apm association for project management

THE CHARTERED BODY FOR THE PROJECT PROFESSION

PROJECTING THE FUTURE

A big conversation about the future of the project profession

CHALLENGE PAPER 4

THE FUTURE OF MOBILITY AND TRANSPORT

JANUARY 2020

#projectingthefuture

ABOUT THIS PAPER

HOW DOES THE PROJECT PROFESSION THRIVE IN A CHANGING WORLD?

That's the question at the heart of Projecting the Future, a big conversation about the future of the project profession, which is being led by APM during 2019-20.

This is the fourth in a series of six papers which are examining different aspects of our changing world and the implications for the project profession. It focuses on the fast-changing field of mobility and transport – an area where new technologies promise to transform both how people travel and how goods are transported, with significant implications across the economy both in the UK and around the world.

It is a field with clear links to the topics discussed in the previous three papers in this series, in particular with the technologies of the fourth industrial revolution and the challenge of climate change. And, as with all the areas explored in Projecting the Future, the project profession will be at the centre of the changes that lie ahead, tasked with leading complex projects and programmes and delivering transformative change.

It is our belief that the project profession is on its way to becoming a true leadership delivery profession. Projecting the Future aims to support that journey, by exploring how the profession is already changing, and starting to shape collective responses to the challenges that lie ahead.

Whatever your stake in the profession – an individual project manager, an employer, a 'customer' of projects, or an expert in a given field – we want to hear your voice as part of this big conversation.

We look forward to your input, and to developing a shared view of how the project profession as a whole can realise its potential as a true leadership delivery profession.

JOIN THE CONVERSATION

We hope you will share your views, insights and evidence with us and other project professionals on LinkedIn, Facebook, or Twitter.

#projectingthefuture

You can also email your thoughts and comments to: **ptf@apm.org.uk**.

We are particularly keen to hear about case studies of projects and strategies that are delivering innovation in mobility and transport.

Alongside this paper, we recommend reading the Projecting the Future initial discussion paper and the other challenge papers in the series, including:

1. The fourth industrial revolution: data, automation and artificial intelligence;
2. Climate change, clean growth and sustainability;
3. Ageing and demographics: the 100-year life.

See **www.apm.org.uk//projecting-the-future**

THE BIG ISSUES

How people travel and how goods are transported around the world are set to be revolutionised in the years ahead. The digital technologies that are driving the fourth industrial revolution (4IR) are set to have a profound impact on mobility and transport.

The significance of mobility is underlined by the UK government's 2017 Industrial Strategy,[i] which identifies it as one of the four 'Grand Challenges' facing the nation – alongside artificial intelligence (AI) and data, the ageing society, and clean growth (topics which are addressed in the first three Projecting the Future challenge papers). The Industrial Strategy aims that the UK becomes "a world leader in shaping the future of mobility". Areas of focus include two critical challenges: preparing for self-driving autonomous vehicles, which the government wants to see on UK roads by 2021; and decarbonisation: as part of the response to climate change. The strategy aims to put the UK "at the forefront of the design and manufacturing of zero emission vehicles": transport is, after all, now the biggest source of emissions in the UK.[ii]

In the near to medium term, there are several major transport infrastructure projects underway in the UK. HS2 is perhaps the most 'visible', but upgrades are set to be delivered across several other rail lines and in October 2019, the Chancellor of the Exchequer announced a £25bn investment in roads for 2020-25. In the longer term, other technological developments are likely to drive far-reaching change in the coming decades.

Of the more imminent technologies, connected and autonomous vehicles (CAVs) might have the biggest economic impact. Whether for individual consumers, fleet managers, or haulage companies, the arrival of CAVs – and the shift to electric vehicles (EVs) – promises significant advantages, including in running costs, maintenance and overall ownership costs.[iii] But those will be weighed against costs such as the disruption caused by their arrival, not least to the jobs of today.

Changes in technology are also set to be accompanied by changes in consumer behaviour and the transformation of today's business models, with the rise of Mobility as a Service (MaaS). Many experts predict a shift to shared ownership models; some suggest that this will blur the lines between private and public services, with CAVs perhaps supplementing or even replacing city bus services. But could already crowded cities cope with more vehicles?

New forms of mobility will demand significant infrastructure work. CAVs will use existing infrastructure, in the form of the national road network, though they will need 5G mobile data connectivity for reliable vehicle-to-vehicle and vehicle-to-network communication. On the other hand, developments in rail, aviation and shipping will generate new infrastructure. Such projects will have major budgets, complex stakeholder networks and hotly-disputed political dimensions.

More radical innovations could see drones being used more widely: soon they could be delivering groceries to online shoppers and supplying life-saving vital medicines to remote areas – perhaps even serving as airborne people carriers. Elsewhere, significant high-speed rail projects are under way. Next-generation developments like commercial space flights, Maglev rail, and hyperloop technology – described by Tesla's Elon Musk as the 'fifth mode' of transport [iv] – remain longer-term prospects.

Of course, transit is inherently international and global. One of the most ambitious initiatives globally is China's Belt and Road Initiative, a '21st century silk road', that aspires to link land and maritime transport routes. China is planning on carrying out infrastructure projects in more than 60 countries along the routes it has identified.[v]

Whether in the development and roll out of new forms of transport, the construction of vital infrastructure, or the establishment of new business models, project professionals will be much in demand in delivering the future of mobility and transport.

IN NUMBERS

AUTONOMOUS VEHICLES ARE SET TO BE OPERATING ON UK ROADS BY

2021

SHARED AUTONOMOUS VEHICLES COULD CUT PASSENGER COSTS PER KILOMETRE OF ROAD TRAVEL BY

20-40%

THE CONNECTED AND AUTONOMOUS VEHICLES INDUSTRY COULD BE WORTH

£62BN ANNUALLY BY 2030

1 IN 8

ELECTRIC CARS SOLD IN EUROPE IN 2017 WAS MADE IN THE UK

10%

PROPORTION OF UK CAR SALES THAT WERE ELECTRIC OR HYBRID IN OCTOBER 2019

SOURCES FOR THE ABOVE GRAPHICS: 2021[vi], 20-40%[vii], £65BN[viii], 1 IN 8[ix], 10%[x]

£40BN

ANNUAL COST TO THE UK OF TRANSPORT CONGESTION

CHINA'S BELT AND ROAD INITIATIVE WILL COST OVER

$1TN

1.35M

GLOBAL ROAD DEATHS ANNUALLY – WITH HUMAN ERROR A FACTOR IN

95%

OF ACCIDENTS

760 MPH

POTENTIAL SPEED OF HYPERLOOP

SOURCES FOR THE ABOVE GRAPHICS: £40BN[xi], $1TN[xii], 1.35M[xiii], 95%[xiv], 760MPH[xv]

OPPORTUNITIES AND CHALLENGES

Developing self-driving vehicles

The government aims that connected and autonomous vehicles (CAVs) will be operating independently on UK roads from 2021. This is set to be spear-headed by an autonomous bus service crossing the Forth in Scotland, and self-driving taxis in up to four London boroughs:[xvi] trials by the UK tech firm Oxbotica began around the former Olympic Park in Stratford in October 2019, with a further trial involving taxi firm Addison Lee due to begin in June 2020.[xvii] There are questions about whether the UK is keeping up with other nations: US-based industry leader Waymo announced in October 2018 that its self-driving vehicles had completed 10 million miles of testing, and almost 7 billion miles in simulation.[xviii]

Realistic or not?

Despite the government's ambition for 2021 and widespread industry excitement, some insiders remain sceptical about the pace of change. Andy Palmer, chief executive at Aston Martin, has cast doubt on the ability of CAVs to master complex real-world situations in the near future: "To drive up a mountain, or Delhi or London street – I think we're dreaming if we think it's going to be around the corner".[xix]

Benefits of autonomous vehicles

The latest industry forecasts suggest that CAVs could be worth £62bn annually to the UK by 2030.[xx] They could offer cost reductions of 20-40% compared to traditional motoring,[xxi] as the result of a switch from private car ownership to shared ownership schemes and 'Mobility as a Service' (MaaS) models. Advocates also point to the potential convenience of self-driving vehicles: summoned via an app, a car could drive itself to the chosen pick-up point before ferrying passengers to their destination while they relax, work, or sleep. AI traffic management on smart road networks should also lead to faster travel with less congestion, and more efficient energy use – resulting in lower emissions. Where they are deployed will be a critical decision: perhaps they will work best as the 'connective tissue' between public transport and local areas, in effect providing door-to-door transport with trains or trams, say, covering the main bulk of the distance travelled.

Safety

Human error is a factor in 90% of road accidents today, so the potential benefits of AI-managed, connected vehicles are plain: one motoring trade association, the Society of Motor Manufacturers and Traders (SMMT), forecasts that 47,000 serious accidents could be avoided in 2019-30, and 3,900 lives saved.[xxii] Industry opinion varies as to how close AI technology is to being road-ready, able to recognise and understand varied road conditions, to make life and death decisions, and to manage potentially erratic human behaviour on roads. Besides questions of technical capability, there are deep ethical questions: how should AI be programmed to deal with situations that involve threats to human life? Incidents such as the fatal crash between an Uber self-driving vehicle and a pedestrian in Arizona in 2018 highlight that the technology still has some distance to go.[xxiii]

Public trust

One report in 2019 highlighted that while people around the UK are generally positive about CAVs, their views are "nuanced and complex", reflecting concerns not only about the technology, but also about the implications of a shift to MaaS and a possible decline in private car ownership. Key questions surround safety, the availability of vehicles, who would control them, and how the UK can transition to a future with CAVs on the road.[xxiv]

Meeting social needs

CAVs could have other social benefits, such as enhancing the independence of older people at a time of increasing human longevity (a topic explored in the third Projecting the Future challenge paper). One survey by the American Association of Retired People (AARP) found that the most-wanted technology among older people was the autonomous car.[xxv]

A view from the Chartered Institution of Highways & Transportation

"The way transport professionals plan and develop future networks is changing." The CIHT FUTURES report in 2015 highlighted a need to embrace uncertainty into the systems that governments and those that advise them use. CIHT's advice Better Planning, Better Transport, Better Places 2019 shows how planning and transport need to be integrated across a wide range of areas.

"The fundamental challenge of climate change linked to the growing issues of health and inequality will mean the development of mobility and transport in the future cannot be undertaken on economic grounds alone. Projects cannot be treated as simple end to end processes but will need to demonstrate how they contribute over time to the complex outcome's societies need".

5G network infrastructure

While CAVs will use existing road infrastructure, they will also require fast and stable data connections throughout the transport network, across cities, suburban areas and rural spaces alike. 5G mobile phone services started rolling out in 2019, but the annual report on major projects by the Infrastructure and Projects Authority gave an 'Amber/Red' rating to the government's 5G testbeds and trials work, meaning that "successful delivery of the project is in doubt".[xxvi]

The climate change challenge

The need to reduce emissions from transport is a significant driver of change in mobility and transport. The latest data shows that transport accounts for 33% of the UK's greenhouse gas emissions, and has overtaken energy supply as the main source of the UK's emissions.[xxvii] Globally, transport accounts for 14% of global emissions.[xxviii]

Policy on petrol (and diesel)

The UK government's 2018 'Road to Zero' Strategy promised £1.5bn of support to "to put the UK at the forefront of the design and manufacturing of zero emission vehicles", [xxix] with a commitment to phase out sales of new petrol and diesel cars by 2040. Transport Secretary Grant Shapps has said that the government would "thoroughly explore the case" for a 2035 deadline,[xxx] while Labour had also said that it would end such sales by 2030.[xxxi] Government plans for green number plates for ultra-low emission vehicles were put out to consultation in October 2019: already used in Norway, Canada, and China, they could be available on electric and hydrogen-fuelled cars, and are thought to encourage take-up of low-emission technology.[xxxii]

Low emission technology

How will the road vehicles of the future be powered? Today's electric vehicles (EVs) are most commonly powered by lithium-ion batteries. Their capacity has been improving rapidly, and further improvements might soon allow cars to be fully charged within 10 minutes.[xxxiii] Hydrogen fuel cells are also being used in a small number of new cars: debate continues over the relative merits of the competing technologies in terms of range, emissions and costs, with companies such as Toyota backing hydrogen fuel cells, while Tesla and others prefer batteries.[xxxiv] The UK government has pledged £1bn over ten years to help develop low carbon powertrains, via the Advanced Propulsion Centre and Faraday Battery Challenge.[xxxv] The fact that the Nobel prize in Chemistry was awarded in October 2019 to John B Goodenough, M Stanley Whittingham and Akira Yoshino (for their work on lithium-ion batteries) is a reflection of the technology's growing importance.[xxxvi]

Charging infrastructure

The switch to electric vehicles is likely to make charging infrastructure critical. There are major challenges, including ensuring the capacity of the power grid to meet growing demand; securing the necessary 'real estate' in already-crowded streets; developing systems for payment and managing usage; questions of whether charging points should be grouped together or more spread out in ones and twos; and challenges in developing and installing the necessary technology. Some estimates suggest 60% of charging will be done at home, with 30% at work and 10% split between destination and 'en route' charging.[xl] The Department for Transport has produced a 'league table' of the current availability of charging points, including an interactive online map. London is leading the way, with almost 4,000 public charging devices, Scotland has more than 1,500, with the North West, South East and South West just behind. The best-performing local authorities include Glasgow, Manchester, Liverpool, and Milton Keynes.[xli]

Persuading the public to change

EVs accounted for 2.13% of new car sales in the UK in 2018. [xxxvii] Policy makers are increasingly targeting high emissions vehicles: the London Ultra Low Emission Zone came into effect in April 2019, adding a £12.50-a-day charge to higher emissions cars. It will be expanded significantly in 2021: meanwhile, Birmingham, Leeds, Southampton, Nottingham and Derby have been mandated by the government to establish Clean Air Zones, while Bristol has approved plans to restrict diesel vehicles in the city centre from 2021.[xxxviii] Some countries are reducing speed limits: the Netherlands is set to drop the daytime speed limit from 130 to 100kmh.[xxxix]

Human powered transport

There are also significant challenges in creating the conditions, including the infrastructure, needed for more human self transport or 'active' travel, such as walking and cycling. The 2011 Census found that 741,000 people cycled to work – 90,000 more than in 2001 – but the proportion of commuters using bikes has remained under 3%.[xlii] The government's *Future of Mobility: Urban Strategy*,[xliii] published in March 2019, reaffirms the principle that active travel should remain the best option for short journeys.

Sustainable aviation?

Commercial aviation accounts for 2.4% of global carbon emissions [xliv] and 12% of total transportation emissions globally – but levels have been rising rapidly and are on course to triple by 2050.[xlv] Airbus has forecast that the number of commercial aircraft in operation will more than double in the next 20 years, to 48,000 planes worldwide.[xlvi] Modern planes are more fuel-efficient than older models,[xlvii] although critics have accused airlines of being too slow to adopt new planes.[xlviii] More radically, airlines are exploring a variety of recycled waste fuels and biofuels: Boeing and Etihad Airways are experimenting with Dwarf Saltwort, for example, an edible succulent which produces oily seeds from which fuel can be produced, although for now sustainable fuels account for just 0.01% of total aviation fuel use globally. December 2019 saw the world's first fully electric commercial aircraft tested successfully in Vancouver, while a prototype hybrid-electric plane is set to be flying in the UK by 2022, through Project Fresson, an initiative involving Cranfield Aerospace Solutions, Rolls Royce and others.

Drones

Unmanned drones could have widespread use in areas as diverse as agriculture, delivery, emergency services, engineering, environmental management, media, and communications.[lii] Expanding their use at scale will demand the development of smart infrastructure and AI-managed systems to co-ordinate airspace that could quickly become crowded. There are also security and safety risks to be managed, as vividly illustrated by the shut-down of Gatwick airport thanks to reported drone activity in December 2018. Such risks pose major questions for lawmakers and the authorities. At the same time, there is increasing research on the potential of drones as a mode of personal transport: in October 2019, the New Zealand government pledged its support for the testing and development of advanced unmanned aircraft through a new trials programme with Zephyr Airworks, a company which has been testing self-flying, electric, vertical take-off and landing since 2017.[liii]

High speed rail

New forms of rail travel promise to slash travel times, increase capacity, and potentially boost productivity. The HS2 link between London, the Midlands and the North West is one of the furthest-advanced and most hotly-debated projects under way to date. Other technologies could offer even bigger speed increases. Maglev technology has not yet been used on a large scale but is set to be deployed in Japan in the coming years.

Upgrading the current network

Outside of high-speed rail, there are several other major programmes under way to overhaul the UK's existing rail network. The East Coast Mainline, East West Rail, Great Western Route Modernisation, Intercity Express, South West Route Capacity and Thameslink programmes will all command significant resources in the years ahead.

Shipping

The venerable shipping industry is far from immune to change, not least because it accounts for around 2-3% of global CO2 emissions.. The world's biggest shipping company, Maersk, aims to be carbon neutral by 2050, yet says that suitable ships have simply not yet been built. Having invested $1bn in energy efficient technology, Maersk said in December 2018 that it wanted to start dialogue with "all possible parties" to find new solutions. Industry proposals being discussed in late 2019 included the simple idea of reducing speed: although costs would increase as ships spend more time at sea, a 20% cut in speed could reduce emissions by 30%.[liv]

Space travel

Exploration of space is advancing at some pace. A number of commercial firms are working on developing suborbital space flight capabilities, raising the prospect of 'space tourism': Virgin Galactic's VSS-Unity reached an altitude of over 50 miles in February 2019. A number of space programmes are active around the world: China's Chang'e 4 made the first landing on the far side of the Moon in January 2019, while India's Chandrayaan-2 crash-landed on the Moon in September 2019.

Hyperloop

Described by advocates like Tesla's Elon Musk as the 'fifth mode' of transport (after land, air, sea and space). Hyperloop could deliver enormous speeds, potentially up to 1,200kph. Such speeds would doubtless be attractive to passengers and could help move people away from carbon-heavy aviation. Companies like Richard Branson's Virgin Hyperloop One are investing in research and development, although the technology remains firmly in its infancy.

A VIEW FROM JACOBS

"Project management responsibilities, opportunities and constraints need to be better understood. Exciting as new technologies are, the industry's first priority must be to look for the things that actually have been proven to work well. Otherwise we risk a form of hyperopia – focusing on the distance without seeing the solutions nearer to us.

"One of the major considerations in transport and mobility is climate change, which will progressively become a fundamental concern of large scale transport projects – especially in how it effects transport infrastructure. With increasing populations and extreme weather events, the transport network will come under even greater levels of stress, with less capacity to deal with problems.

"Fundamentally, we need to be clear: is it the job of project managers to simply oversee whatever idea is currently being funded – or is it to challenge and guide? Should we install charging infrastructure for electric vehicles where it isn't needed, simply because we have the funds? We can install solar panels where they are visible rather than where they are useful, but should we? Or should we instead look for previous transport success stories and bring the lessons forward? That's the challenge for the profession in the decade ahead."

Craig Higgins is Senior Associate Director and Regional Solutions Leader (Transport Planning), UK & Europe, at Jacobs.

A PROJECT PROFESSION VIEW

We look at some of the potential implications of the transformational changes in mobility and transport that could lie ahead. Agree or disagree, we look forward to hearing your ideas – and your examples of how the project profession is already delivering the future.

The project profession will be involved in delivering enormously exciting transformational projects in mobility and transport over the years ahead, as 4IR technologies converge with cleaner, greener power sources. The arrival of autonomous vehicles, of drones, the delivery of high-speed rail, airport expansion, and changes in shipping all offer huge challenges and opportunities. At the same time, there will be major projects to maintain and upgrade existing transport infrastructure – with all the challenges inherent in working on services that are used by high numbers of people every day.

New infrastructure, physical and digital, will be needed to enable new modes of transport. New systems will be created for managing transport services. New business models will be created, as companies transform their products and services to make the most of new technology. Established, incumbent businesses and industries will be challenged as new models emerge: the leaders in AV technology are not the old car manufacturers but companies like Waymo, which began as a Google project.

Get it right, and the benefits for consumers and society as a whole could be immensely positive: but get it wrong, and the future could be nightmarish. Speaking early in 2019 about the potential of autonomous vehicles, the then Transport Minister Jesse Norman contrasted his optimistic vision of the future with a dystopian 'Pod World', with city streets "full of autonomous vehicles, all travelling at four miles per hour, 12 inches apart".[lv] As Norman argued, the challenge requires "deep and long-term thinking about principles and priorities". That means action from policy makers, but it will surely also challenge project professionals to build meaningful and extensive stakeholder engagement into their work.

Further challenges to project professionals will stem from the types of projects needed to deliver the future of mobility. To start with, mobility and transport projects are often high-budget infrastructure projects – many are 'megaprojects' (usually defined as being projects with budgets of over £1bn, or $1bn). Over-runs are often hugely costly, as with London's Crossrail: its total budget is now £18.25bn, over £2bn more than initially planned, and its opening has been delayed from December 2018 to a planned opening – as of late 2019 – "as soon as practically possible in 2021".[lvi]

Critics have argued that megaprojects are often, in effect, too big to fail: Bent Flyvberg of the Saïd Business School has found that as many as nine out of ten go over budget. McKinsey has identified three areas of weakness: over-optimism and over-complexity, poor execution, and weakness in organisational design and capabilities.[lvii] Political commitment to megaprojects can lead to initial estimates that are over-optimistic, and the under-stating of potential costs and risks. Once work has begun and significant expenditure has been incurred, it often becomes unpalatable to consider cancellation, even if major problems arise and significant time or cost over-runs become likely. They are, in effect, too big to fail.

Yet complex circumstances and ambitious, transformative aims will continue to define many mobility and transport projects in the years ahead. Improving success rates may need a rethink of how they are managed: potentially adopting a programme approach, breaking monolithic megaprojects into more manageable chunks or an agile approach of incremental implementation, with each project delivering benefit along the way. In what circumstances are these approaches useful? Would there be a risk that the sense of importance and urgency associated with prestige megaprojects is lost?

The challenges ahead also demand clarity about the intended benefits of projects. So often speed is perceived as the highest priority in transport: yet as recent proposals to restrict speed limits on roads and in shipping remind us, high speed means high energy use, and that means higher harmful emissions. Might we adopt better measures – perhaps of customer experience? For example, would people accept slower journeys if they were guaranteed a seat, or greater reliability, or door-to-door connections? Can we better measure the overall performance of transit systems? A sophisticated view of project benefits will be vital.

Projects to deliver the future of mobility and transport will need the highest levels of professionalism and expertise from the project profession. They will demand technical excellence in delivery, and a real emphasis on the people dimension, including engaging stakeholders with diverse and potentially challenging views: after all, transport projects are frequently contentious. Just think of the long-running and heated debates over HS2 and airport expansion in London and the South East.

There will be enormous challenges in delivering mobility and transport for the future. Regulatory, political, technological, environmental and commercial factors will all be in play, along with questions of changing consumer and citizen behaviour. Yet the potential for radical transformation is clear. Project professionals will be challenged like never before: they will be at the heart of shaping the future of mobility and transport.

DISCUSSION QUESTIONS FOR THE PROJECT PROFESSION

Throughout Projecting the Future, we want to explore the questions that matter about the future of the project profession.

We want to hear from you: from individuals, teams, departments, organisations, institutions and communities. We want your views, ideas and evidence relating to the following questions – but feel free to pose and answer other questions as well.

We are also keen to hear about examples of how the project profession is starting to adapt to these challenges.

1. How will trends in mobility and transport affect project professionals over the next 5-10 years?

2. Do the trends ahead in transport and mobility create any particular challenges for the skills and capabilities of project professionals? If so, what are these, and how could these capabilities best be developed?

3. Many of the projects in the field of mobility and transport will not only be transport infrastructure projects, they will be digital projects. Do specialist project professionals in these sectors have the expertise and experience that is needed? If not, what are the implications?

4. Research suggests that high-value megaprojects are often doomed to cost and time over-runs. Given the importance of infrastructure projects to shaping the future of transport and mobility, can megaprojects be delivered more reliably? How can problems be minimised and success rates improved?

5. Are there any other issues in this area, which will affect the project profession in the years ahead, which should be considered?

See page 2 for details of how you can join the big conversation.

FIND OUT MORE: TOP SOURCES

- *A time of unprecedented change in the transport system* – the future foresight report from the Government Office for Science, published in January 2019, looks at how the transport system is used, how it's changing, and sets out four potential scenarios to aid thinking and decision making about transport in 2040 https://www.gov.uk/government/publications/future-of-mobility

- The UK government's industrial strategy includes a section dedicated to assessing the 'Grand Challenge' of mobility. The 2017 strategy, and subsequent updates, can be found at www.gov.uk/government/topical-events/the-uks-industrial-strategy

- The latest government paper on the future of mobility is the urban strategy published in March 2019, which also covers details of the next steps for the future of mobility grand challenge www.gov.uk/government/publications/future-of-mobility-urban-strategy

- The government's Transport Investment Strategy sets out the basis for funding https://www.gov.uk/government/publications/transport-investment-strategy

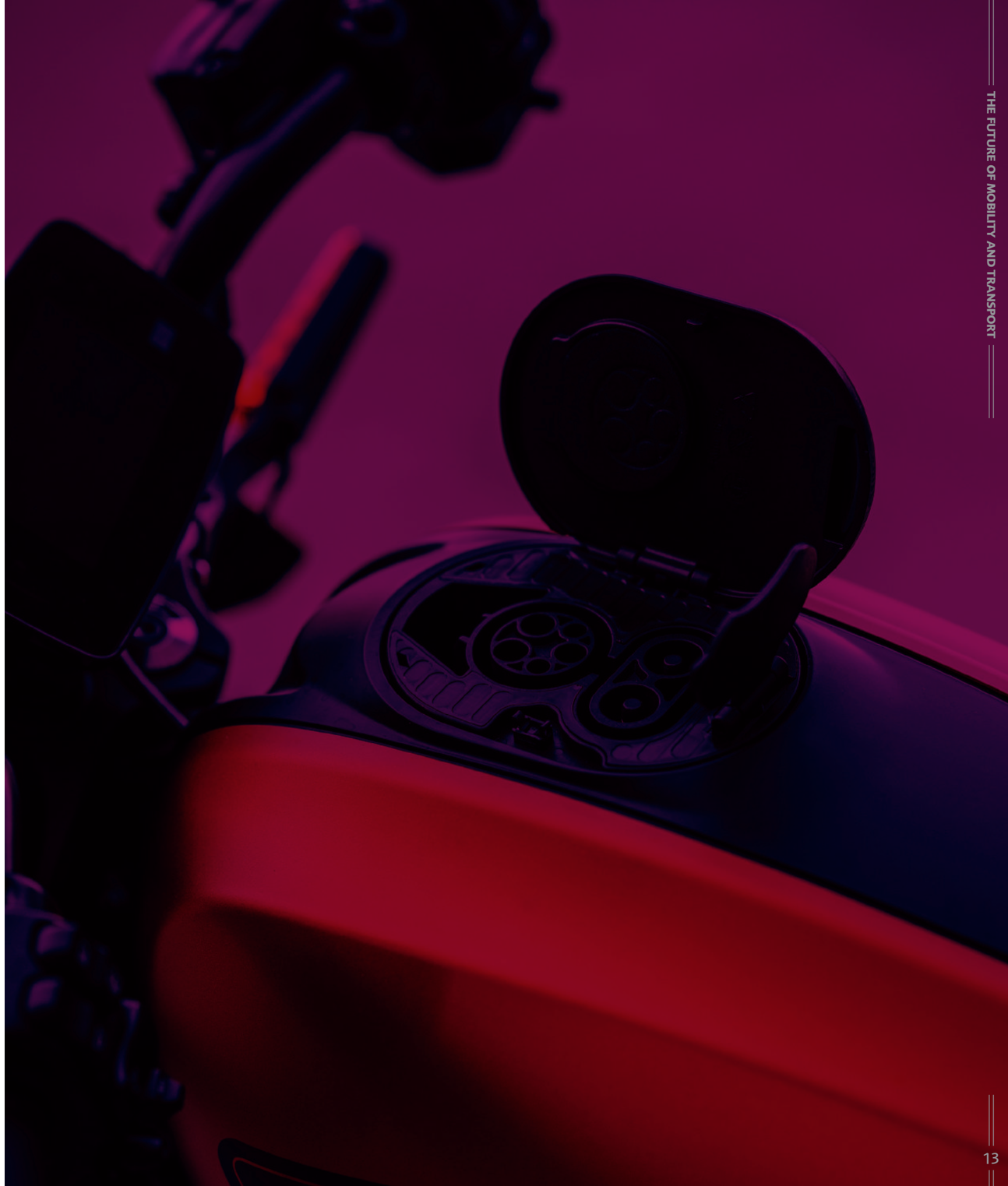
- The 'future of transportation' series from the Economist Intelligence Unit offers articles, video and infographics on the future of mobility https://thefutureishere.economist.com/transportation/blogs-future-transportation.html

- The World Economic Forum has a platform dedicated to the future of mobility, with frequent commentary, insight and analyses of this fast-changing area https://www.weforum.org/platforms/shaping-the-future-of-mobility

- McKinsey's Center for Future Mobility published analysis and insight spanning autonomous driving, connectivity, electrification and shared mobility https://www.mckinsey.com/features/mckinsey-center-for-future-mobility/overview

- The Society of Motor Manufacturers and Traders (SMMT) is a trade association for the motor industry, providing reports on developments in the industry https://www.smmt.co.uk/

- The Moral Machine is a website developed by researchers at MIT to explore life and death scenarios which might be faced by AI in control of autonomous vehicles. It aims to build a crowd-sourced picture of human opinion on how machines should make decisions when faced with moral dilemmas. Add your views at http://moralmachine.mit.edu/



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