

# FORGING OUR DIGITAL FUTURE WITH 5G: A STRATEGY FOR SCOTLAND





## FOREWORD

The technological revolution will be a significant opportunity for Scotland over the coming years. The rollout of 5G is the next wave and will potentially see huge social, economic and environmental benefits to the whole country.

While the UK's mobile network operators are already investing large sums in rolling out 5G, we must act collectively to ensure that all of Scotland – including rural areas – benefits from this revolution. The prize is a boost to our nation's fortunes, creating better, healthier and happier lives for everyone.

The Scottish Government's aspiration is for Scotland to be at the forefront of this revolution and, ultimately, to establish the whole country as a leading 5G digital nation.

5G is so much more than an upgrade of previous generations of mobile connectivity. It will enable new or enhanced connectivity in the fields of transport, artificial intelligence (AI), robotics and remote monitoring – the opportunities are endless. This enhanced connectivity will make us

more productive and efficient as a country and play a vital role in the transition to a zero-carbon economy and tackling the climate emergency, e.g. through reduced emissions.

5G will be transformational for businesses, public services and for individual citizens. It is suggested that enhanced 5G capability could reduce business start-up costs, stimulate exports and increase the use of cost-reducing technologies such as cloud computing. It could provide easier access to healthcare, education and online shopping for people, wherever they live in the country.

It is estimated that by enhancing 5G capability, Scotland has the potential to add £17 billion to GDP by 2035, create 160,000 new jobs and increase productivity by £1,600 per worker. 5G could play a part in creating 3,100 new businesses and a £3.3 billion growth in export volumes.

Significantly, 5G also has the potential to help sustain remote and rural areas, allowing all of Scotland's citizens and communities to embrace the technology and reap its benefits.

To make this happen, the Scottish Government is working with a range of organisations and interested parties to ensure the swift national deployment of 5G.

However, telecommunications in the UK is reserved to the UK Government and mobile network rollout is commercially led. We continue to press the UK Government to give us the powers and resources which would allow us to reap the significant benefits that we could see from enhanced 5G provision in Scotland. We cannot wait any longer, which is why we are driving ahead and setting out what action we, with the powers and resources we do have, can take to enhance digital connectivity. The Scottish Government is determined that Scotland will not be left behind. Indeed, we will continue to work with industry, the regulator and others in the public sector to make sure we are at the forefront of this revolution.

In this strategy we set out our commitment and steps to embracing the possibilities of 5G and ensuring that Scotland is able to seize the prize and become a 5G leader and a forward-looking digital nation.

**Paul Wheelhouse MSP**  
**Minister for Energy, Connectivity**  
**and the Islands**



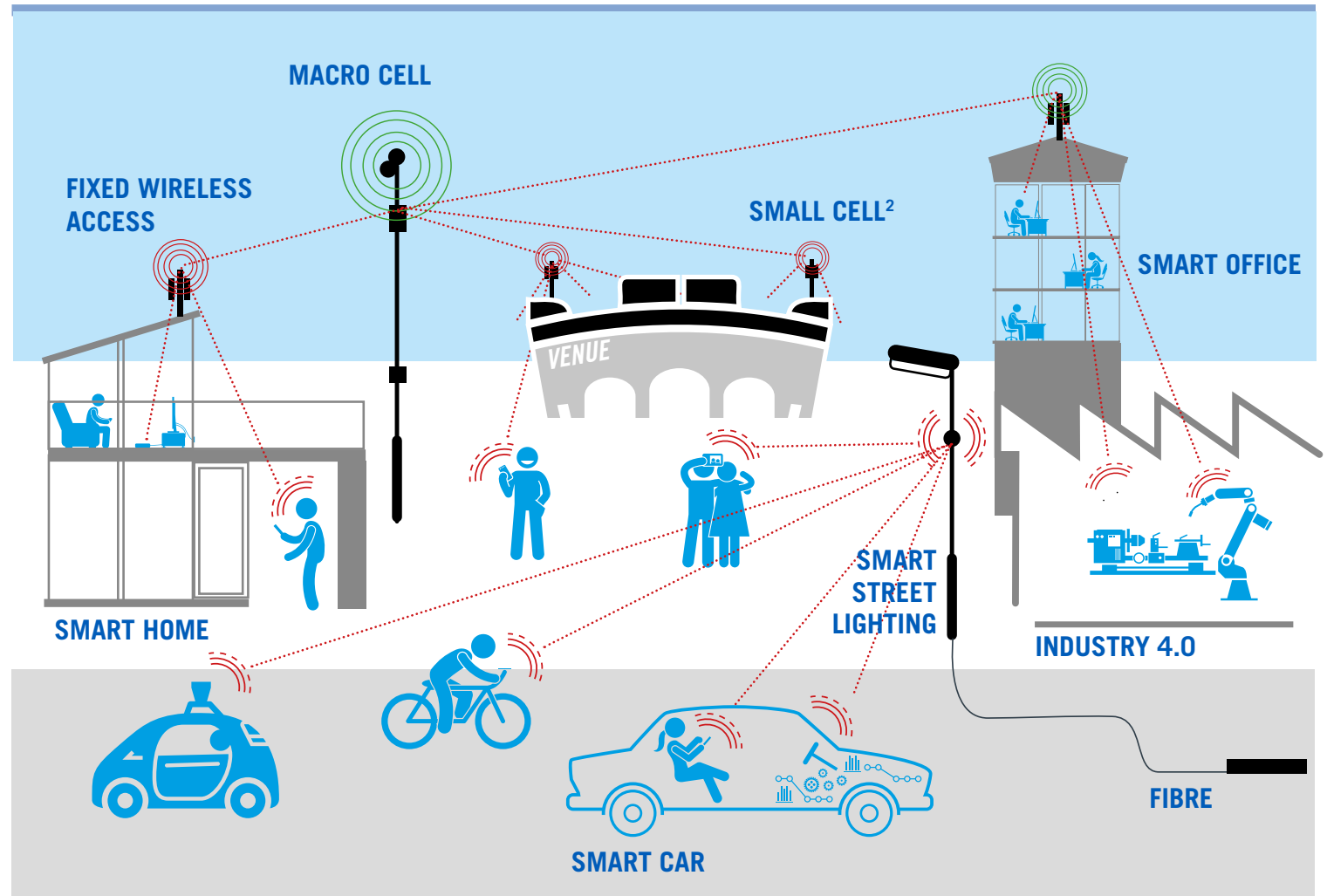
## 5G: THE BASICS

5G is a step up in the quality, capacity and flexibility of mobile wireless communications. 5G has the potential to offer greater reliability, much faster download and upload speeds, greater capacity to ease congestion and accommodate more connected devices or sensors. It also brings lower latency allowing near instant response with no time lag. All of this can enhance people's experience of technology and enable new ways of doing things.

But 5G is much more than just an enhanced version of the present 4G mobile broadband services. 5G will be central to the seamless delivery of high quality and reliable wireless connectivity in any urban or rural environment, in transit and on any mode of transport, including trains and planes.

Furthermore, 5G will have the ability to integrate with other wireless technologies, such as 4G, Wi-Fi and Internet of Things<sup>1</sup> (IoT) technologies.

FIGURE 1 (NOT TO SCALE)



1 The Internet of Things refers to the ever-growing network of physical objects that feature an IP address for internet connectivity, and the communication that occurs between these objects and other internet-enabled devices and systems.

2 Small cells are low-power, short-range mobile base stations covering a small geographical area or indoor/outdoor applications. Small cells have all the basic functionality of conventional base stations, are capable of handling high data rates, and are small in size (typically up to 30 cm by 30 cm with a depth of 15 cm, weighing up to 3kg). In 5G deployments, small cells can be mounted unobtrusively, on or inside buildings, or on exterior installations such as bus shelters or lamp posts.



## 5G: AN ENABLING TECHNOLOGY

Different technologies will be able to seamlessly interact on the move so that a user's device can decide which technology offers the best user experience. As shown in figure 1, this will depend on the user's device accessing the different modes of wireless connectivity throughout any journey.

The technical capability of 5G will satisfy the needs of a wide range of innovative so-called 'use cases' – in terms of extended bandwidth, reliable ultra-low latency, and/or a high density of connected devices, in combination with technologies such as cloud computing, IoT, Augmented Reality (AR) and Virtual Reality (VR) as well as advances in robotics and data analytics.

The Scottish Government has an aspiration for Scotland to be among the global leaders in IoT and the adoption of sensor technologies, which will help drive economic growth, transform public services and give citizens better and healthier lives. In collaboration with public and private sector partners, we are investing £2.8 million in infrastructure to create wider access to IoT and are taking forward activity to ensure our businesses, public sector and citizens understand why this technology is crucial to the way we work and live in the future.

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Wireless networks will transmit data between devices, to the cloud, and back to end-user devices. Cloud services are becoming more ubiquitous, allowing increasingly integrated data analytics and AI capabilities. 5G will enable data to be moved rapidly and enable more devices to be connected simultaneously. Together these technologies allow new use cases to be built on top of wireless connectivity and real-time data, from video analysis, to automated vehicles, robotic factories and drones. For the individual, 5G opens up immersive audio-visual applications which bring to life a raft of new professional and leisure activities.

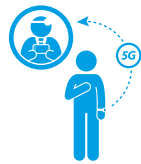
The Scottish Government will play an active role in developing the ethical frameworks and infrastructure to enable the technology to be used for the benefit of Scotland's citizens. Currently, the Edinburgh and South East Scotland City Region Deal contains significant Scottish and UK Government investment into data-driven innovation. 5G rollout in the region will benefit this activity.

Creative industries, including software, computer games, design, and animation, is one of the fastest growing sectors in Scotland. Here innovative businesses rely on seamless interaction between different technologies and instant communication across the globe. The value lies in an ability to connect and create new products and services using immersive technologies and data analytics.

Potential 5G use cases typically involve one or more of the following elements as shown in figure 2.



FIGURE 2



### REMOTE MONITORING

Networks of sensors and devices used to monitor business processes and operations and end-user usage in real time.

#### EXAMPLES

- Healthcare – patient monitoring through wearables and in-home sensors
- Agriculture and aquaculture – soil and water conditions, livestock tracking
- Public services – smart bins, smart parking

#### BENEFITS

- More efficient and accurate
- Removes geographic barriers
- Environmental benefits from reduced travel
- More frequent and detailed data collected



### IMMERSIVE CONTENT

Higher bandwidths and lower latency support high-fidelity content and lag-free two-way communications using AR and VR.

#### EXAMPLES

- Media and entertainment – cloud-based gaming, AR and VR multiplayer games
- Education – tailored, interactive training
- Tourism – immersive content on tourist attractions

#### BENEFITS

- New revenue opportunities
- Removes geographic barriers
- Improved user experience and engagement

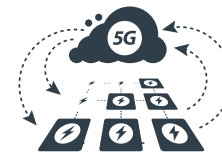


### REMOTE CONTROL AND AUTOMATION

Using real-time data, businesses can respond more quickly, by intervening manually or through automated processes.

- Healthcare – remote diagnosis, response and surgery
- Transport – traffic management, automated vehicles
- Manufacturing – automated production

- Efficiency and cost savings
- Environmental benefits from more efficient use of resources
- Increased safety by removing human error



### AI AND ML ANALYTICS

New uses of data using Artificial Intelligence/ Machine Learning tools.

- Public services – video analysis for crime detection, accident prevention
- Infrastructure – predictive maintenance by using data insights to pre-empt faults
- Agriculture – crop spraying using video analysis

- Efficiency and cost savings
- Improved safety
- New insights obtained from data





New use cases enabled by 5G will have profound implications for Scotland. With a low population density and approximately 330,000 residents living in remote rural areas, the potential benefits from remote service delivery will be particularly significant in Scotland. The benefits will be in terms of social care, healthcare, primary and higher education and employment training.

The capabilities of 5G could be applied in sectors where Scotland already has a leading edge, such as healthcare, transport, education, public service delivery, energy, agriculture and aquaculture. These potential use cases could transform the way services are delivered by driving national productivity, delivering efficiencies and improving the consistency and reliability of the user experience.

In the Deloitte study *Scotland's Digital Potential with Enhanced 4G and 5G Capability*<sup>3</sup>, potential use cases have been analysed in the context of Scotland's existing competitiveness and innovation.

The key industry groups combined account for more than a quarter of total employment in Scotland.

- > Energy, Quarrying and Utilities – A key component of this industry group is the oil and gas extraction industry, though the electricity sector also accounts for a relatively high share of employment.
- > Agriculture, Forestry and Fishing – Fishing and aquaculture are areas of strength for Scotland with farmed salmon the UK's largest food export, though agricultural activities also rank highly.
- > Public Administration – Across the spectrum of activities related to public services, the public sector is a particularly prominent employer in Scotland relative to the UK as a whole.
- > Health and Well-Being – This includes hospitals, medical research facilities and community health clinics which employ around 170,000 people in Scotland, as well as social work and care for the elderly.

Figure 3 summarises the opportunities in areas aligned with the key industry groups above. In addition, other industries where 5G could generate a transformative impact in Scotland are transport; media, entertainment and learning; tourism, advanced manufacturing and logistics.

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3 <https://www.scottishfuturestrust.org.uk/storage/uploads/deloittesfteconomicimpact4g5gfinalreportforpublication.pdf>



FIGURE 3

## THE 5G OPPORTUNITY FOR SCOTLAND

5G networks can benefit urban areas, in which initial deployments are likely to focus, but also rural and remote areas, where they could facilitate remote access to key services and contribute to the sustainability of the rural economy. Analysis suggests a number of key industries in Scotland that stand to benefit:



**Healthcare.** 5G use cases have the potential to drive efficiency and patient engagement, as well as inclusive access to treatment in Scotland’s rural and remote areas.

✓ Current initiatives in Scotland include Fit Homes<sup>4</sup>, using in-home sensors to monitor patient health, and use of IoT to monitor hospital beds and automate maintenance.



**Transport.** 5G connectivity along Scotland’s transport networks could support passenger productivity and a more integrated, user-friendly and seamless transport system.

✓ An autonomous bus trial from Fife to Edinburgh is planned, and Transport Scotland is currently exploring Mobility-as-a-Service<sup>5</sup> as a proof of concept.



**Education.** 5G could support engaging and tailored digital content. With adequate connectivity this could be accessed by students anywhere, any time.

✓ The e-Sgoil<sup>6</sup> programme brings tele-education to the Western Isles, though there are no current initiatives focusing on the role of 5G.



**Public services.** Added to the above, other public services in urban areas particularly can benefit from 5G in the context of “smart city” use cases.

✓ Initiatives in Glasgow include smart lighting and water management; other cities feature in the Smart Cities Scotland<sup>7</sup> programme.



**Agriculture and aquaculture.** New processes driven by data and connectivity could drive efficiency, contributing to the long-term sustainability of Scotland’s rural economy.

✓ 5G RuralFirst<sup>8</sup> trials include salmon health monitoring, autonomous tractors, soil analysis using drones and livestock monitoring through “connected cows”.



**Immersive content.** 5G can support immersive content using AR and VR. Scotland’s strong digital creative industries could drive innovation, including through immersive content in tourism, supporting Scotland’s rural and remote communities, or in education.

✓ The Portal AR<sup>9</sup> app, created collaboratively by Google, VisitScotland, SDI, Talent Scotland and Scotland.org provides immersive and educational content showcasing landmarks to users in any location.



**ENERGY AND RESOURCES.** 5G has the potential to drive efficiencies throughout the supply chain and support Scotland’s low-carbon objectives

✓ Public bodies in Scotland are exploring use cases such as smart lighting, smart heating and smart electric vehicle charging hubs.

4 <http://www.carbondynamic.com/fit-homes>

5 <https://maas-scotland.com/>

6 <http://www.e-sgoil.com/e-sgoil-english-home>

7 <https://www.scottishcities.org.uk/workstreams/smart-cities>

8 <https://www.5gruralfirst.org/>

9 <https://www.scotland.org/about-scotland/scotlands-stories/portal-ar>



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## MAXIMISING FUTURE GAINS FOR SCOTLAND

Recent initiatives exploring 5G use case in Scotland show promise, but are largely limited to small-scale trials and idiosyncratic applications at present. Several organisations are pursuing different initiatives in isolation, potentially leading to fragmented approaches. Against this backdrop, Scotland could benefit from:

- > Increased collaboration and knowledge-sharing across stakeholders, bringing together experience, resources and networks in order to identify key synergies and lessons learned;
- > Holistic thinking to consider the opportunity of seamless 5G connectivity for the benefit of entire communities, without restricting to individual sectors or use cases;
- > Development of longer-term planning, setting out roles, responsibilities and processes to convert successful proof-of-concept trials to large-scale commercial opportunities; and
- > Measure to increase awareness and understanding of 5G across stakeholders, including local authorities and SMEs, and to provide hands-on support as necessary.

Key to all use cases is the availability of seamless connectivity, with the underlying fibre infrastructure extended as far as possible. Appropriate commercial models will be necessary to facilitate this:

- > In urban areas, further exploration of commercial models could support cost effective network deployment that makes use of local authorities' existing physical infrastructure.
- > In rural areas, new approaches to infrastructure and spectrum sharing may need to be explored, as well as any innovative technical solutions that can lower costs, working to continue current public and industry initiatives to address rural coverage.





## 5G AS AN ENABLER – TRANSPORT

It is vital that our roads and motorways of the future are safe for the arrival of zero-carbon autonomous vehicles. Connectivity and cooperation are prerequisites to safe automation. Autonomous vehicles will require a smart and well-maintained road network.

Transport Scotland's Trunk Road and Motorway Network Future Intelligent Transport Systems (ITS) is already building a strategy for mission-critical communication between vehicles, infrastructure and other road users to ensure the safety of traffic and pedestrians.

Transport Scotland is seeking to ensure a coordinated approach for its ITS network and 5G rollout, including Connected and Autonomous Vehicles (CAVs), to ensure investment in digital infrastructure is future-proofed.

Future-ready infrastructure for CAVs is now being considered from both a user's perspective and to enable infrastructure such as ducting, signalling and communications. If the benefits of safety, accessibility and road space capacity of connected vehicles are to be delivered, then 5G networks and advanced traffic management systems, including ITS, must be well thought-out and developed.

The adoption of CAV technologies is expected to deliver substantial safety benefits and economic growth and is linked to Intelligent Mobility, using technology to enable a more efficient movement of people, services and goods. The Scottish Government's ambition for CAV will be aligned with Intelligent Mobility capabilities. Here, the Scottish Government has committed to investing up to £2 million to support Mobility-as-a-Service (MaaS) and also to help identify opportunities that bridge the CAV and Electric Vehicle sectors. Transport Scotland is developing a CAV Roadmap which explores the opportunities and highlights the interventions and initiatives required to unlock these.

Fully connected electric vehicles will revolutionise transport in Europe with a fundamental impact on telecommunications. As electric vehicle drivers turn on in-car systems to seek the real-time status and availability of ChargePlace Scotland<sup>10</sup> chargepoints, networks will expand and be required to share data between moving vehicles, homes, business and digital platforms.

The need for reliable telecommunications networks will be vital in ensuring households and businesses are able to seamlessly and confidently travel across the country. The rollout of 5G will play an essential role in supporting this transformation to a zero-carbon transport system.

<sup>10</sup> <https://chargeplacescotland.org/>



## 5G: A CATALYST FOR COLLABORATION

The Scottish Government is already providing leadership and developing policy using its devolved powers to underpin the infrastructure decisions which will support the commercial investment in 5G networks.

Our strategy is to build on existing relationships, skills and experience which have been established by academic, public sector and industry partners who are currently engaged in 5G-related initiatives across Scotland. Such initiatives are the catalyst for further cross-sector collaboration that will be required for 5G to be successfully deployed across Scotland and the wider UK over the coming years.

This collaboration by the telecoms industry, the regulator, governments and the wider public sector, will collectively support a multi-layered approach for the development and delivery of 5G in Scotland.

Security and resilience will be at the heart of our approach to 5G. Cyber resilience is a critical pillar of our digital ambition to ensure our citizens and businesses have trust and confidence in digital infrastructure, platforms and services.

## WHY SCOTLAND NEEDS A 5G STRATEGY

As a reserved issue, 5G policy and strategy was initiated by the UK Government's 5G strategy in March 2017<sup>11</sup> and updated in December 2017<sup>12</sup>, alongside a competitive challenge fund – the 5G Testbeds and Trials Programme<sup>13</sup>. In July 2018, the UK Government's ambitions were reaffirmed in its Future Telecoms Infrastructure Review<sup>14</sup> (FTIR), which set the goal of the UK being a world leader in 5G, making it a UK Government priority to promote investment and innovation with an aim for the majority of the population to have 5G by 2027.

### SECURITY AND RESILIENCE WILL BE AT THE HEART OF OUR APPROACH TO 5G.

11 <https://www.gov.uk/government/publications/next-generation-mobile-technologies-a-5g-strategy-for-the-uk>

12 <https://www.gov.uk/government/publications/next-generation-mobile-technologies-an-update-to-the-5g-strategy-for-the-uk>

13 <https://www.gov.uk/government/collections/5g-testbeds-and-trials-programme>

14 <https://www.gov.uk/government/publications/future-telecoms-infrastructure-review>

However, the FTIR is focused on the deployment of full fibre connectivity and the Scottish Government believes that there is now a requirement to show leadership at a national level by creating a supportive policy framework to facilitate the development and deployment of 5G to meet the 2027 ambition.

The Scottish Government believes a 'do-nothing' approach will most likely lead to a repeat of previous UK-wide deployments of digital infrastructure (mobile and broadband) where more populous urban areas are the focus of investment and rural areas are at the end of the queue. This is exacerbated by the current uncertainty of commercial business models which would underpin widespread 5G deployment. This will place rural communities at a continuing disadvantage when online service delivery is essential to drive improvements, efficiency and gains in productivity; alongside the societal impacts of this inequality.

But without umbrella 5G deployment across all of Scotland, the country will not reap the potential economic gains that 5G can deliver. As telecommunications is legislated for and regulated at a UK level, while mobile network rollout is commercially led, we believe that Scotland cannot wait for action at a UK level any longer. To avoid repetition of the unsatisfactory deployments of the past, we are clear that more needs to be done at a Scottish level – with appropriate leadership – to ensure that 5G is delivered for all of Scotland.

**THIS COLLABORATION BY THE TELECOMS INDUSTRY, THE REGULATOR, GOVERNMENTS AND THE WIDER PUBLIC SECTOR, WILL COLLECTIVELY SUPPORT A MULTI-LAYERED APPROACH FOR THE DEVELOPMENT AND DELIVERY OF 5G IN SCOTLAND.**



## OVERCOMING THE BARRIERS TO REALISING THE BENEFITS OF 5G

The potential benefits identified in the Deloitte study<sup>15</sup> will be delivered over a 15-year timescale. The study also points out that the benefits from digitalisation in some cases will be gradual and will require long-term commitments by policymakers and industry to address key challenges.

Firstly, the benefits will be reliant on the availability of adequate connectivity. Improving 4G coverage and performance, and achieving large-scale 5G deployments, will rely on key enablers including access to radio spectrum, the availability of underlying fibre infrastructure and the development of new commercial models for network deployment, and specific use cases.

Even with excellent connectivity, there is uncertainty about which use cases will have the most transformative impact. Further research and collaboration across government, industry and academia – building on current initiatives such as the 5G RuralFirst programme – will play an important role in

establishing use case feasibility and the likely costs and demand involved.

Finally, an accelerated rate of digital transformation may only be achievable by improving awareness and understanding of 5G and complementary technologies – and ensuring citizens and business have the skills to capitalise on them. There remains a lack of awareness and understanding about the potential of 5G, while there are also concerns about the commercial costs for the future. Some organisations – including small and medium-size enterprises (SMEs) and local government bodies – require assurances or risk falling behind the technological curve.

Here, the Scottish Government will play a pivotal role in helping Scotland capitalise on the 5G opportunities, so we can maximise the future economic, social and environmental benefits across Scotland.

<sup>15</sup> <https://www.scottishfuturestrust.org.uk/storage/uploads/deloittesfteconomicimpact4g5gfinalreportforpublication.pdf>

## THE IMPORTANCE OF 5G SECURITY AND RESILIENCE

The opportunities of 5G also come with potential risks and it is vital that these are managed effectively to ensure the reliability and integrity of Scotland's 5G networks.

The deployment of 5G is expected to increase security threats as a result of its broader, multi-level 'attack surface' which is significantly different and more open than 4G. The Department for Digital, Culture, Media and Sport's report<sup>16</sup> on 5G architecture and security identifies four requirements that 5G networks must meet:

1. **Cross-layer security.** A unified framework is needed to coordinate different security methods for each security layer, such as applications or IoT.
2. **End-to-end security.** There should be a secure connection for the communication paths between the user and the core network. The distributed nature of 5G networks makes this challenging.

<sup>16</sup> [https://uk5g.org/media/uploads/resource\\_files/5G\\_Architecture\\_and\\_Security\\_technical\\_report\\_-\\_04Dec18.pdf](https://uk5g.org/media/uploads/resource_files/5G_Architecture_and_Security_technical_report_-_04Dec18.pdf)

3. **Cross-domain security is vital.** 5G networks create a massive number of novel use cases with unique requirements. Since the vertical market will only grow in order to fulfil those novel use cases, the report calls for cooperation between those in the 5G system to build integrated security solutions which go across domains.
4. **Secure-by-design.** As the network changes and evolves, security must be built into the design during development.

The Scottish Government believes that building appropriate levels of security into 5G networks from the outset is fundamental. We will continue to work closely with the UK National Cyber Security Centre and other key partners to ensure that cyber threats to Scotland's economy and society, including those from hostile states, are identified and managed effectively.



## HOW 5G CAN BE SUPPORTED

Scotland's Cyber Resilience Strategy<sup>17</sup> and Action Plans on Cyber Resilience<sup>18</sup> set out work to develop an awareness and culture of cyber resilience across our public, private and third sectors. This includes a commitment to ensuring that cyber resilience is embedded in any centrally funded technology innovation activity and that security is designed in from the outset of key infrastructure projects, so that Scotland develops a deserved reputation for being a cyber resilient digital nation.

We want to ensure that Scotland reaps the benefits of being a cyber resilient nation within a 5G landscape. We will ensure our work on 5G is integrated with cyber security research with the aim of promoting world leading innovation in the cyber security sector.

While the UK's reserved 5G policy is expected to evolve, the continued availability of UK-wide funding streams for 5G is also crucial. The Scottish Government welcomes the UK Government's investment in 5G to date, but it is clear that there has been insufficient investment in Scotland. The UK Government must make further funding available to Scotland – and future funding allocations must fully take into account the challenges to widespread rollout which exist in Scotland due to our country's geography. We would expect to be fully consulted on future funding priorities.

The FTIR contains the phrase 'outside in' as regards the UK Government's aim of supporting deployment to the most rural and remote areas as well as urban areas, but it is not clear how this will manifest itself. A key component must be the rural dimension and we would welcome the opportunity to work with the UK Government and Ofcom to consider how investment can be best targeted at areas of Scotland where the private sector will not deploy to on a commercial basis.

For example, the Scottish Government is keen to explore models which could help reduce the industry's deployment and operational costs – to facilitate network deployment in rural and remote areas. This could potentially use existing public sector assets and/or deployments arising from the Scottish Government's Scottish 4G Infill programme<sup>19</sup> as a testbed in which to target public investment in rural areas to reduce the 5G "notspots" in the future. In parallel, proof of concept 5G projects need to be supported by collaboratively working with industry and academia to attract early-stage investment in 5G networks and infrastructure in Scotland.

There also needs to be a more proactive regulatory regime, including access to radio spectrum for 5G. The Scottish Government is clear that proposed obligations for rural coverage in the forthcoming 700 MHz spectrum auctions should be set at a much higher level than

currently proposed for Scotland<sup>20</sup> – and that the proposed national level of coverage should be applied equally across all UK nations. At the same time, we will continue to engage with the UK Government and Ofcom and urge them to have a significantly lower expectation on receipts from these auctions, recognising that this additional coverage has to be paid for from somewhere. Auction conditions could also require network operators to turn their attention to rural areas earlier in deployment programmes, as has been implemented in Germany.

17 <https://www.gov.scot/publications/safe-secure-prosperous-cyber-resilience-strategy-scotland/>

18 <https://www.gov.scot/policies/cyber-resilience/>

19 <https://www.gov.scot/policies/digital/broadband-and-mobile/>

20 <https://blogs.gov.scot/scotlands-economy/2019/03/18/mobile-coverage-must-reflect-far-higher-level-of-ambition/>



## SHORT-TERM FOCUS TO LAY THE FOUNDATIONS FOR 5G

The Scottish Government is clear that action must be taken now and accelerated over the next few years to achieve our objective of making Scotland a world leader in 5G.

We also recognise that not all the frameworks underpinning current commercial infrastructure may be conducive to the widespread deployment of a technology which requires ubiquitous coverage to achieve real transformative social and economic benefits of 5G.

Achieving widespread 5G deployment will involve the coordination of industry and the public sector – and a clear understanding by all parties of how policy can drive change. This also extends to understanding how targeted public-sector support can potentially drive different and wider benefits. While industry is expected to lead the transition to 5G this is still being played out. The rollout of 5G networks is currently in its infancy and the public sector needs to engage with the private sector to not only deploy 5G infrastructure but deliver transformative benefit using the technology.

The Scottish Government wants to achieve a more consolidated and coordinated approach. Several inter-dependent themes have emerged to ensure Scotland builds on the existing momentum with key partners; these are captured below.

### Leading by example:

- > Preparing local authorities to support 5G deployment through being '5G ready' in terms of asset management, planning regulations, procurement, commercial and cyber resilience.
- > Demonstrating 5G leadership in Scotland, incorporating academia, public sector and industry to focus on 5G activity (research and development, demonstrations and funding).
- > Setting up multiple 5G infrastructure networks in different geographical and population locations which can be used to test use cases and demonstrate their application, with a view to being rolled out across Scotland.
- > Explicitly designing security considerations from the outset of all 5G innovation and use case projects.

### Creating the optimum conditions for private investment:

- > Continue the deployment and development of backbone infrastructure through existing initiatives, such as the Digital Scotland Superfast Broadband<sup>21</sup> and R100<sup>22</sup> programmes for fibre, the Scottish 4G Infill programme for 4G, and stimulate private investment into global connectivity and data centres through the Host in Scotland<sup>23</sup> initiative.
- > Coordinate with the transport sector and look for opportunities to share fibre and install fibre during development.
- > Develop commercial approaches on procurement and finance that look to engage private sector investment and skills while retaining public sector influence and control that is suitable to the 5G environment and the market.

<sup>21</sup> <https://www.scotlandsuperfast.com/>

<sup>22</sup> <https://www.gov.scot/policies/digital/broadband-and-mobile/>

<sup>23</sup> <https://hostinScotland.com/>

- > Ensure the Scottish policy environment supports 5G rollout: breaking down barriers to investment – including facilitating the use of publicly-owned assets for telecoms deployment and encouraging infrastructure sharing.

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**ACHIEVING WIDESPREAD 5G DEPLOYMENT WILL INVOLVE THE COORDINATION OF INDUSTRY AND THE PUBLIC SECTOR – AND A CLEAR UNDERSTANDING BY ALL PARTIES OF HOW POLICY CAN DRIVE CHANGE.**

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## CURRENT 5G SUPPORTING ACTIVITIES BY THE SCOTTISH GOVERNMENT

The Scottish Government and Scottish Futures Trust have been leading the development and demonstration of 4G interventions while monitoring emerging 5G activity across Scotland. We have been proactively involved in initiatives that demonstrate a commitment to support the emerging 5G landscape across Scotland.

These initiatives have encompassed:

### Infrastructure Sharing

- > Working with city councils, such as Dundee and Glasgow, to assess how their existing and future assets such as street furniture, buildings and rooftops could be utilised to collaboratively support the deployment of 5G in urban areas with a view to generating best practice and informing approaches elsewhere in Scotland.
- > Exploration with Transport Scotland the development, demonstration and testing of new innovative models based on collaborative working and infrastructure sharing along the roadside or trackside to create a digital transport corridor.

### IoT Scotland

- > Co-funding an IoT Scotland<sup>24</sup> network with Scottish Enterprise, Highland & Islands Enterprise, and Boston Networks that will cover Glasgow, Inverness, Edinburgh, Aberdeen, Dundee, Perth, and Stirling, with the aim of expanding it throughout Scotland. The main aim is to enable companies to innovate, providing low-cost access to next-generation connectivity, helping organisations develop new solutions and devices with global export potential.
- > Partnering with CENSIS<sup>25</sup> (Centre for Sensor and Imaging Systems) to enable engagement in key IoT markets to develop new use cases and services for IoT technologies in Scotland. The aim is to increase efficiency/productivity in key markets and drive growth for the Scottish economy by demonstrating their benefits to both private and public sector in Scotland.

<sup>24</sup> <https://iot-scotland.net/>

<sup>25</sup> <https://censis.org.uk/>

### Enabling IoT for the Scottish Wide Area Network (SWAN)

SWAN<sup>26</sup> is a dedicated network and applications solution for the public sector. Established by the Scottish Government with public sector partners, SWAN serves over 50 bodies. Following successful trials CENSIS and Capita (the SWAN supplier), IoT infrastructure is now being deployed across NHS partners, local authorities and other public bodies.

### Infrastructure intervention

- > Extending rural 4G coverage to selected 4G 'not spots' via the Scottish Government's £25 million Scotland 4G Infill programme by working with the mobile industry to deploy future-proofed mast infrastructure that is connected to fibre offering open access for all mobile network operators.
- > The Scottish Government's R100 programme which will drive delivery of superfast broadband services to 100% of premises in Scotland.

<sup>26</sup> <https://www.scottishwan.com/>

### Scottish Government supporting policies

- > We have extended permitted development rights to provide a more effective mast upgrade process for existing and new mast infrastructure. Permitted development rights grant general planning permission in certain circumstances defined by legislation, and so remove the need to make applications for permission.
- > We are currently offering non-domestic rates relief for new mobile mast sites deployed via the Scottish 4G Infill Programme.
- > We have introduced 10-year non-domestic rates relief for fibre that is deployed both commercially and via existing and future interventions. This will support the aspiration of pushing the rollout of fibre in rural areas to ensure that as much of rural Scotland as possible has access to the fibre required to underpin future 5G infrastructure and services.





## NEW SCOTTISH GOVERNMENT ACTIVITY TO SUPPORT 5G

The Scottish Government will continue to support the various existing 5G-related projects focusing on the unique challenges that Scotland's geography and dispersed population add to 5G infrastructure deployment.

Coupled with the work that city councils are undertaking to understand the 5G requirements for deployment, the Scottish Government has recognised the need to capture this work by fostering a collaborative approach to drive future 5G initiatives across Scotland. We will take forward the following short-to-medium term actions.

### 1. DEVELOPMENT OF 5G USE AND USER CASES

> Working with key partners, we will fund the development of a number of use case projects where 5G offers operational benefits or are dealing with challenges which require a deeper understanding of what role 5G can play in overcoming problems.

These will be focused on a number of themes including:

> **Rural connectivity:** building on the 5G RuralFirst activity on Orkney, we will work with industry and other bodies including Ofcom to address 5G solutions for the rural digital divide issue building on the activity on Orkney, we will work with industry and other bodies including Ofcom to explore 5G solutions for this digital divide.

> **Remote Healthcare:** secure, robust and reliable communications across rural areas will mean more effective remote health interventions, reducing the requirement to travel for specialist treatment. We will develop rural use cases for enabling technology, such as pop-up health networks, but also consider the operational demands of the hospital covering a large, geographically dispersed and often remote and very rural catchment area.

> **Agri-tech:** 5G has the potential to transform rural life and industry by streamlining agriculture, aquaculture and food production. This includes the delivery of high-speed connections to support the control of autonomous tractors, drones for real-time identification/classification of soil conditions, real-time remote veterinarian diagnostics support, and proactive management of animal health. We will continue the work of the 5G RuralFirst project with partners including the Agri-Epi Centre and explore opportunities to collaborate with other research institutes in Scotland working in this field.

> **Tourism:** 5G can bring innovative ways of enhancing tourism to rural Scotland through, for example, the delivery of dynamic content to the visitor experience with knock-on benefits to the local area and the economy, or provision of connectivity to tourists in very remote locations via both private 5G and authenticated Wi-Fi networks.

> **Design and Development of Urban 5G Networks:** We will work with partners to develop the tools and services required for planning and development of digital infrastructure, such as 3D mapping, building infrastructure management technology and radio propagation modelling for urban environments. Specifically, the opportunity for both mobile network operator networks, alongside private 5G networks, roaming networks or shared spectrum networks will be considered.

> **Energy Management:** As we move from centralised energy systems, which relied on large power stations, to a hybrid model that combines centralisation with increasing adoption of distributed energy resources, the need for fast and efficient smart grid communications technologies and IoT energy monitoring facilities is essential. Solar photo-voltaic, wind, hydro, tidal and wave can all be generated in remote locations in Scotland. 5G will unlock this further by allowing the dynamic management of renewable and distributed generation, battery storage, distribution and consumption.



> **Precision Medicine:** Security of personal health data is critical, requiring new approaches which are compatible with 5G networks. Data-intensive clinical interventions require fast and secure infrastructure. 5G will support the delivery of improved personalised healthcare and well-being through collecting, analysing and aggregating data across a spectrum of connected devices, sensors and wearables.

> **Machine to Machine (M2M):** IoT connectivity is a key component of so-called Industry 4.0, which is already improving the flexibility, versatility, usability and efficiency of manufacturing. Integrating 5G with IoT, Big Data, AR/VR, AI and robotics will accelerate the pace of change. The fundamental change to the architecture, operation and management of networks offered by 5G can bring transformational benefits, in particular with the establishment of private LTE/5G networks.

> In our development of 5G use cases, we will ensure an explicit

focus on security and resilience. This will include consideration of how technology could be misused and how cyber attack and other threats can be managed effectively throughout the whole lifecycle of a 5G project.

## 2. ACCESS TO PUBLIC SECTOR ASSETS

- > We will develop rental guidance to facilitate the use of public sector assets, including land and buildings, for the siting of 4G, 5G and other telecoms infrastructure; initially focused on those owned by the Scottish Government.
- > We will develop the case for the creation of an asset register and coordinate its development at local level and national level. Due to the required proliferation of small cells to create a 5G ecosystem, local authorities will be targeted by mobile network operators to offer their assets for use. An asset register would allow operators to examine the location and condition of local authority assets.

## 3. DIGITALISATION OF TRANSPORT SCOTLAND ASSETS

> Working with Transport Scotland, we will collaborate with industry to understand how sustainable 5G transport corridors can be created. We will pilot our approach by utilising an existing trunk road to demonstrate:

- > The sharing of roadside assets to build a collaborative platform with industry to develop innovative ways to deploy 5G-ready infrastructure. This will enable industry, academia and the public sector to demonstrate and secure the collective benefits for road and rail users, local communities and businesses.
- > Retrofitting 5G-ready infrastructure using existing ducts, buildings, street furniture and power by filling the gaps to create an end-to-end stretch of trunk road that can be used to support the above vision.

## 4. PLANNING POLICY

- > We will progress the fourth National Planning Framework (NPF4). The Planning Bill is repositioning the framework by combining it with Scottish Planning Policy and enhancing its status as a part of the statutory development plan which will give it greater influence in individual planning decisions. Existing Scottish planning policy recognises electronic communications infrastructure as an essential component of economic growth, and that the planning system should support development which helps deliver world-class digital connectivity. NPF4 will bring an opportunity to set a clear policy framework for how planning can support appropriate rollout of the infrastructure needed to improve connectivity across all of Scotland and enshrine this as a core policy for planning decisions.
- > We will undertake a wide review of permitted development rights. We last extended permitted development rights for telecommunications infrastructure in 2017 and a



recent sustainability appraisal commissioned from independent consultants suggested the option of taking this further in advance of a consultation on our detailed proposals.

- > We will publish revised guidance which will replace the existing Planning Advice Note 62: Radio Telecommunications<sup>27</sup>. This will provide useful information and advice to planning authorities, the telecommunications industry and the public to enhance understanding of the need for additional communications infrastructure, both to serve the growth in customer demand and in response to changing technical requirements. The guidance will advise on good practice in appropriate site selection and design, illustrating how equipment can be sensitively installed to minimise physical impact.

## 5. SUPPORTING LOCAL AUTHORITIES

- > We will develop a local authority infrastructure mapping portal, initially on a pilot basis. In order to begin implementing a 5G strategy at local level, local authorities and public sector bodies will need to know whether they will benefit from existing Scottish Government projects and the quality of the user experience. We will identify with public bodies and the private sector what the essential information is needed to make the early and long-term implementation decisions and will develop tools for accessing this information.
- > We will develop a 5G procurement toolkit. State Aid and the revised Electronic Communications Code have created perceived ‘barriers’ to deployment but these can be overcome and procurements initiated if there is a consistent understanding of the legislation. We aim to provide this to allow bodies to initiate discussions about procurement projects. We will also disseminate lessons learned from existing projects and look to produce guidance and assistance to local bodies.

- > We will develop best practice guidance to get 5G ready. Many local authorities are already putting in place initiatives to ensure their internal processes and governance is ready to engage with the private sector on 5G deployment. This can range from streamlining processes to creating a digital champion. 5G Scotland would share these approaches with other local authorities and work with industry to identify what else can be done.

## 6. EXPLORING NEUTRAL HOST SOLUTIONS FOR 5G

- > As part of the Scottish 4G Infill programme, we will explore the development of a sustainable neutral host model that can be tested in partnership with industry to reduce the cost of rural 4G and 5G deployment. The objective is to influence how the mobile network operators view the programme’s proposed locations in terms of future proofing their infrastructure.

- > Working with partners, we will explore how a neutral host model could accelerate private sector investment in 5G infrastructure in a city/urban environment.
- > We will also explore how a neutral host model could be developed to create a 5G platform which demonstrates how aggregation of various rural 5G use case demands could collectively contribute to a sustainable business model for 5G deployment in rural areas – and address current coverage not spots.

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**THE GUIDANCE WILL ADVISE ON GOOD PRACTICE IN APPROPRIATE SITE SELECTION AND DESIGN, ILLUSTRATING HOW EQUIPMENT CAN BE SENSITIVELY INSTALLED TO MINIMISE PHYSICAL IMPACT.**

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<sup>27</sup> <https://www2.gov.scot/Publications/2001/09/pan62/pan62->



FIGURE 4

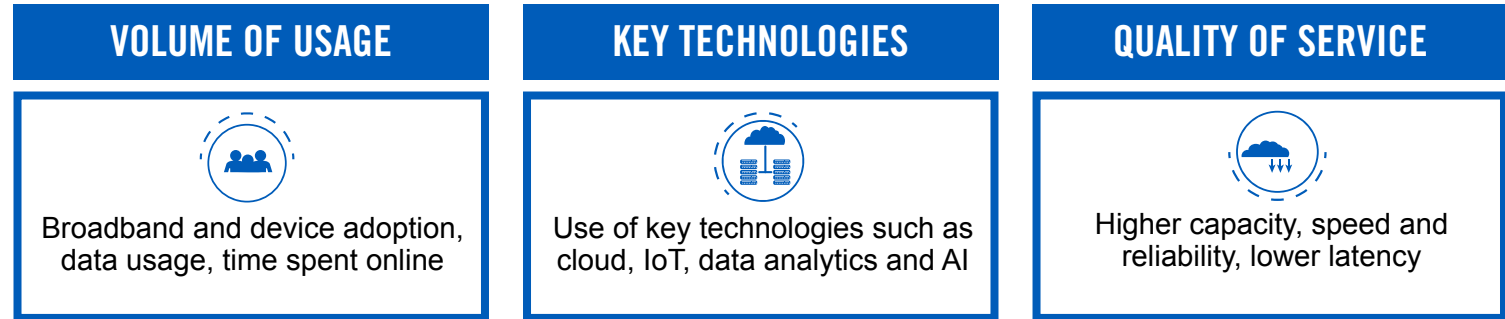
**ANNEX A**

**ECONOMIC IMPACT ANALYSIS**

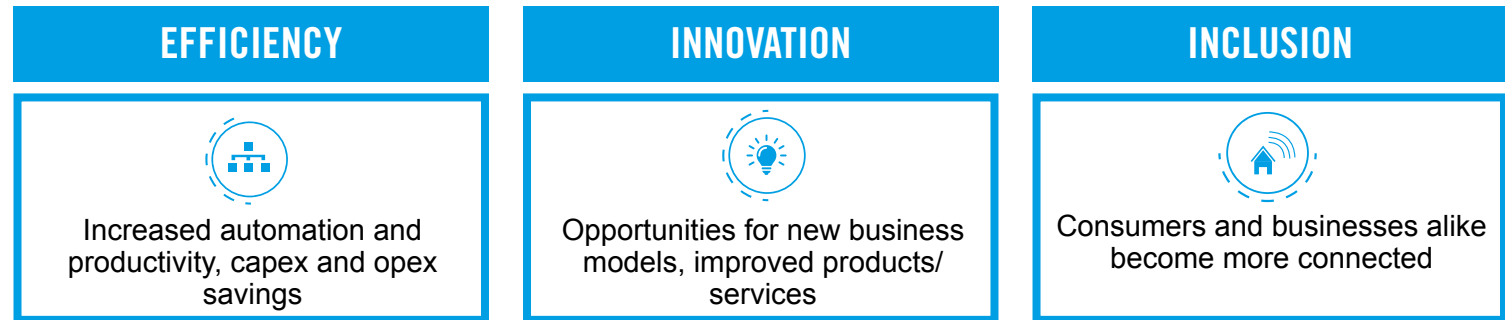
The Scottish Futures Trust, on behalf of the Scottish Government, commissioned Deloitte to undertake an assessment of the potential economic impact of enhanced digital capability in Scotland relating to wireless and mobile technologies such as 4G and 5G. This report: *Scotland's Digital Potential with Enhanced 4G and 5G Capability*<sup>28</sup>; being published alongside this strategy, provides estimates of the economic impact for Scotland under different future scenarios. To support the analysis and build upon existing understanding, potential 5G use cases are identified in areas that could strengthen Scotland's competitiveness and contribute to current areas of innovation.

Several scenarios have been used to demonstrate the breadth of the potential impact to the economy, to society, to communities and to remote and rural communities. A transformative scenario looks ahead to 2035 and focuses on the role of wireless capability within a wider

**DRIVERS OF DIGITALISATION**



**BENEFITS FOR USERS**



**MACROECONOMIC OUTCOMES**



<sup>28</sup> <https://www.scottishfuturestrust.org.uk/storage/uploads/scotlandsdigitalpotential.pdf>



digital ecosystem.

As such, it captures improved outcomes in areas that support the potential of wireless connectivity, such as fixed broadband connectivity, IoT, cloud computing and data analytics.

This transformative scenario models a world in which pervasive, high-performance 5G connectivity is at the heart of a rapid acceleration in digital transformation. Flexible and reliable networks will enable a plethora of innovative use cases. In this scenario, the so-called digital divide, between the haves and have-nots, is reduced to a minimum and businesses are able to leverage new technologies to generate efficiencies and revenue growth.

This scenario shows incrementally improved outcomes compared with a base case scenario which represents how Scotland might evolve if there is an absence of any actions to improve 4G and 5G capabilities. The estimated economic impact associated with this transformative scenario is based on the framework summarised in figure 4.

The Deloitte report's<sup>29</sup> key findings are summarised as follows:

#### **GDP impacts**

- > Scotland could add £17 billion to GDP by 2035 which would represent a return to Scotland's historical long-run trend growth rate of 2%, from the GDP growth rate of 1.5% otherwise assumed in the base case.
- > In absolute terms, the GDP impacts are far larger in urban and semi-urban areas than in the rest of Scotland but are proportionately larger for rural and remote rural areas of Scotland.
- > However, this simply reflects that urban and semi-urban areas account for the largest proportion of economic output.
- > In fact, it is rural and remote areas that see the largest proportionate impact in the most positive scenarios, as enhancements in 4G and 5G capability narrow the digital divide by allowing consumers and businesses to access services regardless of the

location. It will allow citizens in remote areas to remain economically active, maximising opportunities for remote and flexible working, preventing rural depopulation.

- > The estimated GDP impacts are the product of two factors: higher employment due to increased economic activity and higher labour productivity due to more efficient ways of working.
- > Around 160,000 net new jobs would be created by 2035 in the Scottish economy relative to the base case, representing an increase of around 6% compared to the projected level of employment in 2035.
- > Productivity per worker is estimated to increase by a weighted average of £1,600 per year by 2035.

#### **A MORE DIGITALISED ECONOMY**

- > Enhanced wireless capability will lead to a more digitalised society, creating demand and opportunities for new business models, products and services across various sectors.

- > This may reduce business start-up costs, increase the chances of scaling-up innovative enterprises, and stimulate exports, with the adoption of flexible working practices and cost-reducing technologies, such as cloud computing supported by enhanced 4G and 5G capability.
- > Estimated increase in the creation of 3,100 new businesses and a £3.3 billion growth in export volumes, both of which are indicative of increased global competitiveness for Scotland.
- > Transformative use cases could support a more inclusive and greener society:
  - > In addition to economic impacts, enhanced wireless capabilities could also generate positive social impacts.
  - > Greater levels of remote and flexible working could potentially enhance national levels of productivity, reducing travel and associate carbon emissions, delivering sustainable rural growth.

<sup>29</sup> <https://www.scottishfuturestrust.org.uk/storage/uploads/scotlandsdigitalpotential.pdf>





## SOCIAL IMPACTS

> In summary, new use cases can increase digital participation, leading to greater social inclusion and wider access to key services and opportunities, while specific use cases in sectors such as education, healthcare, transport and energy can enable the delivery of high-quality public services while minimising negative impacts on the environment.

### INCLUSION

- ✓ Greater inclusion, equality and participation, including for vulnerable groups
- ✓ Wider access to more flexible employment
- ✓ Easier access to healthcare, education and online shopping
- ✓ New use cases in agriculture, aquaculture and tourism support rural communities

### ENVIRONMENT

- ✓ Reduced consumption from smart heating and automation
- ✓ Automated processes reduce use of energy and resources
- ✓ Reduced emissions from smarter transport ecosystem
- ✓ Smart energy grids facilitate integration of renewables
- ✓ 5G enables higher energy efficiency

### DIGITAL PUBLIC SERVICES

- ✓ Preventative healthcare with greater patient engagement
- ✓ Immersive and interactive educational content
- ✓ Efficient and reliable transport ecosystem with a high degree of multimodal integration
- ✓ Public safety enhanced by new uses of technology to respond in emergency or disaster situations





## ANNEX B

### SCOTTISH 5G CASE STUDIES

#### CASE STUDY 1 – 5G RURALFIRST: 5G ON ORKNEY

The UK's most ambitious testbed for rural 5G connectivity, demonstrating the potential and identifying practical use cases that will benefit businesses and communities, is 5G RuralFirst. With funding from the Department for Digital, Culture, Media and Sport's 5G Testbeds and Trials Programme, it is a co-innovation project led by Cisco and the University of Strathclyde, alongside partners including the BBC, the Agri-EPI Centre, Orkney Islands Council, and Scottish Futures Trust, as well as local SMEs from Scotland, such as Cloudnet IT Solutions Ltd from Orkney.

Since its inception in June 2018, 5G RuralFirst has deployed tests and trials on Orkney to showcase the potential of 5G in rural environments. It is focused on the problem of patchy and unreliable connectivity in rural areas and builds on Scottish Government-funded trials by the University of Strathclyde and Cloudnet IT Solutions of TV Whitespace technology, delivering digital connectivity on Orkney. Orkney was chosen because of its challenging landscape, making it the perfect place to trial connectivity in one of Scotland's most rural and isolated areas. Orkney also has a track record for cutting-edge technology trials and is well set up for the needs of the project.

#### 5G RuralFirst's trials and use cases on Orkney include:

**Sustainable Tourism** – Despite having only 20,000 inhabitants, Orkney welcomed nearly 340,000 visitors in 2017. By deploying connectivity to tour buses operating in Orkney in summer 2019, the trial will enable visitors on the buses to access dynamic content, helping to manage tourist density during peak times, and deliver an enhanced passenger experience.

**Radio broadcasting**– Testing on the island of Stronsay has explored the potential of 5G to broadcast BBC radio nationwide in a more efficient manner.

Future plans aim to explore the potential for user-generated content creation over 5G. The BBC will only turn off terrestrial TV when alternatives can cover 99% of the population, so diverting their broadcast costs to 5G mobile network operators could be a valuable contributor to the 5G rural business case.

**Legionella monitoring** – IoT enabled remote monitoring of water in a local school has provided a cost effective solution for health and safety compliance.

**Salmon Farming** – 5G-connected sensors enable developing fish stocks in salmon tanks and sea-water pens to be monitored to ensure healthy development of farmed salmon and trout.

**Connected Wind Farm** – IoT sensors enable high value equipment monitoring integrity, weather and wind speed. This aims to help identify potentially dangerous weather conditions, and enable appropriate action to be taken, minimising impact. This could lead to reduced insurance premiums, helping to improve the efficiency of wind farms.

5G RuralFirst is committed to demonstrating the economic and social value of connectivity, and the potential of 5G to connect rural areas. By exploring new business models for 5G, such as spectrum sharing, 5G RuralFirst aims to show how deploying and operating 5G services in rural areas could be commercially viable and attractive.

It also aims to demonstrate how policy decisions around spectrum sharing and 5G legislation could support independent organisations and improve rural connectivity for the broader benefit of the UK. Beyond this project, there is a desire for collaboration to share the lessons and recommendations of 5G RuralFirst with a view to affecting lasting change in how we approach and deliver connectivity to our rural areas.



## **CASE STUDY 2 – CIVTECH BETA CHALLENGE – SCOTTISH ENVIRONMENT PROTECTION AGENCY**

The Scottish Environment Protection Agency (SEPA) set CivTech<sup>30</sup> a challenge to develop an effective hyper-local early warning system to give people time to prepare for flooding.

While Scotland has effective flood warning systems in place for cities and many towns, SEPA wanted to reach more and smaller communities. Inherent in the challenge was how to overcome the limits of network connectivity in the smaller and more remote vulnerable communities.

One of CivTech's start-up companies, RiverTrack, developed a solution which is a robust, low-maintenance river level monitoring and alarm system, which incorporates low-power network connectivity, cost effective components and innovative design. Acoustic sensors measure river level changes and feed information to display units placed in homes, community centres, pubs, schools and businesses – in fact anywhere needed.

Independent of any communication infrastructure (which can fail in adverse conditions) the displays also act as boosters to create a resilient mesh across wide areas, meaning no-one need be without early warning.

The system was tested with extremely successful results in late 2016. Two full-scale community pilots were carried out successfully in Moniaive in Dumfries and Galloway and Menstrie in Clackmannanshire in 2017. RiverTrack is now manufacturing the device with a scheduled product rollout working in coordination with the Scottish Flood Forum and Resilience Networks.

## **CASE STUDY 3 – IOPTASSETS**

Glasgow-based iOptAssets works with managers of large property portfolios across the UK, helping them monitor the environment within each and every one of their properties. Clients range from commercial property owners to managers of public sector housing stock. To do so, iOptAssets is currently using Low Powered Wide Area Networking technology (LPWAN), where sensors provide small amounts of data and only have to be switched on for short periods every day. As a result, some sensors might run for 5-10 years on a single battery.

For many clients, this is likely to be enough to generate great value, however, iOptAssets believes that in the future, clients will increasingly demand more complex information, possibly exceeding what LPWAN technologies can provide. As Scotland's 5G capacity grows, through commercial deployment and through the use of public sector assets, it is likely 5G will play an increasingly important role as a high capacity and low latency carrier of data.

30 <https://civtech.atlassian.net>



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#### **CASE STUDY 4 – DUNDEE WATERFRONT**

The Scottish Government and Scottish Futures Trust are supporting Dundee City Council's procurement of an ultra-fast Wi-Fi network that will serve as a 5G testbed. This is part of an overall £63.8 million Growth Accelerator for the ambitious Dundee Waterfront development.

Public Wi-Fi will be the first technology platform to be deployed within the Waterfront area and will be underpinned by fibre utilising Dundee City Council's assets such as street furniture, ducting and power in parallel with access to Abertay University's telecoms room.

Dundee City Council is seeking a 5G partner that can demonstrate how the Council's assets can be used to develop a testbed. The partner will be expected to work closely with the Council to develop and implement the Council's 5G aspirations by leveraging industry and external financial relationships to improve the city's connectivity to 2026. Key to the success will be cross-sector collaboration to demonstrate and test technology, commercial approaches and use cases. The Council will assess each initiative before committing how to demonstrate and commercialise them outside the Waterfront area.



## ANNEX C

### SCOTTISH GOVERNMENT DIGITAL STRATEGIES AND ACTION PLANS

*Forging Our Digital Future With 5G: A Strategy For Scotland* is aligned with the Scottish Government's overarching digital strategy: *Realising Scotland's Full Potential in a Digital World* which is about ensuring our nation continues to prosper in an increasingly connected and competitive world. The following table sets out the Scottish Government's current digital-related strategies and action plans.

DOCUMENT	LINK(S)
Realising Scotland's Full Potential in a Digital World: A Digital Strategy for Scotland (2017)	<a href="#">Link to PDF</a>
Safe, Secure and Prosperous: A Cyber Resilience Strategy for Scotland (2015)	<a href="#">Link to PDF</a>
Enhancing Learning and Teaching Through The Use of Digital Technology: A Digital Learning and Teaching Strategy for Scotland (2016)	<a href="#">Link to PDF (Strategy)</a> <a href="#">Link to PDF (Summary)</a>
Scotland's Digital Health and Care Strategy (2018)	<a href="#">Link to PDF</a>
The Digital Strategy for Justice in Scotland (2014)	<a href="#">Link to PDF</a>
Digital Participation: A National Framework for Local Action (2014)	<a href="#">Link to PDF</a>
STEM Education and Training Strategy for Scotland (2017)	<a href="#">Link to PDF</a>
Tourism Scotland 2020: A Strategy For Leadership and Growth (2012, with 2018 update)	<a href="#">Link to PDF (Strategy)</a> <a href="#">Link to PDF (March 2018 Review)</a>
Open Data Strategy (2015)	<a href="#">Link to PDF (Strategy)</a> <a href="#">Link to PDF (Resource Pack)</a>
Data Hosting and Data Centre Strategy for the Scottish Public Sector (2014)	<a href="#">Link to PDF</a>
Scotland's Labour Market Strategy (2016)	<a href="#">Link to PDF</a>
Scotland Can Do: an Innovation Action Plan for Scotland (2017)	<a href="#">Link to PDF</a>
A Manufacturing Future for Scotland (2016)	<a href="#">Link to PDF</a>
Mobile Action Plan (2016)	<a href="#">Link to PDF</a>
National Action Plan on Internet Safety for Children and Young People (2017)	<a href="#">Link to PDF</a>



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