vodafone

Digital Ambition 2030

A WPI Strategy report for Vodafone UK

June 2022

Together we can

Contents

About WPI Strategy

WPI Strategy is one of the UK's leading political communications consultancies, with a track record of delivering high impact public affairs campaigns. We offer senior strategic counsel and work extensively with our sister company, WPI Economics, to ensure that campaigns are underpinned by evidence-based content.

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About Vodafone

Vodafone is a technology communications company that connects people, businesses and devices to help our customers benefit from digital innovation. Our services span mobile, fixed line connections, home and office broadband, and the Internet of Things (IoT).

We have a strong track record as a tech pioneer, making the UK's first mobile phone call, sending the first text message, and making the UK's first live holographic call using 5G in 2018. We were also the first to start carrying live 5G traffic from a site in Salford, Greater Manchester. We have 5G in 100 locations in the UK and 240 across Germany, Spain, Italy and Ireland.

Our 4G network coverage currently reaches more than 99% of the UK population. And in October 2020, Vodafone was named Network Provider of the Year by readers of leading technology advice website, Trusted Reviews.

Today, Vodafone serves more than 18 million mobile and fixed-line customers in the UK. To help deliver Gigabit UK, our full-fibre broadband roll-out programme now covers 15 UK towns and cities through partnerships with CityFibre and Openreach.

For more information about Vodafone UK, please visit: **www.vodafone.co.uk**

Foreword

The enormous benefits of full 5G are clear. Developing high capacity, standalone infrastructure promises to be a gamechanger for our transport network, for industrial settings such as smart factories, and for public services such as hospitals. What is less clear at present is whether the UK will get to feel the full benefits of the next generation of mobile technology in the near future.

There are plenty of reasons to be optimistic about what 5G Standalone (5G SA) could mean for the UK in years to come. With an investment-friendly environment, the prize for the whole of the country is undoubtedly huge. But the less uplifting reality is that we are not quite there yet. As our report makes clear, the current regulatory and policy environment is simply not going to work for many of our smaller cities and towns.

If the UK is to seize the opportunities offered by 5G SA then decision-makers in Westminster and Whitehall cannot afford to brush aside the findings of this report. The cost of failing to make the UK attractive as a place for investment in future 5G technology is considerable. Our research shows that the difference between an attractive and an unattractive investment environment is worth as much as £7bn a year to the UK economy by 2030.

Ministers advocating the 'levelling up' agenda should also be interested to see that most of the losses resulting from an unattractive investment environment are from outside of London and other major cities. The biggest cities, which have the biggest populations and are most commercially attractive to investors, previously saw the fastest 4G roll-out and are now well-positioned to attract investment in 5G. Yet for many smaller cities and medium-sized towns in every region and nation of the UK, except London, it is a very different story.

In total, our report identifies 58 local authority areas that would see a high or very high benefit from a good investment environment for 5G. From this, we can see how smaller cities and towns up and down the country would be the big winners from getting 5G investment right. Conversely, the same places would fall further behind if investment continues to be limited to major cities, inflicting significant and lasting damage on the Government's 'levelling up' agenda.

Of course, it is not too late to ensure that 5G investment works for the whole of the UK. With significant investment across all parts of the country, we can still create an investment-friendly environment that enables all of us to benefit from the next generation of mobile technology. The Government's starting point should be to publish an updated 5G strategy which sets out specific ambitions and tactics for the roll-out of full 5G networks. This should mirror the approach that was taken to the roll-out of full-fibre broadband, with financial and legislative support to plug the gaps in semi-urban and rural areas.

Government should also use its procuring power to create market demand in 5G-related services while the UK's communications regulator has a key role to play in ensuring that the UK leaves all doors open in the quest to become a more attractive setting for investment in future 5G technology.

As the world wakes up the full extent of the opportunities offered by full 5G, the UK cannot afford to sleepwalk into a scenario in which we miss out on the economic benefits. Countries like South Korea are emerging as global leaders in 5G roll-out, with high levels of take-up by citizens and businesses.

In the years ahead, the UK could also make 5G work for all of our citizens and businesses. But to get there, we need a course correction. On the present trajectory, the risk is that only our biggest cities will feel the benefits of full 5G, while many smaller cities and towns from Bath to Barnsley get left behind.

Ahmed Essam, CEO, Vodafone UK

Introduction

5G promises not only faster speeds and higher capacity than people's existing 4G connections, but completely new applications and use cases which were simply unthinkable with earlier generations of mobile technology. From hospitals to highways, from factories to farms, from gaming to the grid, 5G – and in particular full 5G – opens up new possibilities which can benefit all of us.

The UK Government has announced, in its Levelling Up White Paper, that its ambition is for the majority of the population to have access to a 5G signal by 2027,[1] although this is not a commitment about full 5G. While it is right to have an ambition of this kind, and to go beyond it with full 5G as well as non-standalone, ambitions need to be backed up by action if they are to be delivered. Both non-standalone and full 5G rollout will only happen quickly if mobile operators invest in it – which depends on their confidence in a return on that investment, and therefore on the nature of the investment environment in which they make their decisions. And as it stands, rollout of both technologies can only happen in areas of the country where it makes commercial sense to invest – in the case of full 5G, in major cities – creating a risk that areas which are seen as less commercially attractive could be left behind.

This report looks at the difference creating the right investment environment could make to the speed and geographical spread of full 5G rollout and the ability of consumers, businesses and public services to start to use 5G themselves and see its benefits. It shows that while some parts of the country – London and our major city centres – are likely to be seen as safe bets for full 5G investment and therefore reap the benefits of new infrastructure quickly, other areas will only be attractive targets for investment if the right policies are in place, and are at risk of losing out if they are not.

In fact, our new analysis shows that the difference between a good investment environment for full 5G and a poor one is worth as much as £2.6 billion per year by 2025 and £7 billion per year by 2030 in terms of economic output. And this difference is not felt equally across the country, but sees smaller cities and medium-sized towns losing out in every region and nation of the UK except London: exactly the places the Government wants its Levelling Up strategy to help. This report shows in detail where the winners from getting the investment environment right are – and where the losers are from getting it wrong.

The good news is that we know what getting it right looks like. We can learn from countries like South Korea, which has become a global leader in 5G rollout and take-up by its citizens and businesses. There, a clear vision from government, and a policy framework to enable that vision to be realised, has created an environment that fosters investment and innovation. And we can make sure that a similarly investor-friendly framework is created here in the UK as we have seen with the Gigabit programme for broadband, so that we unblock barriers to investment, roll out full 5G as widely and quickly as possible, and enable 5G to be a driver of levelling up in every part of the country.

Chapter 1: The potential of 5G

5G is the next generation of mobile technology. It follows on from 3G, which enabled the launch of smartphones which could do more than simply allow voice calls and text messages, and 4G, which allows much faster connectivity and the ability to stream films and music without a wired connection. As with previous step changes in mobile technology, part of what it offers is greater capacity and speed. Its high capacity means that millions of devices can be connected simultaneously in a small area. Its low latency means that the delay between a device being instructed to perform an action and that action being carried out can be reduced so far that it is indistinguishable from taking place in real time.

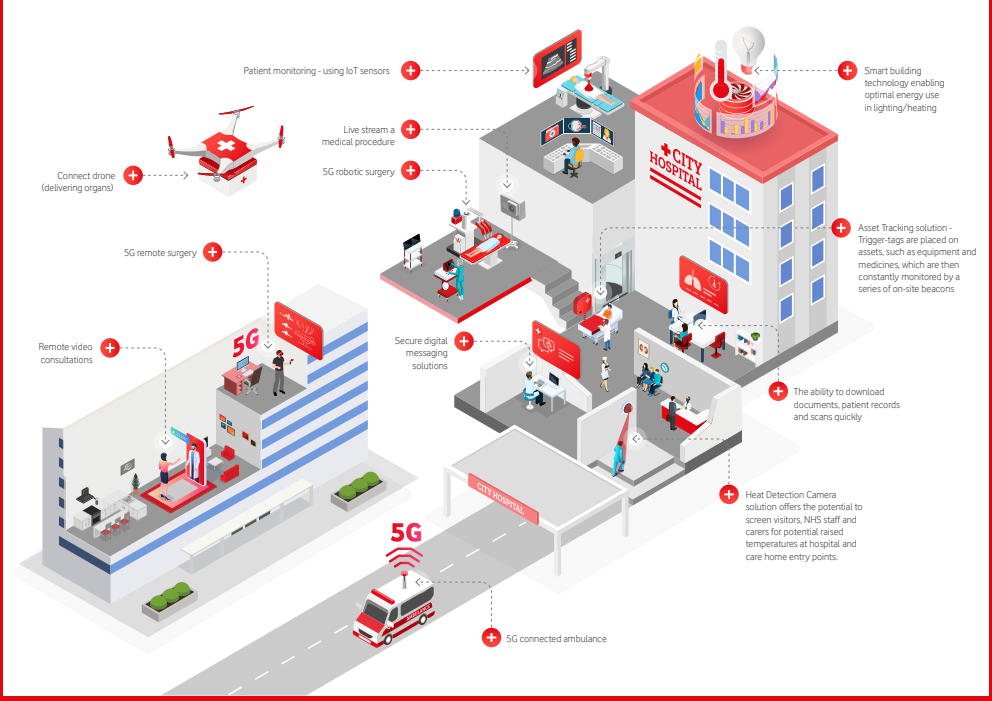
That will bring real improvements to consumers' experience, with 5G-enabled smartphones which are even faster than the ones they have today, even in crowded places like stadiums or stations, allowing gamers to play online with friends around the world with no perceptible delays, supporting the most realistic and immersive Virtual Reality experiences yet seen. But most of the biggest benefits of 5G will be seen not by individuals but by businesses, industry, agriculture, transport, government and public services – ushering in, in conjunction with internet of things (IoT) technology, what some have described as "the fourth industrial revolution". Several of the most exciting potential use cases for 5G and IoT are described later in this chapter.

For these to be fully realised, we will need the rollout of full 5G: that is to say, standalone 5G rather than the non-standalone hybrid 5G that we are seeing in the initial 5G rollout. Non-standalone overlays 5G equipment on existing 4G infrastructure, which offers significant improvements on what was previously available and allows the delivery of much higher-speed connectivity to consumers with 5G-enabled devices, but is not what is required for some of the industrial, business-facing and public service use cases full 5G will enable. In principle, the Government's ambition of over half the population having access to a 5G signal by 2027 could be fully met through non-standalone 5G. But while this would bring considerable benefits to consumers in terms of faster connections, it would not allow many of the most exciting potential use cases for 5G, which are not possible with existing networks, to be implemented. And it would not provide most of the economic benefits associated with full 5G which are discussed and quantified later in this report.

Full 5G uses new network architecture, designed for the 5G era, to deliver fast, high-quality connections with ultra-reliable, ultra-low-latency communication. It provides capability for end-to-end "network slicing" which uses dedicated portions of the network to be tailored to the needs of specific customers or industries, with shared infrastructure but customised virtual networks with different characteristics operating simultaneously and serving different users. And this is what allows 5G to be revolutionary, not just evolutionary, with brand new applications which do not simply build on what is already possible with existing 4G networks, but open up possibilities which have never existed before. According to a recent survey by Make UK, 57% of manufacturers across the English regions want the Government to prioritise improving digital connectivity, including full 5G coverage for businesses not just households.[2]

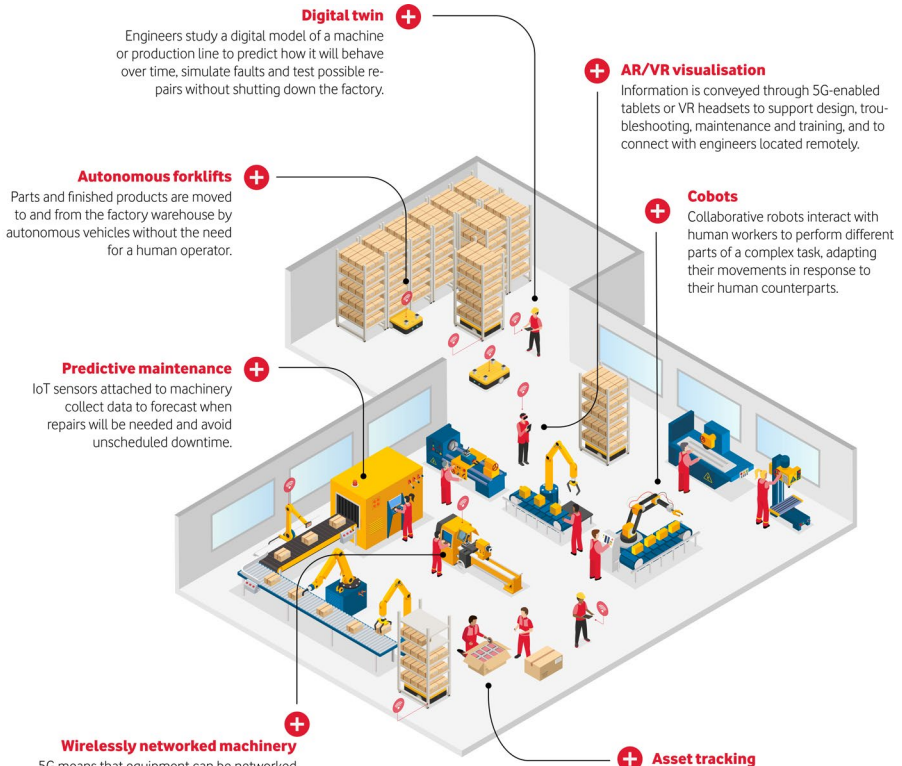
Healthcare

The introduction of full 5G and IoT technology in healthcare promises huge benefits to both patients and staff. In the 5G-connected hospital of the future, surgeons will be able to provide remote expert guidance on surgery through Augmented Reality (AR) without needing to be in the same operating theatre – or even the same country. The same technology can be used to carry out medical training remotely. The massively increased speed and capacity of full 5G compared to 4G means that very large files, such as MRI scans, can easily be shared securely for review between clinicians in real time, enabling more patients to be moved along the care pathway more quickly. 5G allows drones to be used to transport vital medical supplies including organs for transport, medical equipment and drugs, more quickly and cheaply than by courier. And 5G-connected ambulances can link paramedics working with an emergency patient in transit with a hospital clinician using high-resolution video and tools that share the patient's medical records as well as live clinical data such as heart rate. Clinicians can examine the patient remotely, assess symptoms, perform initial diagnosis and prescribe urgent treatment that the paramedics can carry out before the patient even arrives at the hospital.



Manufacturing

In manufacturing, full 5G is what makes "smart factories" possible. Full 5G's high capacity and speed means that it can be used to transfer large quantities of data from lots of IoT-connected devices simultaneously and in real time, enabling better and faster decision making, facilitating machine learning and allowing processes to be adapted to maximise productivity. Full 5G can allow real-time monitoring of critical safety data such as heat, vibration, sound levels or gas to facilitate predictive maintenance, modelling and forecasting when repairs will be needed and avoiding costly unscheduled downtime. Collaborative robots, or "cobots", can work alongside human workers, interacting with them and reacting and adapting to them in real time to perform different parts of a complex task. Workers in 5G-connected smart factories can benefit from Augmented Reality (AR) and Virtual Reality (VR) providing them with information, instructions, annotations in the form of digital overlays via tablets or smart glasses, or immersive 3D digital models and simulations via headsets. The high capacity and low latency of 5G allows real time simulations, without nausea-inducing lag. This can also be used in training, in design and in connecting the factory floor with engineers who are based in a completely different location.



Transport

5G will change the face of transport, both in the vehicles we use and in the management of transportation systems and logistics. Autonomous vehicles, including driverless cars, will rely on 5G connectivity to enable rapid decision-making and response to changing road conditions and other road users – indeed, allowing reaction times faster than humans are capable of, raising the prospect that they are not only as safe as cars with human drivers, but even safer. Vodafone's 5G network is already enabling the first testing of autonomous vehicles on UK roads. 5G also allows more effective route planning, taking congestion and obstacles such as accidents into account, and better public transport management to track passenger demand and avoid empty or overloaded vehicles. And IoT devices combined with 5G enable remote monitoring, tracking and tracing of freight across supply chains, allowing the logistics industry to increase its efficiency.

Energy

5G can allow energy and utilities companies to better monitor and understand energy use, allowing them to adjust the production and distribution of electricity, or to adjust power consumption as efficiently as possible, reducing overall levels of demand. 5G-enabled smart grids can perform this monitoring and analysis, and respond dynamically to rapidly changing patterns of demand and use, remotely and in real time. They can reduce the impact of power outages and make the grid more resilient and secure, by isolating outages and automatically rerouting electricity before large-scale blackouts can develop. The energy industry can also use 5G to enable predictive maintenance, and consumers can benefit from the next generation of 5G smart meters to manage their own energy use in the most cost-efficient way. And 5G-connected smart buildings can improve facilities management, reducing both emissions and energy bills, by automatically adjusting lighting, heating, ventilation and air conditioning based on how rooms are used by employees.

Smart cities

Smart cities apply technology to improve many different aspects of urban living including traffic and public transport, utilities, waste management, emergency services, crime prevention, healthcare, air quality and many more. A smart city can reroute traffic around congestion, automatically schedule repairs for failed streetlights or bridges, and intelligently manage energy use and pollution. Smart cities are made possible by the collection and analysis of vast quantities of real-time data through 5G and IoT technology. 5G's network slicing capability means that many more devices can be connected simultaneously, vastly increasing the quantity of data that can be captured at once and the speed and reliability with which it can be transmitted, analysed and used, with benefits to local government, businesses and citizens.

Chapter 2: Speed matters

The importance of full 5G to businesses and public services is only going to increase over time. But, as we saw with the UK's full fibre rollout, the time it takes for the technology to become available makes a big difference to economic growth and productivity. The progress of rollout will affect how early the exciting new use cases described in the previous chapter will be able to be put into effect – as well as affecting how much of the country can take advantage of them. And that, in turn, will make a difference to how far and how fast the UK can benefit from the economic growth catalysed by full 5G and its new opportunities.

Our 2020 report, Levelling Up: How 5G can boost productivity across the UK, looked at the economic benefits to the UK of the productivity gains associated with businesses moving from 4G to 5G. It found that in the five years to 2025, cumulative benefits to UK output stand at more than £38 billion, and for the five years to 2030, they stand at more than £120 billion.[3]

That analysis was based on a central estimate of the speed of 5G rollout: in fact this will vary depending on how favourable the investment environment is. How much could it vary, and what difference will that make to the economic impact of 5G on the UK as a whole?

To answer that question, WPI Economics modelled a baseline case in which the rollout of standalone, or full, 5G broadly matches the rollout profile of the 4G network in the UK, and in which each local authority in the UK is assigned to one of three categories of roll out: "high", "average" and "low", corresponding to the group of local authorities that are statistically meaningfully higher or lower than the average 4G rollout coverage from 2017. As the map at Figure 1 shows, the highest rollout speed category – shown as dark red – is dominated by the UK's main cities, with some individual cities clearly visible as small dark red patches as well as concentrations of dark red around Greater London, Greater Manchester, the West Midlands conurbation including Birmingham and its surrounding towns, West and South Yorkshire and the East Midlands. These represent the UK's main population centres, and the most commercially attractive areas for investment.

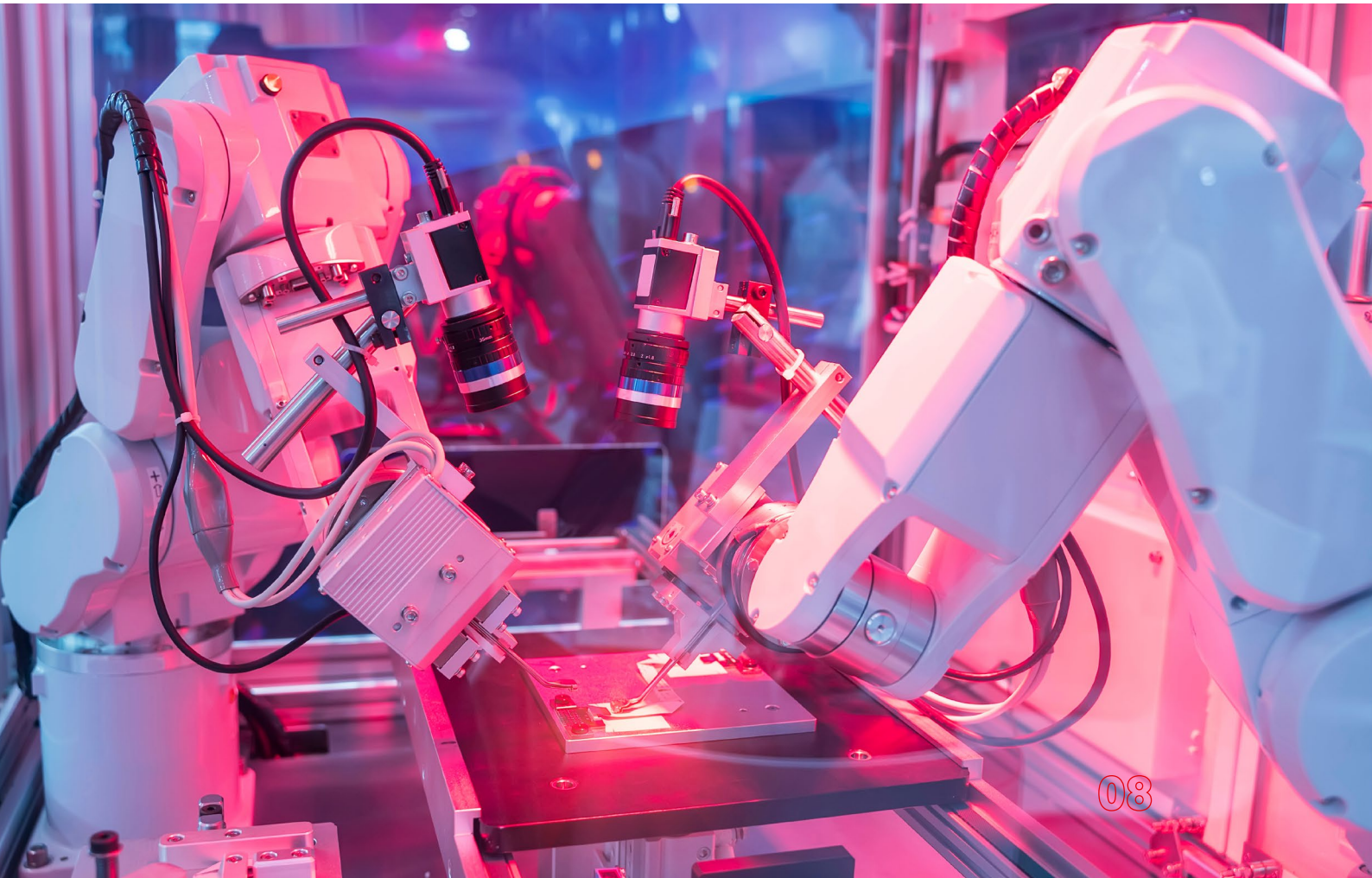
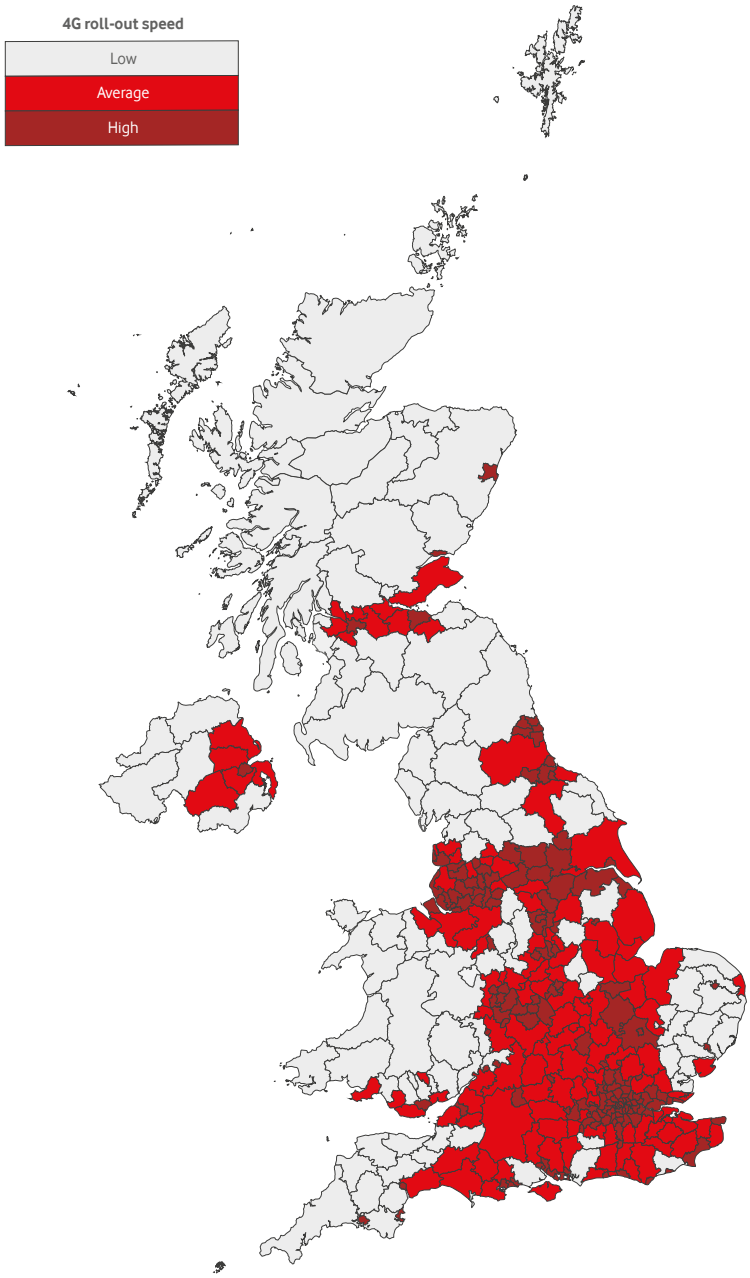


Figure 1: 4G rollout speed, by local authority



We then modelled three possible investment environments: a **moderate investment environment**, in which rollout in each of the categories of local authorities will be as it was in the baseline 4G case; a **poor investment environment**, in which rollout in the "high" and "low" areas remains the same as under the baseline (high in the most commercially attractive "high" areas and low in the least commercially attractive "low" areas, and with coverage assumed to be lower in "average" areas than under 4G); and a **good investment environment**, in which rollout in the "high" and "low" areas remains the same and rollout and coverage in the "average" rollout areas increases compared to the 4G baseline. The moderate investment environment scenario reflects the assumptions made in our 2020 Levelling Up report.

In the poor investment environment, coverage in "average" areas is the same as the average of the "low" areas in the baseline 4G scenario – the equivalent of a 52% slower roll out in these areas. In the good investment environment, coverage in "average" areas is the same as the average of the "high" areas in the baseline 4G scenario – the equivalent of a 32% faster roll out in these areas.

We then estimated the potential economic contribution of 5G in 2025 and 2030, drawing on existing analysis of the productivity and economic growth benefits of full 5G and various use cases.

Taking the moderate investment environment as a benchmark, we were able to show how much the UK as a whole, and individual regions within the UK, would lose or gain under the poor and good investment environments. The differences, which are very significant, are shown in Table 1. They are not distributed equally around the UK. By 2030, under a poor investment environment, the East Midlands loses £590 million per year compared to the moderate investment environment, the North West loses £460 million per year, the South West loses £495 million per year and the South East loses almost £1.4 billion per year.

Table 1: Difference from economic impact of "moderate" investment environment for full 5G

	Bad case Impact (£ million)		Good case Impact (£ million)	
	2025	2030	2025	2030
North East	-35	-100	29	83
Yorkshire and the Humber	-107	-69	17	48
North West	-162	-459	83	234
West Midlands	-76	-216	41	116
East Midlands	-208	-588	110	311
East of England	-169	-479	80	227
London	0	0	0	0
South East	-487	-1,376	280	791
South West	-176	-496	151	427
Scotland	-124	-351	69	195
Wales	-66	-187	60	169
Northern Ireland	-32	-90	13	36
UK	**-1,642**	**-4,411**	**933**	**1,500**

Source: WPI Economics

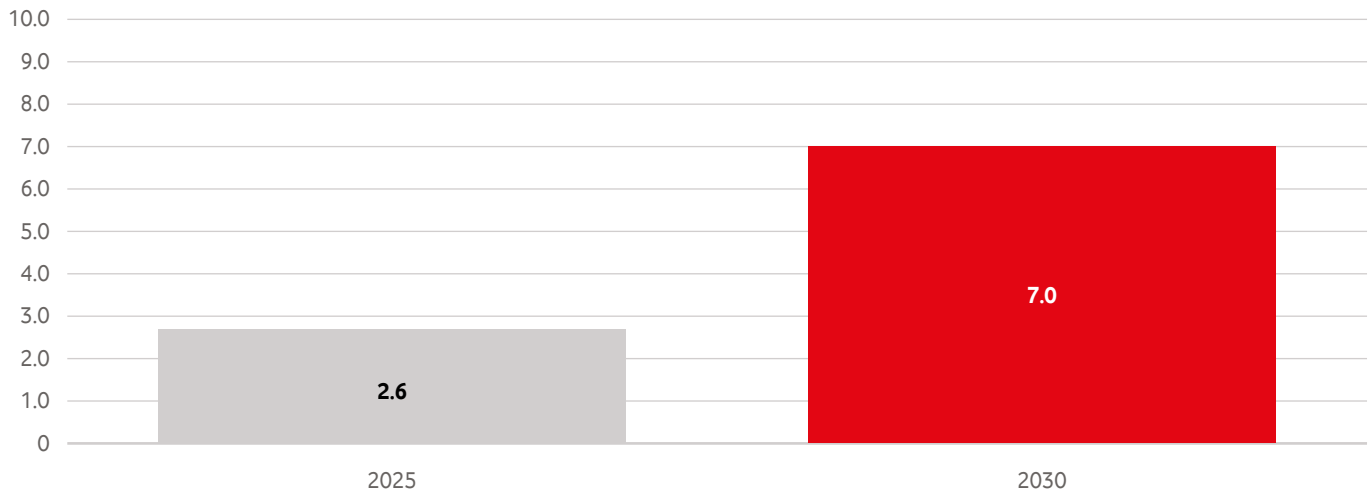
London fares equally well under the poor, moderate and good investment environments. This is significant: the reason is that as the most attractive region of the country in which to invest, London is likely to see the same level of investment regardless of the overall environment. The same is broadly true of other major cities, but London is the only city which makes up an entire region in its own right.

This means that the benefits of moving from a less favourable to a more favourable investment environment for full 5G will be felt almost entirely outside London, and largely outside the UK's major cities. To put it another way, those places that

stand to lose the most from a poor investment environment, and gain most from a good one, are some of those most in need of levelling up.

Across the UK, the poor investment environment delivers a loss of over £1.6 billion per year by 2025 and over £4.4 billion a year by 2030, compared to the moderate investment environment. By contrast, the good investment environment delivers almost an additional £1 billion per year by 2025 and over £2.6 billion per year by 2030, compared to the moderate investment environment. As Figure 2 shows, the difference between the poor and good investment environments amounts to £7 billion per year by 2030: an economic benefit well worth aiming for.

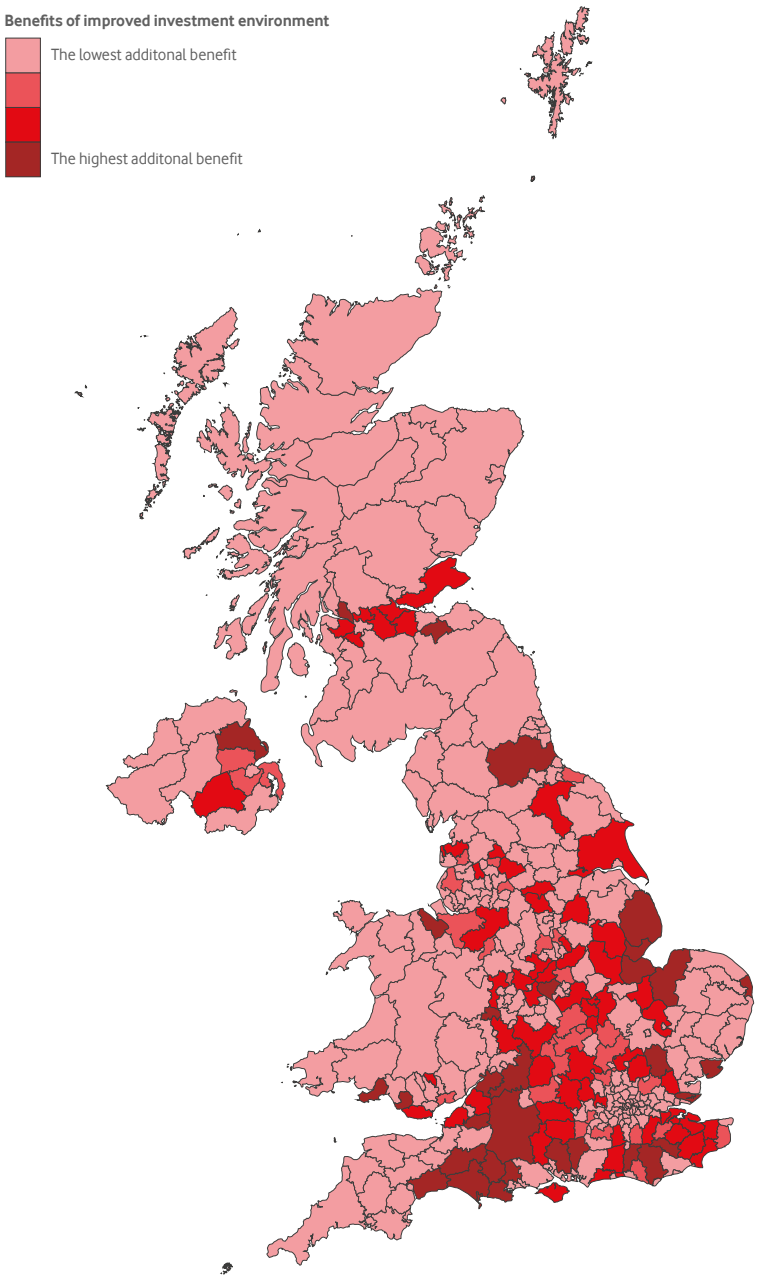
Figure 2: Difference between economic impact of good and poor investment scenarios for full 5G across the UK (£bn)



Source: WPI Economics

The map in Figure 3 shows which local authority areas would see the highest additional benefit as a result of the good investment environment we modelled. Our model assumes that the most commercially attractive areas – the main population centres which previously saw the fastest 4G rollout, as shown in Figure 1 above – will receive investment even with a poor investment environment, which is why the areas where we already expect to see the fastest full 5G rollout see little additional benefit from a good one: the big differences are seen elsewhere.

Figure 3: Additional economic benefits resulting from a good investment environment for full 5G, by local authority



The real winners from getting the investment environment right are in places with significant populations below this level: smaller cities or medium-sized towns. The local authority areas seeing high or very high benefit from a good investment environment for 5G are in every region and nation of the UK except London, and include County Durham, Swansea, Wyre Forest, Midlothian, Bath and North East Somerset, Sheffield, Pendle, Canterbury and many more – see Table 2.

Table 2: Local authorities seeing a high or very high benefit from a good investment environment for 5G, compared to a moderate investment environment

Local authority	Region	Benefit	Local authority	Region	Benefit
South Derbyshire	East Midlands	High Benefit	Mole Valley	South East	High Benefit
Harborough	East Midlands	High Benefit	Horsham	South East	High Benefit
North Northamptonshire	East Midlands	High Benefit	East Hampshire	South East	Very High Benefit
North Kesteven	East Midlands	High Benefit	Winchester	South East	Very High Benefit
South Kesteven	East Midlands	High Benefit	Tunbridge Wells	South East	Very High Benefit
Hinckley and Bosworth	East Midlands	Very High Benefit	Wealden	South East	Very High Benefit
Boston	East Midlands	Very High Benefit	Mid Sussex	South East	Very High Benefit
East Lindsey	East Midlands	Very High Benefit	North Somerset	South West	High Benefit
South Holland	East Midlands	Very High Benefit	East Devon	South West	Very High Benefit
North Hertfordshire	East of England	High Benefit	Dorset	South West	Very High Benefit
Great Yarmouth	East of England	Very High Benefit	South Somerset	South West	Very High Benefit
King's Lynn and West Norfolk	East of England	Very High Benefit	Bath and North East Somerset	South West	Very High Benefit
Rochford	East of England	Very High Benefit	Wiltshire	South West	Very High Benefit
Tendring	East of England	Very High Benefit	Cotswold	South West	Very High Benefit
Uttlesford	East of England	Very High Benefit	Stroud	South West	Very High Benefit
County Durham	North East	Very High Benefit	Vale of Glamorgan	Wales	High Benefit
Cheshire East	North West	High Benefit	Blaenau Gwent	Wales	High Benefit
Pendle	North West	High Benefit	Flintshire	Wales	Very High Benefit
Mid and East Antrim	Northern Ireland	Very High Benefit	Swansea	Wales	Very High Benefit
Midlothian	Scotland	Very High Benefit	Bridgend	Wales	Very High Benefit
West Dunbartonshire	Scotland	Very High Benefit	Stratford-on-Avon	West Midlands	High Benefit
West Berkshire	South East	High Benefit	Wychavon	West Midlands	High Benefit
South Oxfordshire	South East	High Benefit	South Staffordshire	West Midlands	High Benefit
Isle of Wight	South East	High Benefit	Wyre Forest	West Midlands	Very High Benefit
Basingstoke and Deane	South East	High Benefit	East Riding of Yorkshire	Yorkshire and Humber	High Benefit
Test Valley	South East	High Benefit	Hambleton	Yorkshire and Humber	High Benefit
Ashford	South East	High Benefit	Barnsley	Yorkshire and Humber	High Benefit
Canterbury	South East	High Benefit	Sheffield	Yorkshire and Humber	High Benefit
Sevenoaks	South East	High Benefit	Calderdale	Yorkshire and Humber	High Benefit

Ensuring that 5G rollout reaches places like this quickly means that business, industry and public services based outside the UK's main cities can benefit from the use cases described in Chapter 1, and allow businesses to invest and create jobs there. This would enable 5G rollout to make a significant contribution to levelling up – rather than enabling the places that are already doing well to pull away, accelerating the divide between cities and towns.

Chapter 3: Learning from South Korea

With the right policy framework and regulatory environment, governments can incentivise and facilitate significant investment in 5G, to the benefit of their citizens, businesses and ultimately economies. South Korea, which has long been a global leader in deploying mobile infrastructure, shows what can be achieved when a government has a vision for full 5G and a strategy for translating that vision into concrete achievement.

The first commercial mobile 5G networks were launched in South Korea in 2019, available to consumers with 5G-enabled smartphones, and hit 1 million subscribers in just 69 days. The country had 1.6 million 5G subscribers by the end of June 2019, compared to 130,000 in the USA and 90,000 in the UK at the time – over 80% of the world's 5G subscribers.[4] By the end of 2021, South Korea had almost 21 million 5G subscribers, amounting to nearly a third of all the country's mobile subscriptions.[5]

This world-leading performance did not happen by accident. South Korea's success in being one of the first countries to bring a domestic 5G network to scale is a direct result of a long-term national strategy, a series of national policies, developed over a number of years, prioritising 5G development with an explicit aim to be a global leader in 5G technology.

In 2017, South Korea's Hyper-Connected Intelligent Network Deployment Strategy presented four policy goals: (1) the world's first 5G commercialisation, and nationwide 5G coverage by 2022; (2) increasing IoT connectivity; (3) implementing a smart and reliable network based on software and AI; and (4) deploying nationwide high-speed internet access. South Korea's 5G+ Strategy, launched in 2019, built on this existing policy and set out the Government's vision, as well as the steps it would take to achieve it. It included specific policies for supporting ten strategic industries (network equipment, next-generation smartphones, VR-AR devices, wearable devices, intelligent CCTV, drones, connected robots, 5G V2X, information security, edge computing) and five core services (immersive content, smart factories, autonomous vehicles, digital healthcare, smart cities) in which to prioritise investment and support. And it set concrete, measurable policy goals for the level of production achieved by the priority industries, in terms of global market share, level of exports and job creation as well as a safe user environment with the creation of a 5G Cybersecurity Council.[6]

The South Korean Government recognised its own role in developing an environment for 5G in which the private sector could invest and innovate. Some of this has involved direct funding of 5G projects in which there are public sector use cases – using its own purchasing power to enable early adoption of 5G use cases so that it can both encourage R&D and innovation and drive further market demand. It provides a tax credit of up to 3% for investments in the 5G network to encourage private financing. It has funded 5G testbeds and trials in key strategic areas such as smart drones, digital healthcare and smart factories. It has encouraged collaboration between stakeholders including the telecoms industry, government, researchers and civil society. And it has also removed regulatory barriers to support innovation and encourage new entrants to 5G-related industries.

While every country is different, South Korea's conscious choice to become a world leader in 5G and to create a policy framework to support this has been highly successful and provides useful lessons for the UK and other countries who recognise the benefits of rolling out 5G as quickly as possible. The next chapter looks at what specific policies might be adopted, in a UK context, to achieve similarly positive results.

Chapter 4: A pro-investment environment

The prize for the whole of the UK from rapid rollout of full 5G is huge. We can all benefit, both from the specific new applications we will be able to use ourselves in our daily lives and from the improvements 5G will make to public services and businesses – and from the economic growth and international competitiveness that, as this paper has shown, will flow from that. But that requires large-scale upgrades to networks by mobile operators: building new radio access network sites, alongside major upgrades to existing sites.

This will not happen automatically: mobile operators can instead keep making limited upgrades to the existing networks and sites, gradually rolling out hybrid 5G. While this will deliver some incremental speed and capacity benefits to users, particularly in those urban areas which are the initial focus for network operators, it will not unlock the step-change in availability and functionality across the country that full 5G promises.

Any investment requires investors, who recognise the long-term benefit to their businesses of spending money now to receive a return later. If the return on investment is not there, then the investment will not happen in the first place. In particular, as Chapter 2 shows, the investment will not happen in areas with less commercial potential, outside the main population centres. The return on capital employed (ROCE) needs to be at 10%, and certainly above the weighted average cost of capital (WACC) to persuade investors of the case for investment.

So how can potential investors in 5G infrastructure – the mobile network operators (MNOs) who build, upgrade, maintain and operate the networks we all rely on – be confident in their return on the very large upfront cost of standalone 5G?

Vision

- One of the key lessons from South Korea's success on 5G rollout, as set out in the previous chapter, is the importance of a government having a clear, ambitious vision and backing it up with a strategy, policy and regulation to deliver it.
- The UK Government's stated ambition for the majority of the population to have access to a 5G signal by 2027 is a good starting point, but it does not specify full, or standalone 5G. This could lead to the target being met simply through hybrid 5G – meaning that the UK would miss out on the opportunity to deploy many of 5G's most exciting use cases, and to reap the consequent economic benefits.
- Measures need to be introduced, as explained below, to guarantee return on investment for mobile operators – this should include policy and regulatory reform, procurement and incentives for private sector uptake. It still needs to be recognised, however, that there will remain a gap in semi-urban and rural areas where even this improved investment environment will not support the full 5G business case. This is a similar situation as the one the UK faced with full fibre rollout. **Government should mirror the approach it took to full fibre** – a combination of policy and regulatory reform and direct public funding via the Gigabit Programme. The Shared Rural Network programme offers the correct model for public funding for full 5G, although the Government will need to recognise that funding will be required across a much larger area.
- The Government could also send a stronger signal to investors if it adopted **an additional ambition to make the UK the best place to invest in 5G in Europe.**
- Making industry investment a key strategic goal, and resetting the regulatory and policy framework to create the right signals for investment, would create the conditions to make the rollout of standalone 5G in the UK as rapid as possible.

Identifying priority sectors

- Prioritising certain sectors for 5G uptake and, crucially, incentivising uptake is vitally important, given the hesitation in boardrooms about investing in new technologies.
- **Health and social care, manufacturing, agriculture, transport** and **utilities** are the sectors with the most potential in the shorter term.
- In addition, making **SME uptake** of 5G a priority would be particularly valuable in focusing policy on the need for public networks, to make sure that public 5G infrastructure is a viable investment and that the full benefits of 5G are not limited to large businesses who can afford to deploy their own private networks. An expansion of Help to Grow Digital to include digital infrastructure would be a useful step.

Procurement

- Government needs to show leadership through its own procurement, simultaneously encouraging innovation, creating market demand and benefiting itself, on behalf of the taxpayer, from the 5G-related processes and services it procures.
- For example, **the installation of smart energy management systems in all public buildings** would reduce emissions in those buildings, expand interest in, and the market for, these systems elsewhere, and save money on energy bills.
- **Encouraging the NHS to invest in 5G-connected hospitals** – particularly in the 40 new hospitals pledged by the Government – and the technologies enabled by them would similarly drive market growth as well as bringing benefits to patients.
- Government can also help to support demand for 5G and create markets for it through **continuing to fund testbeds and trials**.

Regulation that promotes investment in 5G

- Once the vision has been established, one of the most important roles Government has is in getting the regulation right. That means reviewing existing regulation through the lens of promoting investment, and taking a new approach to future regulation so that new regulations which inhibit investment are avoided.
- Investors in 5G infrastructure need a competitive environment which enables investment at sufficient scale to recover their large fixed costs. So **regulators need to be open-minded about market consolidation** if there are benefits to return on investment and for businesses and consumers.
- **A level playing field between private and public 5G networks** can ensure that public 5G infrastructure is a viable investment and the full benefits of 5G are not limited to large businesses who can afford to deploy their own private networks.
- **Fair management of radio spectrum** can enable unused or under-utilised spectrum to be traded between operators and allow ineffective licence fees to be redeployed into infrastructure investment.
- **Planning rules need to be set in such a way that they do not stop 5G infrastructure from being rolled out** where it is needed and wanted, and **the business rates system needs to avoid deterring investment** in high-value infrastructure.
- **Net neutrality regulations should enable mobile operators to maximise demand** by offering consumers attractive propositions that make use of the full technological capabilities of 5G.

Endnotes

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