CBI

READY, SET, CONNECT

DELIVERING A ROADMAP TO SUPERCHARGE THE UK'S DIGITAL INFRASTRUCTURE

DECEMBER 2018

This report aims to:

- Set out the latest evidence on the digital infrastructure landscape in the UK and the transformational opportunities of seamless digital connectivity for business
- Make specific recommendations for government to improve the rollout of current and future digital connectivity and outline a roadmap for government action over the next three years
- Examine how government can create the conditions for business adoption of digital connectivity, providing insight for firms on how to practically improve their digital tools.

Methodology and business engagement

This report is based on extensive research with CBI members, including roundtables in Cumbria, Newcastle, London, Wales and Northern Ireland, complemented by interviews with businesses across the UK, including the East of England, North West, Midlands and South West.

CONTENTS

Chapter 1: Digital connectivity offers unprecedented opportunities for businesses and consumers across the UK. With the rise of new technology and modern business practices, seamless digital connectivity can enhance productivity and future-proof the digital revolution.

The UK is sitting on an untapped opportunity to supercharge productivity, prosperity and UK international competitiveness. In today's world, digital connectivity matters more than ever; if data is the new oil, digital connectivity is the pipe. Seamless digital connectivity, from full fibre networks to 5G, offers unprecedented opportunities for businesses and consumers.

Businesses are using digital infrastructure in new ways, and it is changing people's lives by enabling new technologies, reducing costs and allowing people to work more flexibly. As a game-changing technology itself, 5G can also provide a step-change for the UK. Now is the time to capitalise on the UK's leading 5G research base, becoming a global exporter of the technology and the know-how to adopt it.

Chapter 2: The UK has the potential for world-class digital connectivity. But without further bold action, the digital revolution is in danger of buffering.

Building on the UK's superfast broadband rollout, the UK government has set out an ambitious vision to future-proof digital infrastructure. This means rolling out 5G nationwide by 2027 and full fibre by 2033 – and supporting the growth of private investment to achieve this. This is good news for UK businesses, big and small - but without a step change in government action to help this happen, the UK is at risk of lagging behind internationally. More needs to be done to future-proof the UK economy. Without sure-fire action by government and Ofcom to unlock private investment, bust the barriers to rolling out new infrastructure and action to spur business adoption, the UK digital economy will lose out.

Chapter 3: Now is the time to make the UK match-fit on digital connectivity.

To provide the digital connectivity businesses need, government must deliver on its vision to achieve a buffer-free fibre and 5G future by stepping up to the scale of change required. In practice, this means delivering policy at a digital pace, raising government's level of commitment to becoming an international leader, and setting the framework for fast-paced business adoption of existing and future digital connectivity. There's no time to waste.

Step 1: Deliver digital connectivity at a digital pace – accelerate barrier busting plans to unlock investment and drive rollout

1.   Give communication service providers better access to private land

- Fast-track legislation to mandate gigabit connectivity in new builds and access to tenant properties in 2019.
- Streamline access to private land and support consistency by disseminating standardised wayleave agreements in 2019.

2.   Ease the planning restrictions on new infrastructure at pace

- Review digital infrastructure planning permission, ensuring that future telecoms infrastructure falls under permitted development. This review should consult devolved nations to achieve harmonisation in planning laws across the UK.

3.   Conduct a review of the business rates system including productivity-enhancing investments

- This should examine the economic impact of excluding digital infrastructure from business rates as an investment to enhance UK productivity.

Step 2: Lead the way in making the UK a top-tier connected nation – through bold, cross-government action

4.   Commit to delivering the funding necessary for the 'outside in' programme to deliver full fibre across the UK - within the Comprehensive Spending Review

- Set out funding mechanisms and a delivery programme for the 'outside in' programme. The Future Telecoms Infrastructure Review estimated this would cost at least £3-5bn. Ahead of the Comprehensive Spending Review, the CBI will be undertaking analysis on the full cost of this policy commitment.

- Ofcom and government should deliver the regulatory framework set out in the Future Telecoms Infrastructure Review in 2019, committing to incentivising infrastructure competition.

5.   Make integrated infrastructure a national priority by fitting all new transport infrastructure with full fibre and 5G infrastructure

- Join up infrastructure development by creating a cross-departmental Fibre and 5G Taskforce to put the right policy in place for government infrastructure projects to be built with full fibre infrastructure - prioritising large-scale road and rail projects and including MHCLG, BEIS, DCMS, DfT and HMT.

6.   Make the public sector a leading customer for digital infrastructure improvements

- Government must be an 'anchor customer' for 5G and full fibre by upgrading the digital infrastructure on public sector buildings and reusing public sector assets (including street lights, ducts and buildings) for digital infrastructure. The DCMS Barrier Busting Taskforce should continue to support councils in this.

7.   Commit to supporting mobile networks as strongly as fibre networks

- Government must support public funding to help address enduring rural mobile not-spots, barrier busting for 4G and 5G rollout, and continue spurring the development of 5G use cases.

Step 3: Set the framework for business adoption of digital connectivity

8.   Support greater business adoption of available digital connectivity

- Increase the funding pot for the Gigabit Broadband Voucher Scheme and continue the DCMS campaign to support voucher uptake.

- Extend the BEIS Business Basics Fund to support business adoption of 4G and gigabit-capable broadband.

9.   Help businesses prepare for 5G adoption by raising business awareness of 5G

- Share best practice from the government-funded 5G Testbeds and Trials Programme, through UK5G, the Digital Catapult and Innovate UK.

- Make the new 5G sector testbeds open to all businesses within the sector, to be delivered through the Catapult Network.

- Raise the profile of existing available testbeds to encourage businesses in all sectors to access the facilities.

- LEPs to better utilise Openreach digital connectivity postcode checker – so consumers and businesses can check what digital connectivity options are available.

CHAPTER 1

Digital connectivity offers unprecedented opportunities for businesses and consumers across the UK. With the rise of new technology and modern business practices, seamless connectivity can enhance productivity and future-proof the digital revolution.

In today's world, digital connectivity matters more than ever. Seamless digital connectivity, from full fibre to 5G, offers unprecedented opportunities for UK digital transformation, productivity and international competitiveness. Businesses are increasingly using digital infrastructure in new ways, to enable new technologies, reduce costs and allow people to work more flexibly. From using real-time sensor data to monitor machinery, to supporting a highly mobile and international workforce, digital connectivity is making a real difference to people's businesses and lives.

UK businesses are in fierce agreement that digital connectivity is a priority, with 67% highlighting that digital connectivity speeds and reliability are critical for their business to function.[1] Changing demands for digital connectivity are breaking down traditional barriers between consumer and business connectivity – as both businesses and consumers expect to be able to plug into a future-proof digital infrastructure network wherever they are.

Based on extensive research with CBI members, this chapter outlines key untapped opportunities for business that seamless UK digital connectivity can unlock. Not all businesses have the same digital connectivity needs – this often depends on the digital maturity of the company – but there are broad trends underpinning changing business demand that transcend sectors and business size.

Seamless digital connectivity can supercharge technology adoption and productivity

The size of the digital connectivity prize has never been bigger. The UK digital economy is worth nearly £184bn[2] and businesses across the UK are undergoing huge transformation, driven in large part by data-driven and digital technologies. From tried and tested technologies to fast-developing disruptive technologies like artificial intelligence (AI) – businesses are looking to improve productivity and open new avenues for growth by adopting technology. And digital connectivity is a critical enabler of this transformation.

For example, digital connectivity is enabling technology adoption that relies on people, data, machinery and buildings being better connected. As businesses use sensors and data-driven technology to link up their physical assets and deliver new insights, they need a seamless path of connectivity, from high speed fixed connections at their headquarters to 4G mobile infrastructure for their remote assets, like water pipes or data centres.

Seamless digital infrastructure can also provide a major productivity dividend to businesses by enabling greater technology adoption, improving customer service and enhancing efficiency. According to CBI research, 94% of businesses believe that digital technologies are a crucial driver of increased productivity.[3] Over half of businesses are investing in the Internet of Things and 42% of companies are planning to devote resource to adopting AI in the next 5 years.[4] This is boosting demand for digital infrastructure, as businesses increasingly require fast and reliable connectivity to gather and analyse large volumes of data in real-time and across different locations. With data being the new oil, digital infrastructure is the pipe that underpins the UK economy.

Investment in digital infrastructure has the potential to create a virtuous productivity cycle in the wider economy. Deloitte research has shown that a 10% increase in mobile subscriptions can increase GDP by 0.6-2.8%[5] whilst research by the EU suggests a 10% increase in broadband connections could result in 1% GDP increase per year and promote social inclusion.[6]

Today, the fastest growing and most productive businesses are those that have grasped the benefits of digital connectivity and used it to drive technology adoption and innovation

Airbus: Investing in digital connectivity is part of the solution to our productivity challenge

Airbus is a global leader in aerospace, defence, space and related services, with a 14,000 strong UK workforce, including the South West and Wales. One of the biggest challenges faced by advanced manufacturing companies like Airbus is the need to increase productivity. With a 10-year full production order backlog valued at over $1 trillion, Airbus sees data and digital adoption as one of the critical enablers in solving its productivity challenge. Digital adoption gives Airbus the opportunity to make its aircraft smarter, faster, and cheaper. While digital adoption can go some way to increase its efficiency, the digital integration of the supply chain is also essential to meeting its production targets.

Skywise is a digital platform at Airbus that allows airline operators to tap into vast amounts of aircraft operational and performance data to identify areas of improvement. Using data analytics, Skywise can assess failure probabilities in order to anticipate potential maintenance tasks, saving on both costs and time.

Adopting new technologies, like augmented reality and artificial intelligence, leads to the creation of new competencies that impact the way Airbus operates. Pulling engineering, manufacturing, and operability into one 'co-design' sphere better equips Airbus to manage change through the development process. Using Digital Twins, Airbus engineers can build a virtual model of the product and the factory that will ultimately provide the tools required for a seamless digital thread of data, connecting the operating product back to the automated factory and the fundamental design. Fully adopting digital is key to affirming Airbus' status as a world leader in the aerospace industry.

Wessex Water: Digital connectivity spurs data-driven insight across our vast and remote water network

With a range of physical assets like water pipes and sewage facilities in remote locations across the South West, Wessex Water has been assessing its digital connectivity needs and investing in business networks as a priority. Wessex Water aims to make better use of its assets by using sensors to gather insights from data to improve efficiency, reduce leakage and improve service for customers and communities by becoming a smart utility service, this even extends to remote sensors on farms and in rivers to assess water quality.

Having boots on the ground in all situations can be prohibitively expensive, but the combination of sensor data and reliable digital infrastructure could support people to enable better quality customer service and network efficiency. Improving the quality of connection for customers could also support behaviour change and reduce wastage. Wessex Water see the future business model as being a connected, transparent service integrated in the communities it serves.

Ryder Architecture: Digital infrastructure underpins our approach to adopt sector-leading technology and compete internationally

For companies like Ryder Architecture, digital connectivity is a core driver of Building Information Modelling (BIM), the industry's must-have technology. The UK has been an early adopter of BIM software, which allows architects, engineers and construction professionals to collaboratively plan, design, construct and manage physical infrastructure using a visual 3D model of buildings. Importantly, this allows Ryder to quickly share and test multiple design options, improving productivity and reducing waste across the industry. Headquartered in Newcastle, with offices in London, Liverpool, Glasgow, Hong Kong, Vancouver and Amsterdam, a portfolio of international clients, and a range of diverse project sites, Ryder's people require seamless digital connectivity to use BIM technology, from reviewing the building models to accessing real-time updates from Hong Kong, Malaysia and the UK.

For the UK to maintain its Building Information Modelling (BIM) early adopter advantage, sell its design expertise internationally, reap the benefits of hyper-connected cities, and continue to improve building design and construction, high quality digital connectivity is essential across our offices and building sites. Without the right infrastructure in place, the UK architecture design industry won't be able to compete or deliver for customers.

Peter Barker
Partner at Ryder

With seamless digital connectivity, businesses can better embrace modern, flexible working practices

As business models and workplaces change, so do their connectivity needs. More employees are working from home and careers are becoming more mobile, requiring remote working on transport and in public places. Seven in ten commuters now use their smartphone on their journey,[7] whilst 45% households consider digital connectivity important for working or running a business from home.[8] For many businesses, high value work is being conducted in rural and remote locations. This includes the 91% of farm businesses that say that broadband is an essential tool for them to run their business.[9]

The convergence of business and consumer connectivity underlines the importance of improving the UK's digital infrastructure. Business connectivity has shifted towards work being conducted collaboratively across the UK and internationally by a dispersed workforce relying on mobile networks and home broadband. This collaborative working style is driven by technologies like cloud systems and video conferencing that underpin core business functions and need reliable and fast digital connectivity. Digital connectivity is mission-critical for firms as their reputation and capacity to conduct business depends on their ability to communicate effectively using the UK's digital infrastructure.

Travel Counsellors: Seamless home connectivity drives flexible working and success for our company

For companies like Travel Counsellors, the success of their workforce relies on the ability of their counsellors to work from home with seamless digital connectivity. Travel Counsellors has a global head office in Manchester, with over 1800 franchises and seven offices worldwide. The franchises are home-working entrepreneurs who use Travel Counsellors' software system to create unique and bespoke holiday experiences. Just like customers who may sit down after dinner to plan a holiday, the Counsellors can adapt their working hours to when is convenient for family life, meaning that they can communicate with customers at the best time for all. Corporate Travel Counsellors support businesses with all their business travel needs requiring integrated technology and connectivity to provide a more B2B service.

Whilst founded in the era of dial-up modems, Travel Counsellors has gone from strength to strength by putting digital connectivity at the forefront of its business model, allowing its Counsellors to be more productive and efficient. The changing way we communicate - from WhatsApp to Facebook Messenger - alongside the growth of digital content like 360° videos of hotels, is growing connectivity demands. The Counsellors and their customers need to be able to rely on seamless digital connectivity and high speeds across fixed and mobile networks so that counsellors can deliver efficient people-focused services and customers can digitally live the holiday or business trip before booking it. Improving rural fibre access and 4G coverage will allow companies like Travel Counsellors to continue disrupting & innovating in their industry.

The next wave of mobile connectivity – 5G – has the potential to transform products, services and prosperity across the UK

Digital connectivity not only powers digital transformation, it is also a game-changing technology itself. The next wave of mobile connectivity, 5G, has the potential to supercharge productivity and prosperity across the UK. 5G technology could potentially add up to £173bn to the UK economy by 2030.[10] 5G is the 5th generation of mobile networks and represents a step change in both the technology behind the network and its potential uses.

If 4G signal is a torch beam, 5G will be a laser beam - more targeted and powerful. 5G will connect people, machines and devices in previously impossible ways, and will pave the way for technologies like autonomous vehicles and remote surgery. 5G fixed wireless access also has the potential to be used as an alternative for fixed home broadband. A report by O2 found that by 2026, the economic benefits of mobile 5G could even exceed those of fibre broadband.[11]

Whilst the specific use cases and commercial models are still being determined through trials and testbeds, the core benefits of 5G will include:

• **Increased data capacity and speeds,** with potentially 100x speeds and the ability to connect billions of devices with reliable connections

• **Improved coverage** across the UK

• **Better flexibility** of provision, for example businesses may be able to buy a portion of the 5G network for an event, project, network (e.g. smart energy networks) or time period

• **Shorter delay,** also known as lower latency,[12] which will enable applications like autonomous transport and remote surgery that require instantaneous reactions

New 5G capabilities, from higher and more targeted capacity to near-instantaneous responses, will provide new opportunities for both businesses and consumers. The 4G-to-5G evolution will be very different to previous upgrades; initially, 5G upgrades will be based on 4G infrastructure and will provide a range of communication services over one network.

UK 5G trials

EE, part of the BT group, is conducting a 5G trial in locations across 10 sites in East London, and in October 2018 switched on the first 5G test site open to the public in Canary Wharf. EE has announced it is launching 5G in 16 UK cities in 2019.

O2 announced a 5G testbed at the O2 Arena in 2018 to support the development of business use cases and aims for a full commercial launch in 2020.

Three is currently upgrading its mast sites to include enhanced 4G and 5G – and is looking into the possibility of using 5G as an alternative for home broadband.

Vodafone announced that it will be conducting 5G trials across seven UK cities (Birmingham, Bristol, Cardiff, Glasgow, Liverpool, London and Manchester). The first of these, in Salford, Greater Manchester, was switched on in October 2018.

Ford: 5G connectivity opens up new opportunities to improve road safety, urban mobility and traffic efficiency

Ford recently ran a pilot where they logged over one million kilometres driven by 160 light commercial vehicles in London. The data collected from these vehicles led to insights from accident prevention to traffic flow.

When this data collection and communication becomes real time – enabled by 5G – rather than offline, the opportunities for improvements in these areas increase significantly. 5G enables live vehicle-to-infrastructure communication, as well as vehicle-to-vehicle, vehicle-to-bike and vehicle-to-pedestrian communication. This can enable applications such as:

- **Active accident prevention:** for example, if a driver is pulling out of a junction, vehicle-to-vehicle or vehicle-to-bike communication can identify whether the vehicle is about to pull out into the path of an oncoming vehicle, and automatically brake or otherwise intervene to prevent a collision.

- **Improving traffic flow:** vehicles can communicate with connected road infrastructure such as traffic lights, allowing traffic light phasing to adjust dynamically based on data from vehicles that may be approaching a congested area.

- **Enabling multimodal last mile delivery:** dynamically switching between van, bike and pedestrian modes for last mile delivery.

- **Incident reporting:** with the current UK network of cameras and sensors, it takes approximately 15 minutes on average to identify a broken-down car. With 5G connectivity, a vehicle can instantly communicate if it breaks down, enabling emergency service response as well as dynamic traffic re-routing.

- **Autonomous vehicle operation:** the speed of data transmission required for autonomous vehicles can only be handled by a 5G network.

The speed of implementation and breadth of deployment of connected vehicles will be dependent on the coverage, reliability, bandwidth and capacity of the 5G network, with ubiquitous coverage being a top priority for connected vehicle applications.

Looking under the 5G hood:

Five technologies that businesses should know about

Businesses are excited about the potential of 5G in the coming years – but what exactly makes 5G different? Underlying 5G is a family of new technologies, which will come online gradually as an evolution from 4G to 5G. Communication service providers are already upgrading their infrastructure to incorporate 5G technology and get ready for rollout.

Some of the key technologies behind 5G are:

• **5G spectrum:** as more people and devices transmit data on the same network, the radio spectrum bands get crammed. This means people get a smaller piece of bandwidth and a slower service. That's where Millimeter Waves come in. 5G will use these higher frequencies of spectrum which allow more data to be carried.

• **Small cells:** these are portable mini base stations with antennas, thousands of which could be installed in cities, for example on lampposts and telephone boxes, to boost the network. This 'network densification' would increase capacity in urban areas where many people and devices are connected and would reduce the chance of signal dropping off.

• **Massive MIMO (Multiple Input, Multiple Output):** this technology uses multiple antennas on a mast (base station) to boost signal. Whereas current masts use 2-4 antennas, Massive MIMO trials have used between 96 and 128! This means the mast could send and receive signals from many more users at the same time.

• **Network slicing:** this is the ability to segment the network into 'slices' of capacity for specific services or applications. This means the customer doesn't have to share their piece of the network with others, improving service quality. In 2017, BT and Ericsson found that using network slicing for automation in IoT applications generated 35% more revenue over five years and a 40% reduction in operating costs.

• **Fibre backhaul:** fibre networks will be fundamental to deploying 5G. They will be needed to connect the mast (base station) to the exchange point and to the internet. This is known as 'backhaul'.

As the home of world-leading 5G R&D, the UK can be a key global driver of the 5G revolution, exporting both the technology and know-how to adopt it

As a growing hotspot for 5G innovation, the UK must capitalise on its strong foundation and continue to support collaboration between government, business and universities in the years ahead. The Digital Catapult's 5G Nation report highlighted that the UK has boasted 135 academic and 66 industry 5G projects over the last five years. Government-business collaboration must build on the success of the £16m UK5G Test Network, set up by government with hubs at the University of Surrey's 5G Innovation Centre, King's College London, and the University of Bristol. These spaces have provided an opportunity for businesses and academics to work together to trial 5G technologies and test potential use cases.

Horizons 5G is an exemplary partnership between SMEs, large corporates and universities that will help spur the UK advantage in 5G

Horizons 5G is a new partnership between the University of Portsmouth, University of Surrey, Airbus, BT, Avanti, Methera Global and Roke that aims to unlock the unique capabilities of 5G from combining terrestrial and space networks.

The increased hunger for mobile data and the move towards autonomous vehicles and the Internet of Things is driving the demand for a ubiquitous, resilient, super-fast next generation 5G network that provides 100% geographic coverage. The Horizons 5G project is exploring how this can be achieved by combining the future terrestrial network with space-based capability to deliver full coverage that is secure and cost-effective. The project has been established by a number of leading space companies, as well as terrestrial network providers and universities to research and demonstrate the future of 5G with Space at its core. Using a model of open collaboration that allows start-ups, SMEs and established companies to work together, Horizons 5G will deliver technology demonstrations and 5G Testbeds that simulate what the future converged 5G network would look like.

There is also an untapped opportunity for 5G development to spur regional business growth and productivity across the UK. Phase 1 of the government's 5G Testbeds and Trials Programme, launched in 2018, has also supported business partnerships with local authorities to test 5G business models and use cases, from smart farming in Shropshire and rural 5G in Orkney to using 5G to increase the efficiency of manufacturing production lines in Worcestershire (see Exhibit 1 for overview of the full 5G Testbeds and Trials funding programme).[13]

The Urban Connected Communities funding bid, won by the West Midlands, has geared up a wider set of regions across the UK to create regional coalitions to consider their 5G proposition and how it might boost regional growth and productivity. There is now an opportunity to use this regional preparation to further drive the UK's expertise in 5G, combine it with the UK's wider industrial strength and become an international trailblazer on 5G, exporting both the technology and adoption best practice.
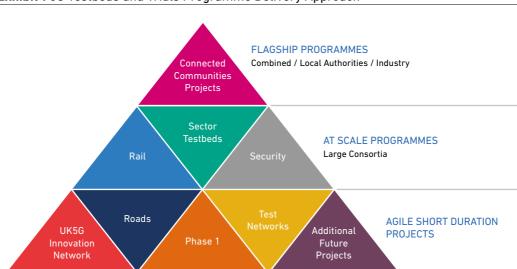
Exhibit 1 5G Testbeds and Trials Programme Delivery Approach

CHAPTER 2

The UK has the potential for world-class digital connectivity. But without further bold action, the digital revolution is in danger of buffering.

Government has set out a clear and ambitious vision to make the UK a world-leader in 5G and full fibre. This includes rolling out 5G nationwide by 2027 and connecting 15 million premises to full fibre networks by 2025, with nationwide coverage by 2033.[14] The vision builds on positive steps made by government to support nationwide digital infrastructure improvements over recent years, including a suite of programmes outlined in the 2017 Digital Strategy and Industrial Strategy to improve digital infrastructure and stimulate the market for future technologies like 5G. In the past two years, the UK government has promised over £1bn to improve the UK's digital infrastructure, with a further £200m for rural connectivity promised in the 2018 Autumn Budget.

At the same time, digital infrastructure providers are ramping up investment in improving the UK's digital infrastructure. Mobile operators already invest £2bn every year in new network infrastructure.[15] Looking to the future, the private sector will also provide most of the £33.4bn investment needed to deliver full fibre networks across the UK,[16] as well as the £8bn needed to upgrade existing infrastructure for nationwide 5G coverage.[17] This doesn't include further significant investment likely needed for future 5G small cell sites that the private sector will fund.

As the majority of the investment for full fibre and 5G will come from the private sector, it is therefore government and Ofcom's responsibility to take urgent and bold action to unlock this investment, and help the digital infrastructure providers go further, faster.

The UK has made progress on broadband rollout and now the focus is shifting to future-proofing connectivity. But without a step change in government action, the UK is at risk of lagging behind internationally.

Increasing provision of superfast broadband across the UK has been a key focus of the government's telecoms policy. Since 2011, the government-funded Broadband UK (BDUK) programme has supported rollout of copper-based superfast broadband in areas of market failure. Now, 95% of UK premises have access to superfast broadband. Having created 49,000 jobs and provided a £9bn boost to the economy,[18] this programme highlights the far-reaching impact of improving UK connectivity. More recently, the Universal Service Obligation was set out in the Digital Economy Act of 2017, which mandates that Ofcom ensure all premises have the right to request 10mbps broadband by 2020. Progress is also being made in the devolved nations:

• The Welsh government's Mobile Action Plan 2017 focuses on nine key areas where devolved government action can provide consumers and businesses with the mobile connectivity they need to harness the digital revolution.

• The Scottish government has committed £600 million for the final phase of the 'Reaching 100%' investment to ensure every home and business in Scotland has access to fibre broadband by the end of 2021.[19]

• In Northern Ireland, the DUP and Conservative Confidence and Supply Arrangement 2017 committed £150m investment to deliver the broadband aspirations for Northern Ireland. The CBI-chaired Northern Ireland Broadband Industry Forum advised on how the £150m for Northern Ireland ultrafast broadband could be best spent, focusing on rural SMEs.[20]

But this is not enough to fully future-proof the UK economy. Without further action by government and Ofcom to incentivise private investment in digital infrastructure, businesses will be unable to rely on UK networks to adopt new technologies, communicate with colleagues and clients around the world, and attract investment in a competitive international market.

Seamless digital connectivity will be crucial for government to make progress on the Grand Challenges set out in the Industrial Strategy.[21] From supporting an ageing society using AI to clean growth and future mobility, the new suite of technologies behind 5G will enable real-time insights at scale to use resources efficiently, reduce congestion and better tailor services to people and businesses.

The UK economy requires quick rollout of gigabit connectivity to support the ambitions of business and futureproof UK connectivity

Internationally, the UK fares well on superfast broadband provision, which delivers the connectivity many customers need in 2018. However, delivering a full fibre future is vital to future-proof the UK's digital connectivity. Today, 4% of premises in the UK have access to full fibre broadband compared to Spain (71%), Sweden (95%) and Japan (97%).[22] These high levels of international fibre access were achieved by fostering private investment and competition where possible and the UK must follow suit.[23] The World Economic Forum's 2018 Global Competitiveness Report reiterates this, placing the UK 75th in the world for full fibre provision.[24] On mobile coverage, 87% of the UK's landmass has 4G signal from at least one operator, but opportunities to improve coverage remain.[25]

This evidence highlights that fast-paced policy and regulatory action is needed to accelerate investment and achieve government's full fibre and 5G ambition. If the necessary changes are achieved at pace, Openreach has committed to delivering full fibre connectivity to three million premises by the end of 2020 and 10 million premises by the mid-2020s. Alternative providers (alt-nets) have made similar commitments, such as CityFibre which has committed to deliver full fibre to five million homes by 2024.

Regionally, there are also significant variations in the digital connectivity available for consumers and businesses. Businesses welcomed the £200m boost for rural digital connectivity in the 2018 Autumn Budget, but this must be a starting point. Without the right approach to spending this funding on innovative approaches to rural connectivity, the UK risks further embedding a digital divide between regions, and rural and urban locations. Government must support the improvement of existing 4G mobile connectivity and full fibre networks in these commercially unviable areas. This must go hand in hand with removing barriers to deployment to help private investment go as far as possible, so that government assistance can be targeted at areas where it is genuinely needed.

Businesses are clear that digital connectivity matters, but barriers to uptake need to be addressed

Every business should be able to access and adopt the digital connectivity needed to harness the opportunities of the digital revolution. The companies who have successfully embraced digital adoption have considered their digital connectivity requirements and taken steps to upgrade their provision. Yet, this CBI research finds that many businesses still struggle to improve their digital connectivity.

Government has made promising inroads to address these adoption challenges, including launching the Gigabit Broadband Voucher Scheme in March 2018 to give SMEs up to £2500 towards the installation of gigabit connectivity. This is a useful starting point, but a bolder approach is needed to address the wide array of challenges to business adoption. Based on feedback from firms across the UK, there are four main challenges firms face in improving their digital connectivity:

- **Business connectivity is stalling due to the length of time needed to install new connections.**
  Whilst cloud services can be provided within a matter of hours, it can take months for both business and consumer fixed networks to be provided due to a range of rollout barriers that communication service providers face. Addressing these barriers to rollout (set out below) quickly would make a significant difference to businesses, particularly if they require short-term connectivity, for example to a building site or filming location.

- **Businesses have limited influence on consumer-focused mobile networks.**

  As businesses embrace modern working practices like remote working, their employees increasingly rely on broad commercial networks like 4G which individual businesses have limited power to improve. Government's focus until now hasn't been on the business need for mobile networks, but as the importance of mobile skyrockets for businesses and consumers, businesses will look to government to ensure the regulatory and policy environment eases the barriers to mobile network improvements and puts mobile connectivity on a par with full fibre broadband.
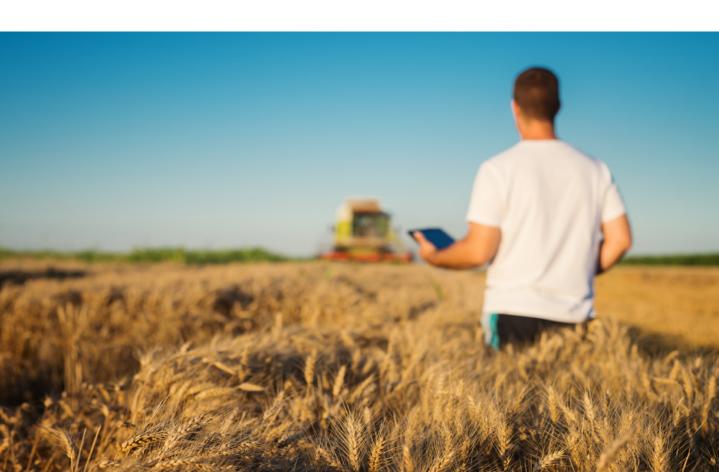
- **Businesses need more insight and opportunity to explore the potential of existing and future connectivity for their business.**

  Whilst businesses agree that digital connectivity matters more than ever, many do not have the tools to access and adopt the best digital connectivity for them. On future provision like 5G, the business use cases and commercial models have yet to be set. Many businesses do not have the insight or opportunity to explore what new business models and uses may look like and how to address challenges such as cybersecurity on 5G networks – which are likely to reduce initial uptake.

- **Digital connectivity needs to be joined up with government support on technology adoption more broadly.**

   Businesses face a wide array of technology adoption challenges, as CBI report From Ostrich to Magpie and the Made Smarter Review outlined in depth.[26] This includes lack of skills, visionary management and leadership, awareness of the productive potential of technology and infrastructure, and limited capital for investment. The Made Smarter Review in 2017 highlighted slow internet connection speeds as a key barrier to industrial digital adoption, particularly amongst SMEs.[27] Low performance on these factors can translate into a lag between provision in an area and uptake of digital connectivity by businesses - ultimately limiting the productivity of firms.

Government and business must work together to close gaps in digital connectivity adoption now, and set businesses up for full fibre and 5G. Government must be a key partner in setting the framework for business adoption of digital connectivity within wider technology adoption; this must include existing 4G, full fibre, and other suitable forms of digital networks, for example Low Powered Wide Area Networks (LPWAN). This will help businesses put processes in place to be fast adopters of future digital connectivity, such as 5G, later down the line.

Barriers to digital infrastructure deployment continue to slow provision

There are well-known challenges that infrastructure providers face when rolling out digital infrastructure.[28] These barriers to infrastructure rollout hinder investment and increase the cost and time to deliver digital connectivity.

Action must be taken to address the key barriers to rollout. This is also critical to ensure that commercially funded deployments extend as far as possible, allowing government to make the best use of its finite resources and targeting intervention in areas where it is genuinely needed. Government and Ofcom must prioritise the following barriers:

Access to land and infrastructure

- **Providers face difficulty in accessing land to upgrade infrastructure.**

  Gaining access to land through written consent, also known as wayleaves, remains difficult for communication service providers trying to upgrade and expand the UK's digital infrastructure. Providers are often unable to obtain permission from absent landlords, for example, which delays access to improved digital connectivity for the tenants living in the building. To ensure businesses and consumers can access future-proof digital infrastructure, businesses will be looking to government to fast-track the legislation needed in 2019 to ensure access to gigabit-capable connections in tenant properties and mandate gigabit connectivity in new builds.

- **Access to public infrastructure needs to move from last to first resort to enable upgrades to local connectivity.**

  Access to public infrastructure can supercharge digital infrastructure rollout across communities. Yet there is variation between local authorities regarding the support for digital infrastructure improvements. Local councils and providers must use central government's newly created framework and toolkit for UK street works[29] and Digital Infrastructure Toolkit to support the use of government sites for digital infrastructure improvements. Rather than being a last resort, public sector assets such as buildings and street furniture should be first choice 'anchors' to host future-proof digital infrastructure, with national government overseeing progress by local authorities.

- **Planning restrictions slow the rollout of digital infrastructure and are not future-proof for 5G rollout.**

  The current UK planning regime is not future-proof for 5G provision and continues to slow 4G provision. 5G deployment will likely require a denser network of infrastructure, including thousands of small cell sites which do not currently fall under permitted development. This means communication service providers will have to go through the full planning application process for each small cell site. Similarly, Massive MIMO technology will require larger masts to accommodate the number of antennas needed; this has a direct effect on signal strength.[30] Planning reform must increase the cap on mast heights so that it is on par with other European countries. National and devolved governments must adopt a solution-focused approach to planning that is supportive of quick digital infrastructure decisions and delivery. Scotland, for example, has made recent progress amending planning laws to support digital infrastructure rollout.

Supporting investment

- **Business rates are putting a strain on the UK digital infrastructure investment case.**

  In an increasingly digital world, the business rates system is no longer fit for purpose, and needs urgent reform to keep pace with the modern economy. The current business rates system limits UK investment in deploying and adopting digital infrastructure improvements. Government's five-year freeze of business rates for full fibre deployment showed its commitment to full fibre rollout. However, as the investment case for full fibre is long-term and risky, at around 20 years, and most of the UK's full fibre build will happen outside of this five-year window, a longer-term vision is needed. Government should conduct a holistic review of the business rates system,[31] accounting for all sectors and regions, with a closer look at how business rates affect businesses' investment decisions and consumer prices. This should examine the scope of productivity-enhancing investments, and the impact of business rates on achieving the government's full fibre vision by 2033.

- **Committing government support in areas where the investment case doesn't stack up will spur UK-wide provision.**

  It is not commercially viable for communication service providers to deliver digital infrastructure in some areas, notably the last 10% of premises as set out in the Future Telecoms Infrastructure Review. This inevitably slows provision. New rural providers like Gigaclear are adopting innovative approaches to delivering rural connectivity, but additional, targeted government intervention is necessary to address market failure in rural areas to avoid embedding a two-speed UK.[32] It is imperative that this includes both business and consumer provision.

Access to skills

- **The UK's digital infrastructure skills gap risks missing the government's targets for full fibre and 5G rollout.**

For the UK to achieve its ambition to be a full fibre and 5G nation by 2033, an entire workforce of civil works staff trained in rolling out full fibre networks will be needed. Business and government must work together to ensure that the UK skills and immigration system supports the flexibility necessary to hire the talent needed to deliver on this ambition. As outlined in the CBI's immigration report, *Open and Controlled*,[33] communication service providers already rely on skilled engineers and manual labourers from across Europe. This includes fibre skills from Latvia and Romania, as well as civil and general construction skills from Poland.

Updating the regulatory environment

- **The regulatory environment needs updating to support the long-term, high-risk investment needed for full fibre.**

The UK's current regulatory model has been effective in supporting superfast broadband investment, but it is far less well-suited to the larger, riskier infrastructure investment required for nationwide full fibre connectivity, which will need to be rolled out ahead of widespread demand. The government's Future Telecoms Infrastructure Review set out key reforms to deregulate where necessary, acknowledge the convergence of mobile and fixed digital infrastructure, and support different regulatory regimes across the UK. Ofcom and government must now be bold in delivering on these reforms to remove disincentives to investment and take a long-term approach to regulation. The UK needs a delivery plan from government and a commitment to ongoing, iterative policy reform with success judged by ease of infrastructure deployment.

Ultimately, the UK government's policy and regulatory framework must support quick and effective infrastructure deployment, otherwise the UK's world-leading digital economy risks hanging in the balance. Building on the work of the DCMS digital infrastructure Barrier Busting Taskforce, these well-known challenges must be addressed as a matter of urgency.

Government must put digital infrastructure on a level playing field and join up infrastructure provision with a clear goal

The UK government is sitting on an untapped opportunity to commit to digital connectivity. Government support for digital infrastructure must echo its growing importance across all sectors and for wider social benefit. Currently, communications infrastructure makes up just 2% of government spending on the National Infrastructure and Construction Pipeline.[34] Government has an opportunity to better reflect the importance of digital connectivity in policy and investment decisions by intervening to support rollout in commercially unviable areas, as outlined in the section above. This should aim to reduce differences in committing to fiscal intervention between digital infrastructure and other infrastructure such as housing or transport, where needed.

Government should also join up infrastructure provision, including transport, digital and energy infrastructure.[35] Only by joining up infrastructure rollout will the UK reap the benefits of the digital revolution, from smart mobility to an efficient energy grid and connected cities. Government has made promising inroads, for example trialling 5G deployment on the TransPennine rail route through the 5G Testbeds and Trials Programme. But a more structured approach is needed. For example, to improve coverage by fully connecting digital infrastructure and rail, government must join up all the levers it has access to, including Network Rail, mobile licences and Train Operating Company franchise agreements.

Government must commit to bringing together all relevant government departments in a more structured approach - including DfT, DCMS, BEIS, HMT and MHCLG - to ensure the UK can achiever buffer-free connectivity, regional growth, and achieve the government's goal to make every British business a digital business.

The UK economy requires quick rollout of gigabit connectivity to support the ambitions of business and futureproof UK connectivity

CHAPTER 3

Now is the time to make the UK match-fit on digital connectivity

As business demands for digital connectivity change and grow, government must turn plans into tangible action to deliver a buffer-free fibre and 5G future.

This section sets out how government can boldly commit to transforming the UK's digital infrastructure and set the framework for businesses to deliver a world-leading digital revolution by adopting seamless digital connectivity.

Step 1: Deliver digital connectivity at a digital pace - accelerate barrier busting plans to unlock investment and drive rollout

Government must work rapidly to create the right conditions for smooth and quick digital infrastructure improvements. Whilst the private sector will make most of the investment to improve the UK's digital infrastructure – from full fibre to 5G – government and Ofcom must take bold action to unlock this investment now.

As chapter two of this report and the government's Future Telecoms Infrastructure Review set out, there are well-known barriers that slow digital infrastructure rollout. As 5G will likely require more physical infrastructure than 4G, these barriers will intensify. Therefore, government and Ofcom have a key role to play in providing a fit-for-purpose regulatory and policy environment for the rollout of digital infrastructure upgrades.

To accelerate momentum on removing key barriers, government should:

1.   Give communication service providers better access to private land

- Fast-track legislation in 2019 to provide better access to tenant properties and mandate gigabit connectivity in new builds

- Streamline access to private land and support consistency by disseminating standardised wayleave agreements (for example the CLA/NFU rural wayleave framework for fibre networks). This should be led by the DCMS Barrier Busting team and Local Connectivity Group and implemented in 2019.

2.   Ease the planning restrictions on new infrastructure at pace

- Bring forward the government's planning permission review. DCMS to work with MHCLG to ensure that all future telecoms infrastructure, such as 5G small cell sites, fall under permitted development planning permission. This review should also consult devolved nations and aim for harmonisation of planning law.

3.   Conduct a review of the business rates system including productivity-enhancing investments

- Conduct a review of the business rates system, taking a closer look at the scope of plants of machinery and how it impacts investment decisions that are crucial to support productivity improvements in the UK. This should include digital infrastructure.

Step 2: Lead the way in making the UK a top-tier connected nation – through bold, cross-government action

Government has set a clear ambition for UK digital connectivity over the next decade, and now is the time to deliver on this ambition at pace. Government can send an international signal and use its unique policy-making power to drive seamless business and consumer connectivity.

4.   Commit to delivering the necessary funding for the 'outside in' programme to deliver full fibre across the UK, within the Comprehensive Spending Review

- Set out funding mechanisms and a delivery programme for the 'outside in' programme within Comprehensive Spending Review, which aims to deliver full fibre connectivity to the last 10% of premises. The government's Future Telecoms Infrastructure Review estimated this would cost at least £3-5bn. Ahead of the Comprehensive Spending Review, the CBI will be undertaking analysis on the full cost of this policy commitment.

- Ahead of the Comprehensive Spending Review, Ofcom and government should work together to deliver the regulatory framework set out in the Future Telecoms Infrastructure Review, committing to incentivising infrastructure competition. This must acknowledge that the UK is not one homogenous investment environment and delivering UK-wide business connectivity will require different solutions, economic models, and types of government support and regulatory intervention.

5. Make integrated infrastructure a national priority by fitting all new transport infrastructure with full fibre and 5G infrastructure

- Government should join up infrastructure development by setting up a cross-departmental policy Fibre and 5G Taskforce - to ensure that all government infrastructure projects are built with full fibre infrastructure (including ducts alongside rail and road). This will support wider fibre rollout across the UK and prepare the UK transport system for 5G. harmonisation of planning law.

- The taskforce should prioritise large-scale road and rail projects (e.g. HS2) with a view to all cities and major rail arteries in the next 5 years – building on lessons learnt within the 5G Testbeds and Trials Programme TransPennine trial.

- The group must include DfT, DCMS, BEIS, HMT and MHCLG, with input from the NIC.

6. Make the public sector a leading customer for digital infrastructure improvements

- Government must play a vital role as an 'anchor customer' to spearhead 5G and full fibre rollout at local and national level and demonstrate commitment to digital connectivity. By upgrading the digital infrastructure on public sector buildings and reusing public sector assets (including street lights, ducts and buildings) for digital infrastructure, local bodies can better deliver great connectivity for their locality as consumers and businesses will then be able to tap into the improved networks. Building on the Local Full Fibre Network Challenge Fund, the DCMS Barrier Busting Taskforce should support councils in using public assets for 5G deployment.

7. Commit to supporting mobile networks as much as fibre networks

- Government should match the focus it gives mobile and full fibre. The 2018 budget had limited focus on mobile connectivity and government policy must do more to address the importance of rural mobile for businesses, consumers and local growth.

- Government must support public funding to help address enduring rural mobile not-spots, barrier busting for future 5G rollout, and continue support for developing 5G use cases. This will enable the current market to continue to deliver against customer expectations.

Step 3: Set the framework for business adoption of digital connectivity

Working with business, government also has a key role in setting the framework for the long tail of low-productivity businesses to adopt existing and future digital connectivity. Stimulating demand in full fibre and 5G connectivity will supercharge UK productivity and boost prosperity – and is needed to support the business case for communication service providers to rollout the new infrastructure. The following actions must be taken as a priority to ensure UK businesses are well-placed to take up the opportunities of current and future digital infrastructure improvements.

8.   Support greater business adoption of available digital connectivity

- **Increase the pot of funding for the Gigabit Broadband Voucher Scheme and continue the DCMS campaign to support voucher uptake,** in collaboration with Local Economic Partnerships (LEPs), the Business Connectivity Forum and BEIS Business Basics Fund. Simultaneously, conduct a review of the barriers to voucher uptake of the existing scheme to inform future business support.

- **Extend the Business Basics Fund to support business adoption of 4G and Gigabit-capable broadband.** BEIS' £8m Business Basics Fund supports innovative ways of raising investment for the long tail of low productivity firms to adopt tried and tested technologies. Digital connectivity adoption is a key enabler of wider technology adoption therefore the scheme must expand to include digital connectivity investments and extend funding to meet this need. This should also help businesses get 5G-ready.

9.   **Help businesses prepare for 5G adoption by raising business awareness of 5G**

- **Share best practice** from the government-funded 5G Testbeds and Trials Programme. This should be done through UK5G, the Digital Catapult and Innovate UK.

- **Make the new 5G sector testbeds open to all businesses within the sector** so that they can test how they might adopt 5G within their business and through their supply chains – to be delivered through the Catapult Network.

- **Raise the profile of existing available testbeds** to encourage businesses in all sectors to access the facilities for example the Digital Catapult's Brighton 5G testbed and other 5G testbeds from Phase 1 of the 5G Testbeds and Trials Programme.

- **Better utilise Openreach digital connectivity postcode checker** – so consumers and businesses can check what digital connectivity options are available in their area. Local Economic Partnerships (LEPs) should also use this to support local businesses in preparing to upgrade.

Finally, what can businesses do today to take advantage of the digital connectivity currently on offer?

There are steps businesses can take to better take advantage of the UK's digital connectivity and get 5G-ready.

- **Build digital connectivity into your digitisation and technology adoption strategy:** Bring digital connectivity into wider digital adoption and technology transformation strategies. As a first step, firms should identify how their digital adoption plans affect their current and future business connectivity needs - and build this into their investment plans on digital technology and discussions at board level.

- **Take advantage of existing schemes:** SME firms should consider whether they could take advantage of government's £2500 Gigabit Broadband Voucher Scheme: https://gigabitvoucher.culture.gov.uk/

- **Look to your supply chain for best practice** on adopting digital connectivity improvements.

CHAPTER 4

Setting out the roadmap

To get this right, this CBI report sets out the **milestones for movement** on digital connectivity. This should be the basis of the government's implementation plan on digital connectivity, moving from vision to progressive and bold action.

3 MONTHS (2019)	1 YEAR (2020)	3 YEARS (2022)
• Fast-track consultations and legislation to mandate fibre in new build developments and access to tenant properties – by end of 2019 • Start implementation of 'outside in' approach to rural connectivity, drawing on £200m Autumn budget funding pilots • 5G Testbeds and Trials Programme to disseminate findings to wider business community • Extend funding for Gigabit Broadband Voucher Scheme	• Set up cross-department Fibre and 5G Taskforce • Key deployment barriers addressed (disseminate wayleaves agreements, conduct planning reform) • Set out plans for review of business rates system and potential exemptions for productivity-enhancing investments • Commit to the necessary funding needed for full fibre 'outside in' programme within Comprehensive Spending Review, based on forthcoming CBI economic analysis • Incorporate digital connectivity into Business Basics Fund and extend the programme • LEPs to make digital connectivity a key priority to support full fibre and 5G uptake	• Begin process to review UK broadband strategy (Future Telecoms Infrastructure Review)

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