision was correct. The savings are enormous, dwell times at stops were reduced and people soon accepted the new system.

This is the heart of the matter. The benefits of the introduction of technology must be demonstrated to passengers and whatever is introduced must either be inclusive, or alternative arrangements must be made available to those who cannot or will not make use of the innovation. Moreover, they should not be at a disadvantage in terms of pricing, like households which still use pay-as-you-go electricity supplies.

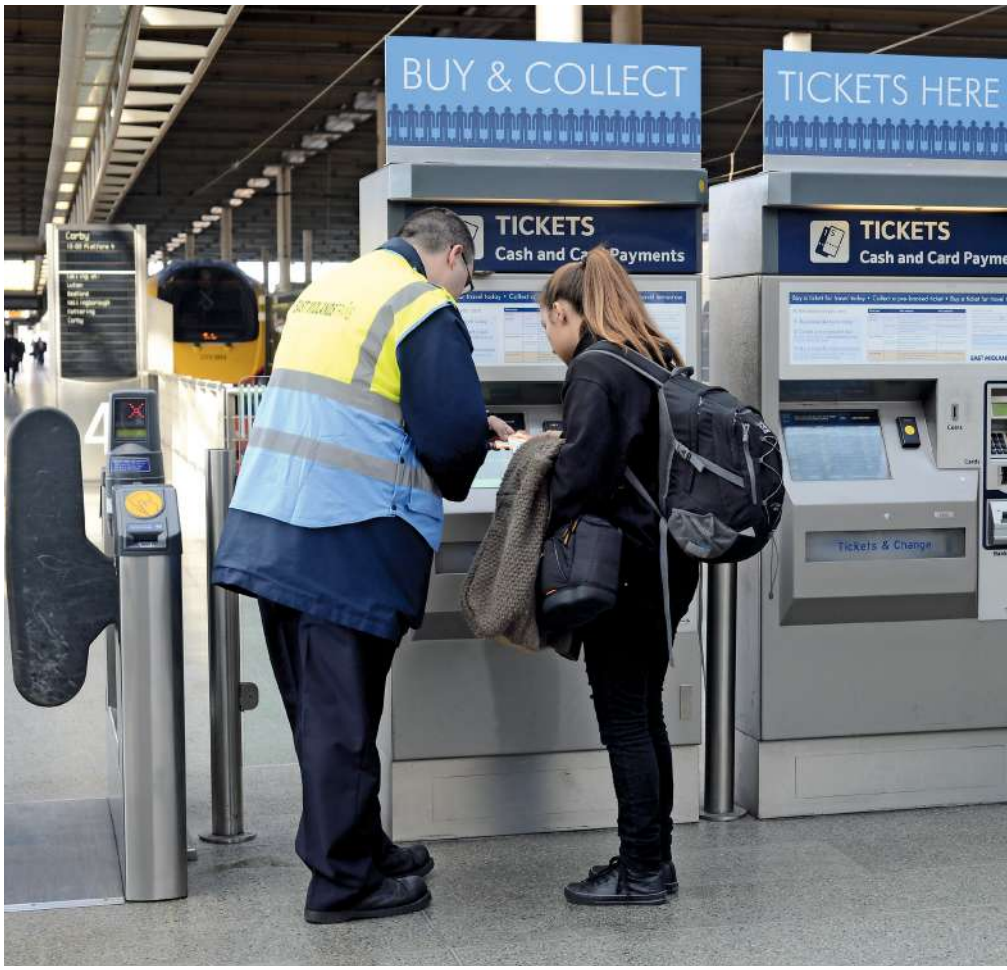
Passengers will soon realise when an innovation offers no benefits to them but results in a less good service - they will vote with their feet. Moreover, freezing out traditional users by making services only accessible to those with nice healthy bank accounts will not do transport providers any favour in the long run. These issues must all be considered before any innovation is introduced. ST

at the press of a button will we see otherwise walkable and cyclable journeys replaced. The negative social impacts of this could be considerable.

Socially complex and challenging times lay ahead but, in this technologist-led environment, who should be society's guardian? What is the role for the Government? The rate of change in mobility is startling, can governments keep up? Can governments do more to boss the debate, working closely with others to develop well-conceived performance-based partnerships which ensure emerging mobility solutions are socially balanced?

As a parent I often stop and admire my children's adaptability. Embracing our adaptability by being more present in how we wish our communities, towns, cities and regions to evolve should now be front and centre. Collectively we, our policymakers and our leaders would do well to not just let this change happen and then adapt but instead for us all to be part of shaping things. In the words of President Abraham Lincoln (et al) "the best way to predict the future is to create it"…but ensuring the intended and unintended impacts on society are fully understood.

I'll be watching with interest and doing what I can to nudge things along. ST



PAUL BIGLAND/SMART TRANSPORT

Research and reports

Here's *Smart Transport*'s digest of documents and reports released by industry bodies during the past few months. A selection of those listed will be available for download from the *Smart Transport* members' database at *https://www.smarttransport.org.uk*. If members would like to submit a report for inclusion, please email *carlota.hudgell@bauermedia.co.uk.*

Tackling transport-related barriers to employment in low-income neighbourhoods

Joseph Rowntree Foundation - August 2018

Making public transport "more accessible and more accountable through technology" is one of four areas on which this paper argues strategic and "coordinated action" is needed. It argues for making open data available, including on fares.

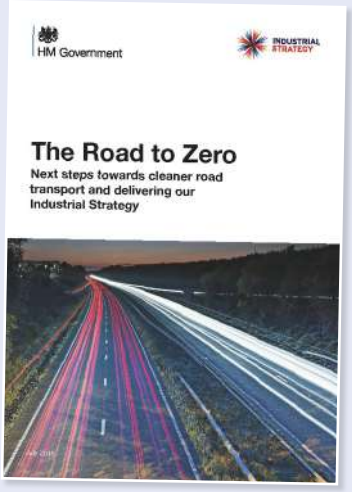
Improving connectivity in low-income neighbourhoods should also come through "implementing bus franchising or 'strong' methods of cooperation", "developing longer-term spatial planning frameworks and tools", and "integrating transport and employment policy".

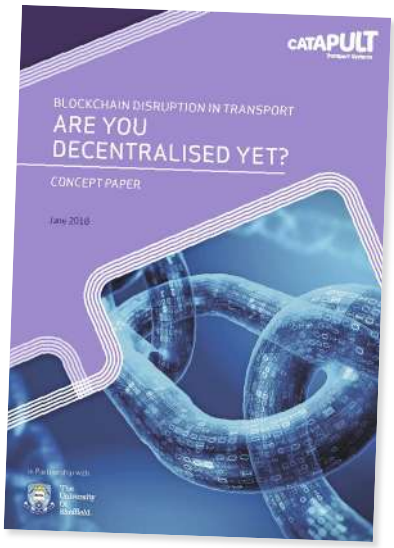
The Road to Zero: Next steps towards cleaner road transport and delivering our Industrial Strategy

Department for Transport - July 2018

"By 2050 we want almost every car and van to be zero emission." So says this Industrial Strategy report from Government on cleaning up road transport.

It lists among long term ambitions putting the UK in the vanguard of the design and building of zero-emissions vehicles - and for at least 50% of car sales to be of zero emissions vehicles by 2030. The Government's approach, it says, is technology neutral.



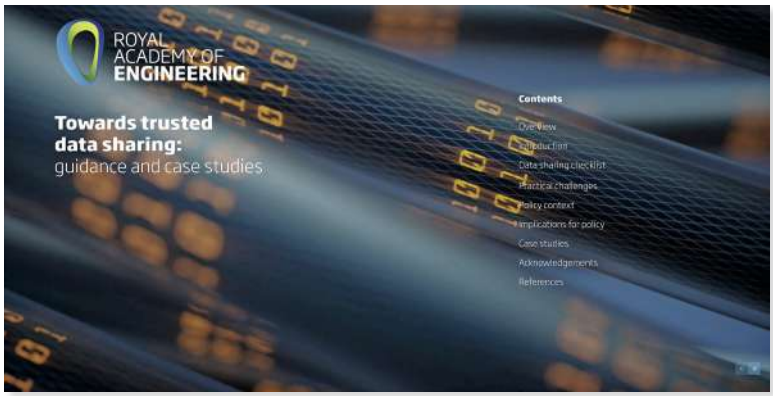


Blockchain Disruption in Transport: Are you Decentralised Yet?

Catapult Transport Systems - June 2018

Blockchain decentralised database technology "could help to increase collaboration, the sharing of trusted information and efficiency, reduce costs and risk, and forge new business models in the transport sphere", this paper argues.

Recommendations include stimulating the market through establishing a research and development programme supported by Government funding, and increasing understanding and knowledge-sharing through creation of a 'Community of Interest'.



Towards Trusted Data Sharing: Guidance and Case Studies

Royal Academy of Engineering - December 2018

Containing a checklist and case studies, this report argues that increasing the scale of data sharing "where it meets business and privacy needs, will help to release value but it requires sources of friction to be reduced and it must be done in ways that maintain, and do not erode, trust."

Barriers to sharing of data include regulatory issues, rights management, and difficulties in "creating clear contractual arrangements".

Data Hub

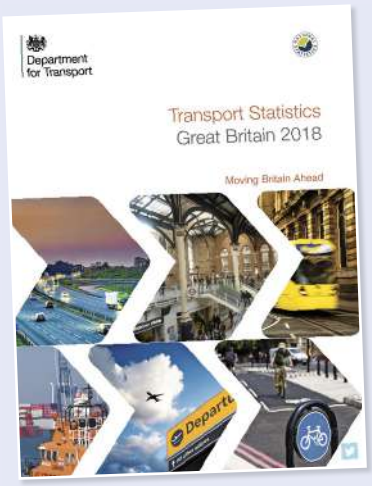
Urban Transport Group - December 2018

A rework of the UTG's Data Hub that was launched in 2017 now includes station entry and exit figures for metropolitan areas. What the UTG describes as "Britain's first interactive transport data tool" now also has an expanded ability to "select, visualise and share" data, as well as to create maps of transport data.

Mobility as a Service

House of Commons Transport Select Committee - December 2018

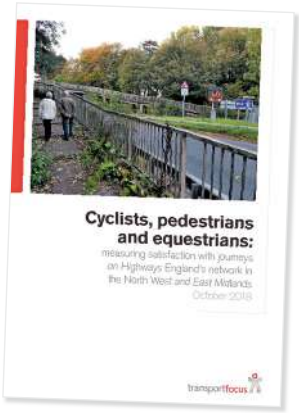
Government "should not miss" the opportunity offered by Mobility as a Service, the Transport Select Committee argues - and says that MaaS should form a "key part" of ambitions to make the UK a leader in the future of mobility. It sets three tasks (leadership, practical support and legislative/regulatory underpinning), calling on government to set out its vision for MaaS, offer financial support for pilot schemes, and bringing forward legislative proposals, among other actions.



Transport Statistics Great Britain 2018: Moving Britain Ahead

Department for Transport - December 2018

Rail accounted for 3% of trips but 11% of distance travelled in 2017, according to the latest annual statistics released by the Department for Transport. Cars were used for 62% of trips (78% of distance), while more than a quarter of trips were on foot – but only 1% of distance. Commuting and business purposes accounted for more than half (51%) of trips made by surface rail.



Cyclists, pedestrians and equestrians: measuring satisfaction with journeys on Highways England's network in the North West and East Midlands

Transport Focus - October 2018

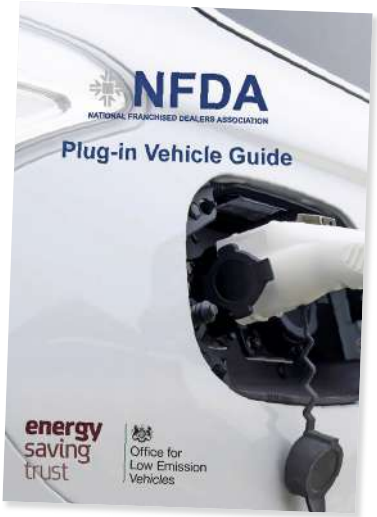
The first findings of a new survey that builds a picture of the experience these users have when travelling along or crossing strategic roads, and will track improvements over time. Data from the online survey, and that from in-depth interviews, is also plotted onto interactive maps that are available for the East Midlands and North West areas.

Driving into 2025: The future of electric cars

J.P Morgan - October 2018

The J.P Morgan Research team explores the rise of the electric vehicle and what the industry will look like in 2025 when "EVs and HEVs will account for an estimated 30% of all vehicle sales".

By 2025, J.P Morgan estimates that sales of plug-in electric vehicles (PEVs) will rise to close to 8.4 million vehicles (or a 7.7% market share) while the HEV sector is expected to swell from just 3% of global sales to more than 25 million vehicles (or 23% of global sales) over the same period.



Plug-In Vehicle Guide

National Franchised Dealers Association - December 2018

Intended to provide NFDA members with information to "accurately inform their customers about plug-in vehicles" this report summarises grants and tax benefits available to consumers as part of encouragement to switch to plug-in vehicles, plus other details including different types of vehicles available.

And finally...

Some closing thoughts on what's trending in the world of **smart transport**

Meet the flying car

MARK WARREN/TERRAFUGIA.

IS it a bird, is it a plane? No, it's a flying car that went on sale in the USA a few months ago.

There's nothing new about cars that can also fly (or vice versa) - there have been many variations on the theme since the early 1900s. But, according to manufacturer Terrafugia (which belongs to the parent company of Volvo), the Transition two-seat hybrid electric vehicle can switch between road and flying modes in less than 60 seconds, and can fly up to 400 miles at a speed of up to 100mph.

The pricetag of such a machine is not yet known, but preliminary sales for the first models are believed to have opened in October 2018. It certainly gives a new meaning to the term 'last-mile solution' with pilots able to land the Transition at a small airfield before activating the wing-folding mechanism and then driving themselves straight home, or to deliver cargo.

Terrafugia signed a lease in August 2018 for 6,700sq ft of hangar and office space at Nashua Airport, New Hampshire, to put the Transition through further testing and then into production. The company says the "unique automotive vehicle and light sport aircraft" will be built to be fully legally compliant with FAA (Federal Aviation Administration) and NHTSA (National Highway and Traffic Administration) standards.

A second-generation concept - the TF-2 - is also in development with vertical take-off and landing (VTOL) capability. And Terrafugia isn't the only company to develop a flying car: Aston Martin is pursuing its Voltane Vision Concept, and Airbus, Uber and Rolls-Royce are working on their own models to offer personal air mobility. Watch this space. ST

Rapid charging stations unveiled

VOLKSWAGEN has confirmed it will introduce a new generation of EV charging stations later this year that can boost the batteries in some models of electric car in less than 20 minutes. The portable stations will be launched in the carmaker's home city of Wolfsburg, before being extended across Germany in 2020.

By being independent from any power source, they can be deployed almost anywhere - such as large public events - and then quickly relocated to cater for shifting demand. They work according to the principle of a power bank, such as those used for mobile phones. An alert is sent to VW once the power packs are depleted to 20% so they can be replaced with a new one.

VOLKSWAGEN.

The stations can also be connected to a 30kW power supply that automatically recharges the power packs, and will allow the storage of renewable energy including wind and solar. With a capacity of 360kWh, each station can recharge up to 15 electric cars to 80% capacity before it is spent.

According to VW, it is able to charge a 28kWh battery in just 17 minutes which typically equates to 80% of a VW e-Golf (109 miles), 71% of a Nissan Leaf (110 miles) or 37% of a Tesla Model 3 (110 miles) which should be plenty of power to get most people home.

Thomas Schmall, Chairman of Volkswagen Group's management board, says: "The mobile charging stations are a decisive step towards an efficient network of charging points.

"They can be set up anywhere as required - with or without connection to the power supply. This flexibility enables a completely new approach for the rapid expansion of the charging infrastructure."

These mobile charging stations offer one further crucial advantage. Mark Mollar, Head of Technical Development at Volkswagen Group Components, explains: "It is only when an electric car is charged with sustainable generated power that it can claim CO_2-neutral mobility. Our charging station is the first to offer the possibility of temporarily storing sustainably generated power."

The announcement forms part of VW's transition from internal combustion to the electrification of its portfolio including the launch of a new electric ID brand, as it continues to recover from the infamous 'dieselgate' emissions scandal of 2015. Volkswagen remains the world's biggest-selling vehicle maker. ST

Does the *Clean Air Strategy* go far enough?

MINISTERS have set out how the Government plans to tackle air pollution with the publication of the *Clean Air Strategy 2019* on January 14. Many of its proposed new policies are aimed at reducing emissions from the biomass and agriculture sectors in order to bring the UK's air quality within WHO guidelines.

Among the ten objectives set out in the strategy is the complete phase-out of coal-fired power stations, new regulations to reduce ammonia emissions from farming, and a possible ban on the most highly polluting household solid fuels, including coal and wet wood.

The document also reiterates the Government's commitment to phasing out diesel- and petrol-fuelled cars by 2040, but that is attracting stinging criticism for not going far enough to combat pollution from road transport, in particular nitrogen oxides, which have regularly exceeded European targets.

Those critics include Mayor of London Sadiq Khan who says: "While the Government has finally accepted that toxic air pollution is a national health crisis, this strategy lacks the ambition required to clean up our air.

"The hard-hitting measures we're taking in London are already starting to make a difference - from cleaning our bus and taxi fleet, to school audits and the introduction of the world's first Ultra-Low Emission Zone in central London this April."

Morten Thaysen, Clean Air Campaigner for Greenpeace UK, agrees with Khan. He says: "Even after acknowledging the seriousness of the air pollution crisis the Government is proposing nothing new to tackle pollution from road transport. Ministers are idling on confronting a key source of toxic emissions. A 2040 phase-out date for diesel and petrol is effectively saying that, yes, your grandchildren deserve clean air, but your children will just have to go on breathing toxic fumes so as not to disrupt the car industry's sales forecasts."

In defence of the *Clean Air Strategy*, Environment Secretary Michael Gove says: "While air pollution may conjure images of traffic jams and exhaust fumes, transport is only one part of the story and the new strategy sets out the important role all of us - across all sectors of work and society - can play in reducing emissions and cleaning up our air to protect our health." ST

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Michael Gove, Secretary of State for Environment, Food and Rural Affairs

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