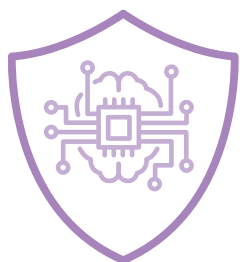**Your World First**

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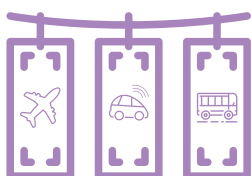Law . Tax

Smart mobility
Infrastructure for our 'Connected Future'
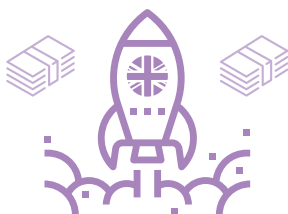
Global infrastructure report

Use of Big Data brings cyber security concerns and requirements.

USD 45bn

2016-2018 – combined value of M&A deals in the Mobility-as-a-Service sector was **USD 45bn**.

GBP 3.8bn

UK government calculates spaceports could generate around **GBP 3.8bn** revenue over the next decade.

Rapid growth between 2018 and 2050 in global passenger mobility (**200% – 300%**) and freight activity (**150% – 250%**) will play a defining role in driving smart railway growth.

Countries to watch

Poland   France   UAE   UK   Singapore

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Connected Future

This report is part of Connected Future. For more information, please visit **cms.law/connectedfuture**

Foreword

Smart mobility is reshaping the transport sector, shaking up and challenging traditional transportation models.

Countries with clear government support and efficient regulatory upgrades are leading the way. The smart city initiative of Dubai is aiming to implement self-driving taxis, and Abu Dhabi expects to have up to 5km of a hyperloop project – linking it to neighbouring Dubai's Al Maktoum International Airport – ready for operation by 2020. Scotland is trialling self-driving buses and Finland's fully revised transport legislation is especially supportive of innovation and the use of new technology.

Fully autonomous vehicles will require vehicle-to-vehicle and vehicle-to-infrastructure communication systems, meaning 4G and 5G networks beyond cities will need significant investment. Existing infrastructure will need to be retrofitted with the necessary technology. This is all likely to require participation from private funders, opening up new investment opportunities and providing new revenue streams.

Mobility is increasingly more important than ownership; the public appetite for personalised services continues to grow fuelling the rise of Mobility-as-a-Service. Ride-hailing and ride-sharing apps are challenging the established model of state-provided public transport and throwing up important considerations for governments.

City centres are likely to change dramatically, with a reduced need for multiple multi-storey car parks as people move from car ownership to mobility services. Drone deliveries may reduce vans on roads but growing demand for instant and personalised transport may in fact increase congestion. State intervention will almost certainly be required to push people to more sustainable forms of transport, ensure that more vulnerable members of society are not left behind, and incentivise healthier travel.

Simultaneously the railway industry is boosting digitisation of signalling, payments and ticketing - anticipated to improve performance and revenues, as well as providing deeper insight into travel patterns - and shipping companies are turning to blockchain for increased security and ease of contracting.

The possibilities and implications are wide-ranging. We explore some of these in this report.

This report is one of four supplements, expanding on the findings of our 2018 Connected Future report and our 2017 CMS Infrastructure Index. The 2019 Infrastructure Index will be available at the end of 2019.

Eleanor Lane
Partner

t. +44 141 304 6058
e. eleanor.lane@cms-cmno.com

Smart mobility

Smart mobility encompasses a wide-ranging set of technology-driven transformations that are reshaping the transport sector. Digitally enabled mobility platforms such as ride-hailing and ride-sharing apps (known collectively as 'Mobility-as-a-Service' or MaaS) are challenging traditional transportation models.

Technology upgrades are making a radical impact on the railway industry too, helping to boost capacity, enhance travel safety and cut costs. However, the most significant change is set to be the mass deployment of autonomous vehicles (AVs), which will affect the whole sector, opening up new revenue streams and challenging established business models.

Based on our findings we have identified the following future key trends in the market:

Infrastructure set to require big data
Enabled by 5G networks, vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication systems will lead to an exponential increase in the amount of data generated by infrastructure assets, allowing road operators to enhance travel safety and optimise traffic management, for example by upgrading electronic toll collection systems and reactive traffic management systems in major cities. For these systems to be implemented, countries will be required to spend considerable amounts improving their 4G and 5G networks. In order to support the analytics necessary to thrive in the digital age, infrastructure operators will have to form partnerships and joint ventures with tech companies.

Smart ticketing and digital railways are set to increase revenue streams
Through the digitisation of signalling, payments and ticketing, the railway industry is set to boost the performance of its assets and its revenues. Investment in signalling is vital to increase the network's capacity in order to meet demand growth. The introduction of smart ticketing will allow rail operators to cut equipment expenses, such as barriers and ticket printers, to minimise ticket fraud and to develop more user-centric services.

Private funding will be crucial to retrofit existing roads and build new ones
For the mass deployment of AVs to be economically viable, existing roads will need significant retrofitting to ensure compatibility with new vehicles, which will be electronic, connected and autonomous. This will involve investment in fibre networks, gantries, cameras and traffic lights, as well as standardised and AV-compatible paintwork and road signs. The upgrade of the network will need to include

both the main motorways and trunk routes as well as smaller roads and streets (both urban and rural) to ensure a seamless AV travel experience. The scope of the upgrade necessary will require considerable injections of both public and private capital.

The business models of car parks could be transformed
While the growth of MaaS is likely to reduce the number of vehicles on the road, this is not going to eliminate the need for car parks. In fact, the reduction in the number of car owners could be compensated by an increase in users who abandon buses and metros in favour of ride-hailing services. Small and medium urban car parks could be replaced by large suburban car parks catering to ride-hailing fleets, rather than to individual drivers, freeing up prime space in city centres for alternative development. Car parks could therefore rely on the stable and long-term revenues ensured by sizable corporate clients.

Public transport will need a tech upgrade to stay competitive
The increasing use of MaaS models could represent a challenge to public transport system as railways and metro. Ride-hailing services could start to compete directly with public transport operators, potentially eroding the latter's long-term profitability. In order to remain competitive, public transport would need to invest heavily in more user-centred and personalised travel experiences. This will be a significant challenge for the cash-constrained local and national governments, which currently support public transport systems.

Investment in cyber security
With the implementation of smart mobility technologies and applications, transport infrastructure will become vulnerable to security attacks. The more immediate cybersecurity concern for today's smart mobility sector is that the companies operating in this space are becoming repositories for huge amounts of customer data. Ensuring that the repositories of data are secure is an ongoing challenge, which requires unfailing vigilance and constant security updates. Investment in cyber security will be crucial to allow infrastructure operators to detect risks and ensure the resilience of critical infrastructure assets.

Image: **Italdesign, Airbus (Pop.Up)**
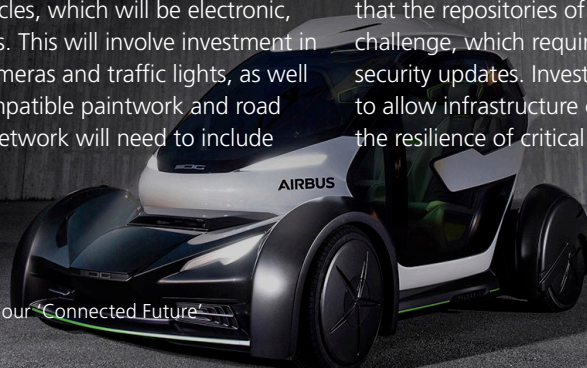
AppyParking

**Ben Boutcher-West,
Head of Mobility**

Smart parking aims to significantly reduce the time spent searching for parking, offering multiple benefits to application users, such as pay-as-you-go options and the elimination of overpayments and parking-tickets, while enabling drivers to make informed choices about their journey. AppyParking is a leader in mobility platforms.

"We're the next generation connected car and traffic management platform that bridges the gap between big data, high definition mapping, IoT and payments," says Ben Boutcher-West. Previously lead engineer at Jaguar Land Rover for autonomous driving and automotive lead for Bosch Mobility Services, he is now responsible for AppyParking's strategy, business development and R&D.

The Parking Platform™ provides a digital infrastructure layer over the existing road network and offers a Platform as a Service for local governments and car park operators to manage their kerbside and assets. Data-as-a-Service (DaaS) is then licensed to the private sector in the form of a marketplace.

"Our agnostic approach offers a holistic and scalable connected car and smart city solution. We are on the eve of 5G technology – while the consumer market enjoys greater 4G coverage, people are connected more of the time, with that comes greater choice. Greater access and the opportunities with multimodal transport are so clear to me and so clear to the team at AppyParking. It's about access to healthcare, access to education and access to employment."

"There are a lot of myths and legends associated with data. Handling the kerbside data is what cities are least equipped to do,

and our technology looks to equip them with the means to manage the data involved, whilst also giving them a revenue opportunity to earn real money," he continues.

"I think there is definitely a mobility cultural shift and people are taking a lot more responsibility for their mobility choices, embracing the range of options that are increasingly available to them," Ben Boutcher-West says.

According to Ben the most attractive markets are those with the biggest pain-point of parking, such as megacities, but also those smaller communities where the car remains the most viable mobility solution for a long time to come – places public transport cannot reach, for example.

"There is a huge divide and we are very lucky to live in a megacity with fourteen or even more ways to travel home from the office. This is a massive contrast to other cities such as Birmingham, in which the car remains the king of transport in the outer suburbs," he continues.

AppyParking's focus is not on private vehicle ownership only, but rather on people that deliver services, such as nurses and plumbers. They also focus on empowering the city to achieve its goals toward occupancy, clean air and congestion with the latest kerbside management technology and analytics. Consumer's acceptance and the swift progress of digital infrastructure are crucial for the future of smart mobility, but AppyParking does not need to wait to deliver tangible results today.

A vast amount of technological development is happening in areas such as Harrogate, Dundee, Bristol, Milton Keynes and Coventry, since these smaller towns are

on the forefront of the latest technology. On the other hand, London has 33 individual boroughs and it is a struggle to integrate them and get the maximum value from new technology.

"It goes without saying that London is certainly going to lead the field on the opportunity that the mobility revolution offers for the UK, but we should not forget those smaller towns where a lot of R&D can happen without the complexity a megacity presents" Ben Boutcher-West predicts.

However, the growing focus on smart mobility platforms and applications could widen the gap between rural and urban environments.

Still, there are a few obstacles ahead, and one of the main risks is represented by regulation. While the government approach continues to improve in this sector, a data ethics code that the private sector needs to comply with is needed to support business. The creation of a standardised regulatory framework for kerbside management will be necessary to avoid an exclusive focus on certain technologies, ensuring the full opportunity is not missed.

However, the future of smart parking looks bright, as the advent of AVs will bring a whole new range of opportunities.

"Since there will be no individuals responsible for parking, the vehicles and operators will be directly dialled into the digital platforms and permits will be requested on a case-by-case basis, in real time. With flexible services comes the need for even more accurate control of the kerbside. The AppyPlatform™ is designed specifically for this," Ben concludes.

In the spotlight: countries to watch

The most successful countries will be those that are swifter in upgrading their regulatory frameworks and in allowing testing. As smart mobility includes a range of different technologies at different stages of maturity, it is not always easy to compare progress across various countries. However, smaller and wealthier countries, such as Singapore and the UAE, are undoubtedly pioneering the implementation of smart city strategies, becoming test beds for new products and services.

We have singled out five key jurisdictions that we think pose the greatest opportunities for investors based on past deals, local incentives and predicted future investment activity:

UK

Leading track record in publicly funded AV developments
The UK aims to be a world leader in AV technology, with four cities allowing public trials and driverless cars on the road by 2021. It holds an impressive track record in publicly funded AV development, and earlier in 2018 the government announced GBP 22m in funding for 22 R&D projects relating to driverless vehicle technology. The Automated and Electric Vehicle Bill became law in July 2018, effectively extending the traditional model for insurance coverage to AVs on UK roads. The private sector is also finding ways to explore the streamlining of transport services, such as Virgin Trains' agreement with Uber to provide last-mile mobility to and from stations.

Singapore

Global leader in AV and smart mobility
Singapore is emerging as a global leader in self-driving technology and smart mobility. The country announced ambitions in 2014 to be the world's first smart nation. As part of this they have dedicated resource to improving transport systems and efficiently regulating them, putting Singapore ahead of the curve.

To improve its transport system, Singapore is concentrating on mobility-on-demand, contactless fares and AVs. From a regulatory point of view, they have established clear guidelines on liability, as well as specific zones and areas for the trial of self-driving vehicles. The Singaporean government has awarded research grants not only for AVs and EVs, but also for the development of peripheral technology and products that will support smart mobility, such as start-ups that are creating broad optimisation programmes and smart mapping technologies. A dedicated pilot town unveiled in November 2017 has been built to test AVs, including self-driving buses.

Poland

Emerging European hub for AV
Poland is a market leader for implementing intelligent infrastructure. In particular, the Mayor of Krakow has led the way in smart solutions. These include smart parking, a tram traffic control system and an urban traffic control system that helps reduce traffic and pollution. In Gdansk, the urban traffic and public transport fleet management system has reduced commute times by 7% by digitalising junctions, providing more information screens for travellers and increasing the number of traffic management centres.

Dubai has laid the foundations for smart mobility with the launch of its smart city project in 2013. Underpinned by large-scale improvements in fibre optic broadband, the city aims to make all transportation autonomous by 2030.

Poland is also emerging as a European hub for AV. In 2017 the city of Jaworzno, in Silesia, signed a letter of intent with the IT company Comtegra and the Motor Transport Institute regarding the development of legal, organisational and technical guidelines that will enable the testing of AVs on Polish roads.

UAE

Hyperloops expected to be operational by early 2020

Dubai has laid the foundations for smart mobility with the launch of its smart city project in 2013. Underpinned by large-scale improvements in fibre optic broadband, the city aims to make all transportation autonomous by 2030. The first segment of a hyperloop between Dubai and Abu Dhabi could be operational as early as 2020.

In early 2018 Hyperloop TT signed an agreement with Abu Dhabi's real estate developer Aldar Properties PJSC to begin construction of a route linking the Al Maktoum International Airport with the Alghadeer residential area. The country has also become a test bed for delivery drones, and Dubai's Roads and Transportation Authority is pioneering self-driving taxis.

Hyperloop TT's co-founder and chairman Bibob Gresta highlights the challenge that regulation poses but advances are being made and all eyes are on the progress of the world's first commercial hyperloop in Abu Dhabi. Hyperloop TT expects to have up to 5km ready for operation by the launch of the Expo 2020 and has already competed the first full-scale passenger capsule.

France

Fibre-optic bedrock will boost smart mobility credentials

France has an excellent bedrock from which to build up its smart mobility credentials. Currently, France boasts Europe's greatest length of driverless metro lines and the country is gradually introducing digital signalling strategies and automation to its Paris metro lines. Digital signalling is already in use on France's high-speed TGV network. The country is now due to start testing driverless high-speed trains in 2019 on its TGV lines, with the aim of running fully driverless journeys by 2023. This system would be the world's first driverless high-speed railway. Railway company SNCF expects it to increase the number of journeys between Paris and Lyon by 25%.

> France is now due to start testing driverless high-speed trains in 2019 on its TGV lines, with the aim of running fully driverless journeys by 2023.

Hyperloop TT

**Bibob Gresta,
Co-founder and Chairman**

Hyperloop Transportation Technologies (TT) - one of the three companies in the world working towards the revolutionary idea of moving passengers and freight using pods accelerated through propulsion in a pressurised environment, envisions to "fix transportation as we know it", according to its Co-founder and Chairman Bibop Gresta.

With the claim of the most efficient and safe means of transport, hyperloop promises speeds of up to 760 mph (1220 km/h) – a promise that could make London to Glasgow a 25-minute trip, or New York to Washington DC a 30-minute one, possibly changing once and forever the way we perceive distance and travelling.

Building on Elon Musk's open-sourced white paper in 2012, Hyperloop TT followed this concept and made an open call for action. Due to its innovative crowdsourcing model, it has attracted an international network of 800 innovators and 45 partnerships across 42 countries.

"The result is magic", Gresta says explaining that this new model played a pivotal role in overcoming the initial major challenge of solving the technological puzzle behind the promising idea.

"Now, the biggest challenge is regulation", he underlines. "We need to design a framework to regulate this new form of transportation".

To this end, in 2017 the company partnered with the German insurance company Munich RE alongside certification and inspection company TÜV SÜD. In September 2018, a workshop was held in Munich where Hyperloop TT, shareholders and governmental representatives were introduced to the first set of guidelines that could regulate hyperloop.

The advancements in the regulatory environment have come in time as all eyes are on the progress of the world's first commercial hyperloop project in Abu Dhabi.

The company has already revealed the completion of the first full-scale passenger capsule, which has been sent to its R&D centre in Toulouse, France for testing and prototyping - a road that will lead to its shipment to Abu Dhabi.

"According to the timeline, we expect to have up to 5km ready for operation by the launch of the Expo 2020, alongside a visitor's centre", Gresta reveals.

The construction of the first full-scale passenger capsule constituted a massive milestone that brought the vision of hyperloop a step closer to becoming a reality.

"We demonstrated that when you put 21,000 skilled engineering hours together with 5,000 assembly hours, you can develop a jewel of technology in less than a year", Gresta says.

Expanding on the achievement, Gresta reveals more details on the technology the company used.

"It took the air industry 30 years to increase the use of carbon fibre from 5% to 60% in airplane manufacturing. It took us less than a year to build a capsule that is 85% made of carbon fibre - this is unprecedented", he explains.

"We combined it with a newly invented material that we named 'vibranium', inspired by the material out of which Marvel's character Captain America's shield is made of", he explains.

Vibranium constitutes a composite material able to monitor speed, sense capsule integrity and atmospheric conditioning in real time. "We opened the road to a new generation of materials that can change humanity forever", he adds.

Other than Abu Dhabi, Hyperloop TT has signed another 10 agreements across the globe, specifically in the US, Brazil, France, Czech Republic, Slovakia, Abu Dhabi, South Korea, Indonesia, China and India. The projects are for different stages of development-from feasibility studies to commercial lines. Besides Abu Dhabi, commercial projects are also being developed in Ukraine and China.

Hyperloop has received heavy criticism from the transportation industry, with its critics mainly calling upon the technological challenges the idea entails.

"Those who say it cannot be done should not interrupt those doing it", Gresta replies drawing on an old Chinese saying.

"We are an open-participation project, and therefore we welcome and we need critics from people who want to contribute", he continues. "However, critics should come from science; the rest is noise", he concludes.

Investment opportunities in smart mobility

Electronic tolling collection

A technological upgrade of the tolling system is necessary to enhance traffic flow and safety. Electronic toll collection (ETC) eliminates the need for cars to significantly decelerate or stop altogether, reducing congestion, fuel consumption and air pollution. ETC also provides the ability to optimise traffic flows and dis-incentivise road use in high-demand times through congestion pricing.

Norway and Japan are regarded as pioneers of ETC implementation, with widespread deployment across both countries. While ETC is not a new technology, when coupled with vehicle-to-infrastructure (V2I), vehicle-to-grid (V2G) and electronic parking fee collection, it will provide even deeper insights into travel patterns and user behaviour, allowing infrastructure owners to implement more dynamic pricing strategies, and so significantly increase revenues.

Digital railways

The railway system is set to experience a momentous transformation. Rapid global population growth and urbanisation, coupled with the need to reduce carbon emissions, is likely to lead to an increase in the worldwide demand for both railway passenger and freight rail services. Existing rail networks will need to be retrofitted and upgraded to keep up with this evolving demand. According to the International Forum of the Organisation for Economic Co-operation and Development (OECD) excessive growth between 2018 and 2050 in passenger mobility (200% – 300%) and freight activity (150% - 250%) will play a defining role in driving the smart railway growth and every aspect of its value chain.

Within the concept of smart railway, smart signalling is one of the most promising, as it will allow train operators to increase capacity, improve performance and safety, as well as reduce delays and costs. In the UK, digital signalling is being introduced over the next 15 years. Infrastructure manager Network Rail has welcomed the involvement of private financing for this.

Nick English, partner at Rock Infrastructure, has highlighted the importance of collaboration between all stakeholders to make this a success. "A successful introduction of digital signalling requires ever closer working between Network Rail and the operators, for a number of reasons: project management of train

fitment, trackside equipment, testing and driver training as a single coordinated project; and introduction to minimise disruption to passengers – including changes to timetables." According to English, this could suggest putting the operator at the centre of the procurement and potentially funding process in close partnership with Network Rail.

Smart ticketing

Smart ticketing is acknowledged as an extremely promising area for public transport, as it will allow metro, tram, bus and rail operators to reduce expenses on equipment such as paper ticket printers and barriers. The concept of smart ticketing includes dedicated smart cards (such as London's Oyster and the Helsinki Card), contactless credit and debit cards, as well as digital wallet services. Thanks to big data and machine learning, infrastructure operators will be able to gain deeper insights into consumer behaviours, delivering a customer-centric travel experience. In 2017, the UK government introduced a GBP 80m investment in smart ticketing, to ensure all passengers have the choice to travel without a paper ticket by the end of 2018.

Mobility-as-a-Service (MaaS)

The emergence of the concept of MaaS has prompted car manufacturers and tech companies to get involved in ride-hailing start-ups and MaaS development. Automotive companies such as BMW, Toyota and Volkswagen are all getting involved. While there are doubts over the short-term profitability of car sharing, involvement in this market will allow automotive players to learn about customer behaviour, in order to be ready for the transition to integrated mobility services. The combined value of M&A deals in the MaaS sector exceeded USD 45bn between 2016 and 2018.

It is predicted that car fleet operators will become the dominant force in city mobility. Several automobile manufacturers have already launched their own car sharing platforms; including DriveNow by BMW, Porsche Passport, Maven by General Motors and Via by Daimler. Car sharing companies are transforming the mobility landscape, with the launch of services such as Toronto's free-floating Communauto Flex in November 2018.

Autonomous vehicles (AVs)

AVs will be more expensive for individual consumers than conventional cars, at least in the early years of use. This will increase the likelihood that fleets of AVs will be

sold to corporates, who will lease them to consumers or provide them on a MaaS basis, both as autonomous cars (such as robo-taxis) and buses. Early investment structures for AV fleets could display similarities to privately financed rolling stock. If leasing contracts are structured correctly then long-term and stable revenue streams could be achieved, enticing infrastructure investors and associated debt providers. For the mass deployment of AVs to be economically viable, existing roads will need retrofitting for AV-compatibility, including clear and standardised paintwork and road signs.

Drones for deliveries

With global e-commerce continuing to grow and competition increasing, delivery companies are looking for ways to make their business models more cost-efficient. One method to enhance efficiency is the introduction of delivery drones, which can cut delivery costs significantly, as well as providing faster shipping. In the early stages, it is likely that drone technology will make its way into rural areas, where van delivery is less economical due to the large distances between drop-off points and regulation of the less crowded airspace will be easier than in urban areas.

Many global logistics and retail companies are exploring ways to utilise drones. Amazon has set up a drone development centre in Cambridge, UK, with commercial operations expected to begin in 2020. A Chinese e-commerce giant, JD.com, is the first to start commercial operations, with 40 drones and two dispatch centres covering 100 villages in Shaanxi province. If drones are widely adopted in the delivery sector, they may also need some sort of launching infrastructure, such as moving vehicles or fixed dispatch centres.

As drone technology matures and its demand spreads across wider applications, the value of its market will expand by 688% between 2014 and 2021, according to a Pepperdine Graziadio Business School report. As shown below, the commercial drone market size is expected to be increased with a 34.3% annual rate from a USD 0.609bn in 2014 to approximately USD 4.8bn in 2021.

Worldwide commercial drones market size (2014-2021)

Market size (USD bn)
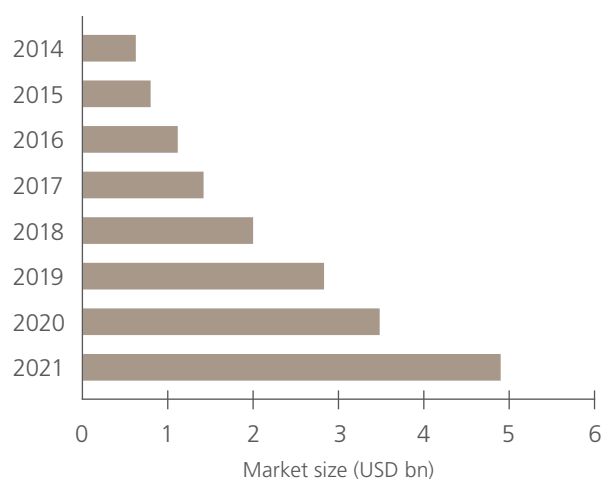
Source: Pepperdine Graziadio Business School 2018

11

Technology Scotland

Alastair McInroy,
Senior Programme Manager

Through their newly established MaaS Scotland network, Technology Scotland and ScotlandIS aim to advocate for the concept of Mobility-as-a-Service (MaaS) and demonstrate the benefits it can bring to operators, transport authorities and users.

"The idea of MaaS is mainly data-driven. The platform itself will be a digital portal, which gathers together all the information on the transport modes available in a particular region — including both public and private services", says McInroy.

The platform includes all modes of transport, from buses and trains, to bike and ride-sharing. However, the most innovative element is represented by the integration of a payment service, which can either be on a pay-as-you-go basis or a subscription-style model that would include a monthly fee for people to make use of all the transports available in an area.

The concept is based on the increasing servitisation of our day-to-day activities spearheaded by an increasing amount of service-based business models that have already revolutionised sectors such music and TV.

"Automotive manufacturers are beginning to react", he says. "Ford, BMW and Porsche are already looking into alternative mobility solutions. They are aware that in the near future they might not be selling cars, but services", he adds.

One of the major drivers for this shift is represented by users' decreased interest in ownership, particularly among younger people. Talking about the benefits of MaaS solutions, McInroy outlines how they can favour both users and operators.

"Public transport can be inconvenient, particularly if you are unfamiliar with it. The major drawbacks of public transportation are represented by the lack of integrated transport platforms, in addition to inefficient – and static – services.

MaaS solutions can address both these challenges. On the one hand, the integration of all available transport options will enable users to access timely and actionable information. On the other hand, through data acquisitions and algorithms, transport operators will have the opportunity to transition into a dynamic service model, in place of the traditional fixed schedule service, which often proves inefficient outside large cities.

When it comes to the business model, McInroy believes that MaaS can fulfil its true potential only through private-public partnerships.

"If the deployment of MaaS services is led completely by the private sector then local and central government authorities risk losing a degree of control over public transportation." In this case, the concept of transport as a public service would be in peril, as transportation would become a pure commodity.

From an investor's perspective, the participation of the government is increasing investor confidence and helping to significantly manage the risks when investing in such a nascent concept.

"The recent GBP 2m funding from the Scottish Government towards MaaS will accelerate the delivery of pilot projects and displace the inertia in the sector", McInroy says. He points out that government funding does not only contribute financially to the project, but it also acts as a reassuring signal that the government is placing MaaS within its long-term transportation strategies.

One of the major barriers of scaling-up the MaaS concept is its dependency on data accessibility, as operators are often hesitant to share information. McInroy, however, is confident that transport operators will soon appreciate the commercial value of data and the benefits they can bring to their business, taking advantage of this untapped opportunity.

With regards to the risk of data protection, security is crucial, yet the disclosure of data for MaaS is not different to users' everyday data sharing on various online platforms.

"Personal data will need to be collected in a fully transparent manner, following GDPR and other legislation. As long as this data is being gathered correctly and is not being shared inappropriately, it will be much like other services we use every day."

Rock Infrastructure

**Nick English,
Partner**

"A successful introduction of digital signalling requires ever more close working between Network Rail and the operators, for a number of reasons: project management of train fitment, trackside equipment, testing and driver training as a single coordinated project; and introduction to minimise disruption to passengers – including changes to timetables," says Nick English, Partner at Rock Infrastructure.

According to Nick English, this could suggest putting the operator at the centre of the procurement and potentially funding in close partnership with Network Rail.

"The partnership with Network Rail needs to be at the route level. One advantage of this is to have a single entity that 'cares' about both the cost and scope of the necessary infrastructure changes and the impact on the passenger," he continues.

This would lead to an increase in the number of trains, to fewer delays and more revenues.

"As more equipment is now on the trains, train owners will tend to become interested in the funding of the whole signalling and traffic management system," Rock Infrastructure's Nick English adds.

However, models that increase the role of the operator regarding management of the infrastructure will cause a tension that needs to be worked through.

Future development

Hear our experts predict the most exciting development in infratech over the next few years

Want to know what the most exciting development in infratech will be in the next three years?

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What does the future hold for smart mobility?

Start-ups and tech companies are constantly changing the game with new innovations in sharing and technology-driven mobility solutions. While it is hard to predict what mobility services will look like in 2030, it is easy to see that some technologies have already won the confidence of the industry and the public and have the potential to reshape our transportation infrastructure.

Hyperloop

Hyperloop uses electric propulsion to accelerate pods through a low-pressure tube at high speeds and promises unprecedented fast and convenient city-to-city transportation, even over long distances. Major developers include Virgin Hyperloop and Hyperloop Transportation Technologies, both headquartered in California. This method of transport could become a major competitor for rail or even air travel. With the claim of being the most efficient and safe means of transport, Hyperloop promises speeds of up to 760 mph (1220 km/h) – a promise that could make London to Glasgow a 25-minute trip, or New York to Washington DC a 30-minute one, possibly changing forever the way we perceive distance and travelling.

The US and UAE are the most active countries exploring hyperloop opportunities for their respective regions; the line that would connect Dubai to Abu Dhabi is most likely to be the first one commercialised thanks to strong government support. Interestingly, Asia Pacific also has multiple countries exploring hyperloop schemes. Indonesia for instance has signed a Memorandum of Understanding with Hyperloop Transportation Technologies to conduct a USD 2.5m feasibility study.

Blockchain

Blockchain offers greater security and transparency, as well as faster transactions, but it is constrained by the lack of infrastructure and regulatory framework. One promising company is Car eWallet, a blockchain-based transaction platform, established by a joint venture between ZF, UBS, and IBM. The platform will enable full end-to-end integration of mobility services, vehicles and infrastructure, allowing self-driving cars to be truly autonomous. Blockchain can also be applied to streamline electronic tolling, eliminating credit card fees and enhancing data security. In 2018, Danish shipping giant A.P. Moller-Maersk announced the creation of TradeLens, a blockchain-enabled solution to ensure a more secure and efficient global trade, in partnership with IBM.

Small satellites

Satellites are already going through a transition from predominantly academic and military tools to wider commercial utilisation, including imagery, telecommunication, geospatial mapping, building information modelling and navigation systems, and are expected to grow in number over the next 10 years. As the market is constantly expanding, one challenge facing the industry is the lack of launch vehicles and, consequently, significant delays to satellite launches. However, companies such as SpaceX, Virgin Orbit and Rocket Lab have already committed to building new facilities.

Space ports

In an era where space is moving from the public to the private sector, perhaps best exemplified by SpaceX and other companies' successful launch programmes, spaceports could follow suit. In the UK, as part of the current government's industrial strategy, GBP 50m in funding was set aside in late 2017 for new launch sites, with the intention of priming the growth of a new hi-tech industry for the country. The government calculates that around GBP 3.8bn revenue could be generated in the area over the next decade. The first recipients of the capital made available emerged in 2018, with a new spaceport project in Sutherland, Scotland being awarded GBP 2.5m in funding in July by the government-owned UK Space Agency.

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Methodology

Our research aims to identify the most promising markets and jurisdictions for investment for broadband, electric vehicles, energy storage and smart mobility. Since the four sectors analysed are markedly different in terms of their maturity, research methods have been tailored accordingly. The analysis of more mature sectors, for example, digital has been more quantitative, other sectors (i.e. smart mobility) required a more qualitative approach.

The quantitative data collated has been categorised according to sector, country, financing model, transaction stage, transaction value, participant role and status, with the goal of developing advanced data-driven analytics and insights. Our main source was dataLive, inspiratia's proprietary project database that monitors global project-financed social infrastructure, transport and renewables deals. Other sources include governments, international organisations, rating agencies, consulting firms, academic literature, newspapers, specialist press, press releases and in-depth interviews with market participants.

Our qualitative analysis was based on in-depth interviews with leading market practitioners to assess the interest of potential investors. This analysis provided insights on potential revenue streams, risks and inhibitors to successful investment, deeper understanding of the successful case studies, political support, regulatory framework, investment climate, technology maturity and gain an understanding of any other issues potentially affecting the investment landscape.

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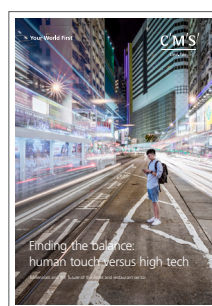
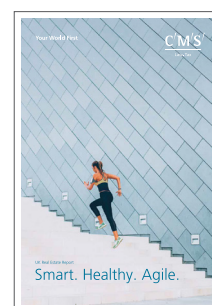In addition to this report, we have a broad range of thought leadership papers covering major sector issues.

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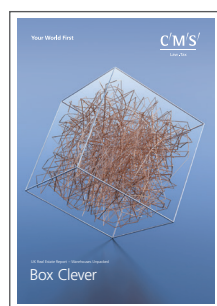
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About Inspiratia

inspiratia pushes the boundaries of analytics in the global infrastructure and renewables sectors, producing the most accurate and insightful analysis, uncovering new financial information and making robust sector predictions.

inspiratia provides clients with the tools to anticipate and analyse market trends in a way that helps grow their pipeline of deals and assists with business development. Based in London and Washington DC, inspiratia has an international team of industry experts and analysts all with in-depth sector expertise and extensive professional networks. **www.inspiratia.com**

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CMS Cameron McKenna Nabarro Olswang LLP
Cannon Place
78 Cannon Street
London EC4N 6AF

T   +44 (0)20 7367 3000
F   +44 (0)20 7367 2000