

Network failure

How the UK can meet its 5G ambitions

Richard Hyde
John Asthana Gibson

SMF

Social Market
Foundation

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ABOUT THIS REPORT

This report primarily draws upon secondary sources identified through desk research. The authors supplemented this with a series of in-depth, semi-structured interviews with key informants and an expert roundtable discussion. The latter took place after the first paper in this project, “Growing Connections”, was published. That paper provided the basis for the roundtable’s agenda.

FORWORD

It is no coincidence that the greatest leaps in economic productivity have accompanied revolutions in communication technology. From the invention of the Gutenberg printing press to the telephone, the advent of the internet to the ubiquitous rollout of mobile connectivity, each step forward has facilitated faster and more efficient exchanges of information, spurring new industries, business models, and opportunities to trade. In short, improved connectivity is one of the most powerful catalysts for economic growth.

Today, the hunt for growth has never been more serious or necessary, a fact recognised by politicians of all parties. Labour took office in July with a clear and unapologetic mission to boost the UK's prospects for economic growth and productivity. Nonetheless, six months on, pressing questions remain about how best to achieve it. This landmark report responds to those questions head on, by focusing on the unique power of connectivity to unlock the UK's economic potential.

By taking stock of the policy landscape and market dynamics leading to the emergence of a limited number of Wireless Infrastructure Providers (WIPs) that have shaped the UK's rollout of 5G, the Social Market Foundation has produced an important analysis of the policy barriers that hamper the UK's 5G connectivity, and which leave it languishing at the bottom of international league tables for performance. Its findings show that widespread, high-quality 5G could boost the UK's economy by £159 billion by 2035, equivalent to more than £500 per person. However, a £20 billion investment gap, vested interests against innovative and alternative investment options for the UK's mobile infrastructure market and a counter-productive intervention by the previous government in the land market diverting resources from network rollout into costly litigation are acting as a brake on the widespread rollout of 5G.

The economic and social implications of this hiatus can already be felt. It is stifling innovation, frustrating consumers in need of reliable high quality connectivity, clogging the judicial system with endless litigation affecting individual and institutional landlords, exacerbating regional inequalities and undermining the UK's ability to compete globally. *'Network Failure. How the UK can meet its 5G ambitions'* sets out a roadmap for reversing Britain's 5G inertia which, if followed, will boost connectivity in every nation and region of the UK.

Earlier this year the Labour Party's election manifesto recognised the importance of connectivity by including a commitment to achieve 5G coverage by 2030. Adopting the seven recommendations in this report would help the government to meet that pledge by avoiding the mistakes of the past.

5G applications are almost endless and the investment opportunity is huge. This report sets out how the UK can create a more connected, more inclusive, and more prosperous future by unleashing 5G's full potential.

Tom Evans, EVP North Atlantic, APWireless

EXECUTIVE SUMMARY

The UK is missing out on growth because of poor 5G connectivity

Ubiquitous 5G connectivity can boost Britain's prosperity

Widespread, high-quality 5G could boost the UK's economy by £159 billion by 2035. That is more than £529 per person. The key private sector gains will accrue through the use by businesses, where 5G can unlock operational efficiencies, as well as the development and diffusion of innovations.

The UK trails behind other countries on 5G coverage and speed

Despite its potential contribution to economic growth, and the ambition amongst politicians for the UK to be world-leading in 5G, Britain is far behind the “global frontier” – the UK ranks 30th out of 39 countries for 5G availability, and 37th out of 39 countries for the quality of the 5G, as measured by average download speed. It is likely to miss its target of high-quality 5G coverage across all populated areas, by 2030. Consequently, the UK is at risk of missing out on much of the potential social benefits and prosperity it could help to generate.

An investment gap is holding the UK's 5G rollout back

The size of the 5G infrastructure “investment gap”

Behind the UK's poor 5G performance is a 5G infrastructure “investment gap”. Ubiquitous high-quality 5G, requires substantial investment in upgrading existing, as well as building new infrastructure. This is because high quality and widespread 5G coverage requires much more infrastructure density than 4G to service the same size population. Further, existing 4G infrastructure is not always capable of hosting 5G equipment and so, in addition to new infrastructure, existing infrastructure may need to be upgraded or replaced to accommodate 5G rollout. One estimate suggests that perhaps as much as double the amount of equipment and site infrastructure, will be needed to operate a country-wide 5G.

Estimates regarding the size of the 5G investment gap differ, with the exact quantum determined by assumptions about coverage and quality. However, to deliver on widespread 5G rollout that goes beyond the current 4G footprint, the amount of investment needed is considerable as existing infrastructure will need to be upgraded or replaced as well as new infrastructure built on new sites. Therefore, the “gap” is expected to be in the range of £20 billion to £37 billion.

The consequences of the “investment gap” are evident in the UK's low number of 5G base stations, per 100,000 of the population (see Figure 3). Mobile Network Operators (MNOs), are not investing at the scale needed to ensure that the UK can reap the full benefits of 5G as soon as possible.

5G requires such a significant amount of investment, largely because there is a need for much more infrastructure in order to have high-quality 5G networks which span the UK, compared to 4G. Some estimates suggest perhaps double the number of macro and micro cells will be needed. Further, the investment requirements are

greater still because existing passive infrastructure may need to be replaced or at least extensively modernised, so that high quality 5G can be delivered.

The causes of the “investment gap”

There are multiple causes of the “investment gap”. Our previous paper, “*Growing Connections*”, briefly outlined the most salient obstacles. These are:

- Uncertainty over demand for 5G services.
- The structure of the mobile market.
- The current approach to spectrum.
- The supply of land and property for infrastructure sites.
- The operation of the planning system.

Uncertainty over demand for 5G services

The “chicken and egg” problem

A significant factor inhibiting investment in 5G telecoms infrastructure, is the uncertainty over whether there will be sufficient demand for 5G services and whether MNOs will ultimately be able to monetise 5G sufficiently, to deliver a good return on large investment in next generation infrastructure and therefore make such investment worthwhile.

The one third decline in MNO revenues since 2012 and the comparatively low return on investment which UK MNOs face, makes it difficult for them to justify the level of investment needed for widespread 5G by 2030. Therefore, they need to see a realistic prospect of adequate future demand from consumers and businesses, including a willingness amongst users to pay for new 5G services. However, survey evidence suggests some reluctance to adopt 5G amongst both business and consumers. For example, one 2019 survey of UK manufacturing executives found that a quarter reported that “existing network solutions cover my needs”, whilst other research suggested that many business leaders believe that 4G delivers around 80% of that which 5G could offer. Similarly, more than 8 in 10 consumers are content with the speed at which their current mobile service operates, whilst the latest Ofcom data shows that 4G accounts for 78% of monthly data traffic in the UK.

Market structure

There is debate over what the most appropriate market structure is in the mobile telecoms sector. Proponents of a more concentrated industry, argue that fewer MNOs would help facilitate greater long-term investment, especially when MNOs have seen their revenues fall significantly in the last decade. On the other hand, advocates of a less concentrated market suggest that only the incentives created by more players can deliver the best outcomes. On the whole, the orientation of mobile sector policy has leaned towards the latter. However, the debate has been somewhat superseded by the recent Vodafone–Three merger decision from the Competition and Markets Authority (CMA). The UK will now be an industry of three, rather than four, MNOs. Certainly, one of the arguments made by the emerging firms was that it would deliver £11 billion of additional investment. Time will tell if that is the case.

The growth of WIPs

The relationship between market structure, MNO revenues and infrastructure investment has become even more complex in recent years due to the rise of Wireless Infrastructure Providers (WIPs, or “tower companies”) who control a growing proportion of the UK’s passive mobile infrastructure. Evidence suggests that roughly 70% of macro mobile infrastructure sites are now controlled by WIPs that are entirely independent of MNOs, and the majority of these are controlled by two dominant players. These companies have acquired their infrastructure assets and now lease them back typically in the context of long-term arrangements with MNOs. Their emergence means that WIPs, as owners of the infrastructure assets, are fast becoming as important to the debate over how to boost mobile infrastructure investment as MNOs. On the one hand, there are concerns that splitting out infrastructure delivery from mobile services could undermine the incentives for investment and create new costs. On the other hand, many European countries have a highly developed WIP sector and notably, a lot of those countries are rolling out 5G faster than in the UK. This indicates that there is unlikely to be any inherent obstacle to greater investment from such a split. Indeed, the growth of WIPs perhaps increases the opportunities for infrastructure sharing. Whilst this is far from a panacea for facilitating the rollout of high quality 5G across the whole of the UK, it can make a contribution. For instance, one modelling exercise suggested that it could save as much as £15 billion in 5G capital expenditure costs.

However, currently, there are no definitive conclusions to be drawn about what ultimate impact WIPs will have. Nevertheless, what seems clear, is that policymakers and regulators concerned about how to encourage more investment in 5G infrastructure need to pay keen attention to how the WIP sector in the UK evolves.

The current approach to spectrum

The connection between the cost of spectrum to MNOs and 5G infrastructure investment

The available evidence indicates that high spectrum costs, i.e. the costs incurred by MNOs to obtain a licence to use a portion of the UK’s electromagnetic spectrum, whether in the form of auction prices or annual fees, tend to have a detrimental impact on MNO investment in connectivity. If there were no annual fees required to be paid by MNOs, and the first tranche of 5G spectrum had not been allocated through an auction in 2018, together, perhaps as much as £4 billion could have been made available for closing the “investment gap”.

The duration of spectrum licences and the effect on MNO infrastructure investment

There is some research to suggest that the length of time an MNO has a spectrum licence, can also influence investment levels. For example, one study estimated that every extra year of spectrum licence, boosted investment by around £1.30 per capita. This implied that extending the typical licence by a decade, could see infrastructure investment in the UK increase by about £850 million over that time.

The extra certainty of a long period of control over spectrum for an MNO can be expected to help with investment planning. Certainly, a long licence is an asset for an MNO and can be used to raise external capital, potentially increasing the amount of finance available for investment. Indeed, the EU has moved in the direction of more certainty in licence duration with requirements on Member States to provide MNOs with minimum 20-year long initial licences and on renewal. The international mobile industry body GSMA is supportive of this kind of length for spectrum licences.

However, there is some counter-evidence indicating licence duration is not a strong driver of investment levels. At the same time, longer-licences have not been found to be detrimental. Therefore, experimenting with a shift to standard fixed period licences of two decades or more could be worthwhile, especially in conjunction with the elimination of the costs associated with auctions and fees.

Supply of land and property for mobile infrastructure sites

The counter-productive effects of efforts to reduce the costs of accessing land

Mobile infrastructure is typically installed on third-party land. Therefore, access to such land for both building new and upgrading existing infrastructure from 4G to 5G, is vital. Further, a steady supply of land is particularly crucial because 5G requires many more sites for the additional infrastructure that is needed to operate a high quality 5G network.

To encourage MNOs to invest more in infrastructure, changes to the Electronic Communications Code (ECC) were made in the Digital Economy Act of 2017. These regulated the rents that land providers can charge for the siting of mobile infrastructure with a valuation framework which aligned with the rules for other utilities. The aim was to cut the rental cost of using private land for MNOs, and in-turn free-up resources for investment.

However, the government's changes ignored the Law Commission's 2013 recommendation to allow the market primacy in determining appropriate rents. One outcome of the reform has been a dramatic fall in the rents that providers of land can now obtain. One analysis suggested those supplying land for mobile infrastructure may have lost £209 million a year in income. This has led to a substantial deterioration in the relations between some landowners and infrastructure providers (i.e. MNOs and WIPs). This effect has been observed by a number of organisations such as the Law Society of England and Wales, and acknowledged by the previous government. This is perhaps most evident in the 109% increase in the number of disputes being referred to the Upper Tribunal Lands Chamber in England and Wales between 2018 and mid-2023. Issues with supply are particularly problematic for the rollout of 5G, because of the need for much more land and other property on which to place the additional infrastructure that 5G needs to deliver the low latency, additional capacity and high speeds that it is capable of.

Certainly, for many, the value to be gained from renting the land to MNOs or WIPs and therefore the attraction of doing so, has significantly reduced. There has been a consequent "chilling effect" on the supply of land for mobile infrastructure. One

analysis suggested that negotiations between parties can now take as long as 11 months instead of the expected 6, while another indicated that in many instances, they are taking up to 18 months.

Whilst there is some debate over whether the worst of the disruption caused may now have passed, the balance of evidence suggests that this remains a problem. For instance, there are predictions that the planned extension of the ECC's land valuation rules, through the Product Security and Telecoms Infrastructure Act 2022, to around 15,000 more rental agreements between operators and site providers that are currently governed by the Landlord and Tenant Act 1954 and the Business Tenancies (Northern Ireland) Order 1996, could result in many more disputes in the tribunal system.

The growth of WIPs raises questions about the extent to which rent savings will be reinvested

In the context of the growth of WIPs as owners of mobile infrastructure, a significant portion of the savings on land rents is, in the first instance, going to tower companies and not the MNOs. To what extent that extra margin will be recycled into lower infrastructure lease prices for MNOs or be invested by WIPs in new sites or upgrading existing ones, is an open question for regulators that needs to be looked at. While it is not possible to yet know how the dynamics of the sector will develop, policymakers and regulators will no doubt want to closely observe whether the structure of the WIP sector i.e. a small number of players often with long-term arrangements with MNOs, will prove to be a boon or detrimental to 5G investment.

The operation of the planning system

Planning capacity is a constraint on building 5G infrastructure

The need for an expanded and upgraded network of infrastructure for widespread and high quality 5G, is going to put more of a strain on the planning system. However, planning authorities are already short on capacity. In English local authorities for example, between 2010 and 2023, planning resourcing has been cut by a seventh. Scotland and Wales have experienced even larger reductions.

The average (mean) amount of time it takes for a mobile infrastructure application to be decided is six months. The median length of time is four months. Overall, it can take between 12 and 18 months to make mobile infrastructure fully operational. Speeding up the planning process, e.g. cutting the mean amount of time an application takes to receive a decision from 6 months to 3 could see more than 300 new cell sites given planning permission each year, or around 1,600 more 5G cells in place by 2030 than would otherwise be the case.

Many local authorities fail to prioritise digital issues such as mobile infrastructure

Further, as the mobile industry has observed, many planning authorities do not have sufficient internal digital technology expertise. Therefore, key technical as well as topographical factors and other constraints on where infrastructure can be suitably placed, are not always sufficiently taken into account by planners in their decisions. There is also a concern that they often fail to consider mobile site applications in the

wider economic context. As a result the importance of mobile infrastructure to the local, regional and national economy is not always a significant enough influence on application decisions. This is a consequence of many local authorities failing to take a more strategic view on digital issues. For instance, a survey of UK councillors discovered that less than a third reported that their authority had a Digital Champion. The presence of such a role in a local council is evidence that the authority takes a more strategic perspective of digital issues, with such positions linked to local authorities prioritising connectivity more highly and planning better approval rates for mobile equipment.

Uncertainty in the planning process deters investment in mobile infrastructure

Uncertainty over the speed and predictability of the planning process between local authorities and across the nations of the UK, is a key concern for those building and operating mobile infrastructure. It is perhaps most clearly reflected in the substantial geographical differences in the proportion of permissions granted. For instance, in London the approval rate is around 4-in-10 applications. This is in stark contrast to some other cities, where the rate is as high 9-in-10.

According to experts spoken with for this research, to date, attempts to reduce some of the uncertainty in planning through the extension of permitted development rights for mobile masts, which are up to 30 metres tall, do not appear to have made the kind of difference that was originally hoped for. Therefore, policymakers may benefit from looking at lessons from other jurisdictions in order to identify more effective approaches. For example, the EU's Gigabit Infrastructure Regulation is unambiguous in its aim of getting more mobile infrastructure constructed, and sets out the need for clarity and consistency in Member State planning processes. A more certain planning system that, for example, raises the proportion of planning applications that are accepted by 10 percentage points from the nationwide average of 8-in-10 to 9-in-10, could see an extra 160 cell sites built each year, or over 800 more between 2025 and 2030.

RECOMMENDATIONS

A “new deal for 5G” is needed to tackle the causes of the investment gap, and catapult the UK to the global frontier for 5G connectivity. The “new deal for 5G” should be a package of complementary measures which, if implemented together, can deliver the high-quality 5G network the UK needs in order to reap the full economic and social benefits of this new technology.

Uncertainty over future demand

Recommendation 1: The government should use public procurement as a tool to stimulate investment in 5G infrastructure.

Recommendation 2: The government should revamp the 5G Test Beds and Trails programme and provide the relatively small amount of funding needed to continue to demonstrate use cases across different sectors.

Concerns over the market structure of the mobile telecoms sector

Recommendation 3: Policymakers and Ofcom should do more to consider the longer term ‘dynamic’ impacts on the economy that arise from low investment in key infrastructure such as 5G, and pay particular attention to the potential effects on investment and competition caused by the alteration of the telecoms value chain with the divestment of mobile infrastructure by MNOs to WIPs.

Problems with the UK’s approach to spectrum

Recommendation 4: The government should overhaul spectrum policy by eliminating annual fees levied on MNOs in exchange for clearly defined 5G investment guarantees, replace future auctions for a system of spectrum allocation based upon agreed investment plans and licences that are at least 20 years in length and which are renewed on the grounds of past performance and future promises.

The supply of land and property for infrastructure

Recommendation 5: The government should reform the ECC valuation regime so that there can be a fair distribution of the economic gains from the use of land for mobile infrastructure between land providers and MNOs and WIPs.

Recommendation 6: The government should commission a mapping exercise of public and private land in the UK to identify suitable places for potential mobile infrastructure and for public land, buildings and other physical assets create a “presumptive permission” status for it.

The operation of the planning system that constrains investment

Recommendation 7: The government should introduce a package of measures to overhaul those aspects of the planning system that hold back mobile infrastructure development.

CHAPTER ONE – INTRODUCTION

Mobile telecommunication networks have evolved to become a key feature of the UK's digital infrastructure

It is predicated that by 2025 95% of the UK population will be smartphone users.¹ The lives of practically every individual in developed countries like the UK are affected by this technology, which has evolved significantly in the decades since their inception:

- The first generation of mobile technologies (1G) emerged in the 1980s as an analogue network, lacking data capabilities.
- 2G technology which delivered SMS text messaging and better voice quality during calls followed in the 1990s.
- 3G arrived in the 2000s and was faster and enabled data services to become central to mobile phone use. The advent of 3.5G facilitated the streaming of audio and video.²
- 4G was being rolled out by 2012, enabling even faster data speeds, reduced latency, and provided consumers and businesses with the opportunity to utilise a range of enhanced in-phone applications.³ The proportion of UK landmass covered by at least one MNO's 4G network is now at 93%, so whilst the vast majority of premises are able to receive a signal, there are still some areas where 4G is not available.⁴

The latest generation of mobile network technology is 5G, and has been rolling out across many countries since the late 2010s. 5G is faster, can provide ultra-low latency and greater capacity and resiliency.⁵ For example, a 5G network can:

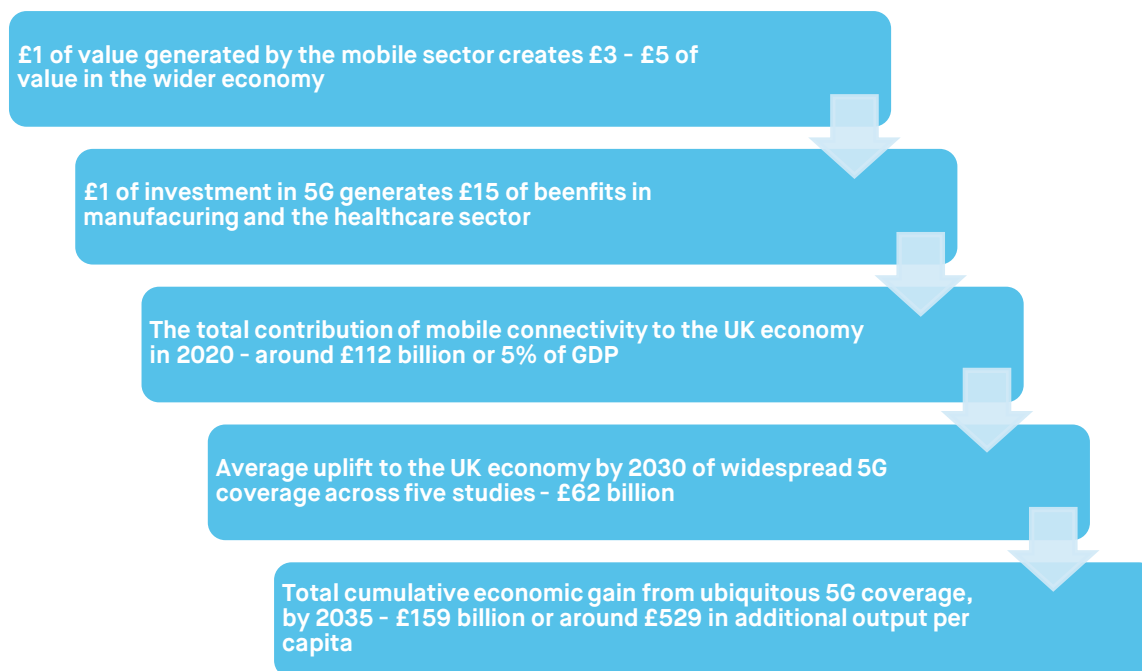
- Transport a huge amount of data much faster with 5G's peak speeds up to 10 times quicker than 4G when using its high-frequency bandwidth.
- Reliably connect an extremely large number of devices within smaller areas.⁶
- Enable network slicing i.e. allow dedicated network resources for specific purposes over defined geographies (e.g. a farm or factory) with guaranteed performance attributes.

Ensuring high-quality mobile coverage delivers significant economic gains

Mobile technology and its impact on UK economic growth

Mobile connectivity is a General Purpose Technology (GPT). Such technologies touch upon virtually every aspect of the economy, therefore their contribution to long-term economic growth can be profound.^{7 8}

Figure 1: The magnitude of the economic impact of mobile technology in general and 5G in particular



Sources: Future Communications Challenge Group – Department of Science, Innovation and Technology (2017), Analysys Mason and Cambridge Econometrics (2021), Connectivity UK (2022) and SMF (2024)

The bulk of the economic gains will come from business applications

Widespread high qualityⁱ 5G coverage will undoubtedly bring benefits to consumers using smartphones. The public sector too, is expected to derive considerable advantages from it. However, perhaps the greatest gains are likely to be made by businesses. It is widely agreed that high-quality 5G coverage could have a transformational effect on a multitude of industries, enabling significant production and supply chain efficiencies and innovative new products and services to be developed.⁹

The UK trails behind other countries on 5G coverage and speeds

Despite laudable ambition and clear policy efforts, the UK's record on 5G has been comparatively poor

There is good evidence to suggest that the UK is going to fall short of the 2030 ambitions for 5G outlined by the last government in various policy statements and strategies.¹⁰ The new government has acknowledged as much, with Chris Bryant, the

ⁱ In this report, when referring to 'high-quality' 5G, we generally mean Standalone 5G networks. Currently, most of the UK's 5G networks are Non-Standalone, meaning that while they use a 5G Radio Access Network (RAN) technology, the core is largely the same as it is with 4G. In short, 5G technology has been 'bolted on' to the existing 4G network.

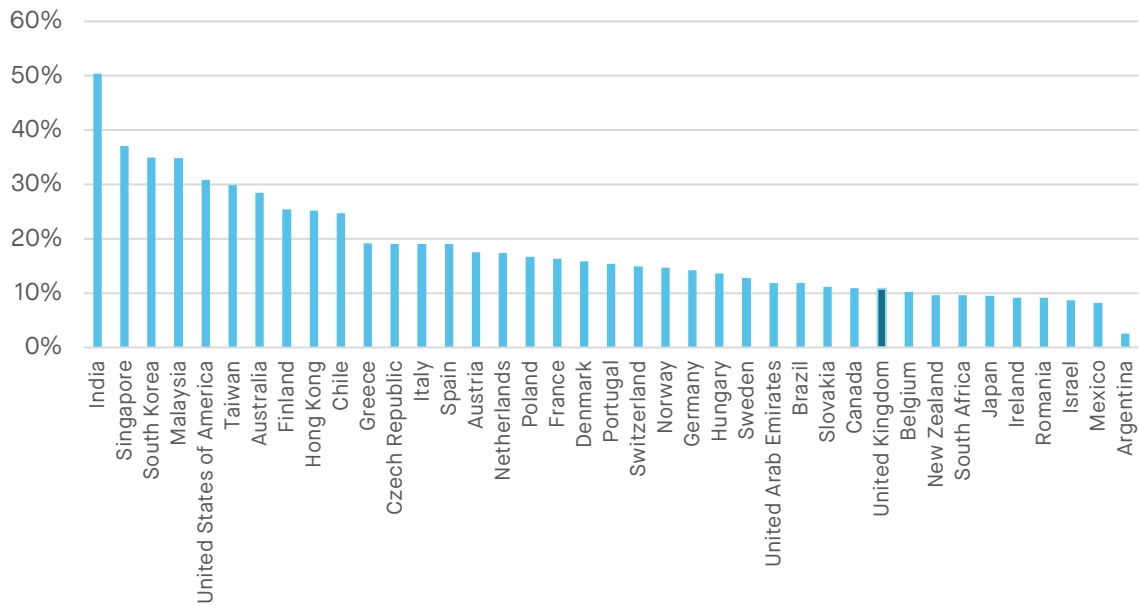
Standalone 5G describes circumstances where the network has been upgraded with 5G-era technology, rather than using a 4G technology core with 5G added on. In most, but not all settings, a 'high-quality' 5G network will need to be Standalone.

Minister of State for Data Protection and Telecoms, recently remarking that the UK is:¹¹

“...significantly behind on mobile connectivity”.

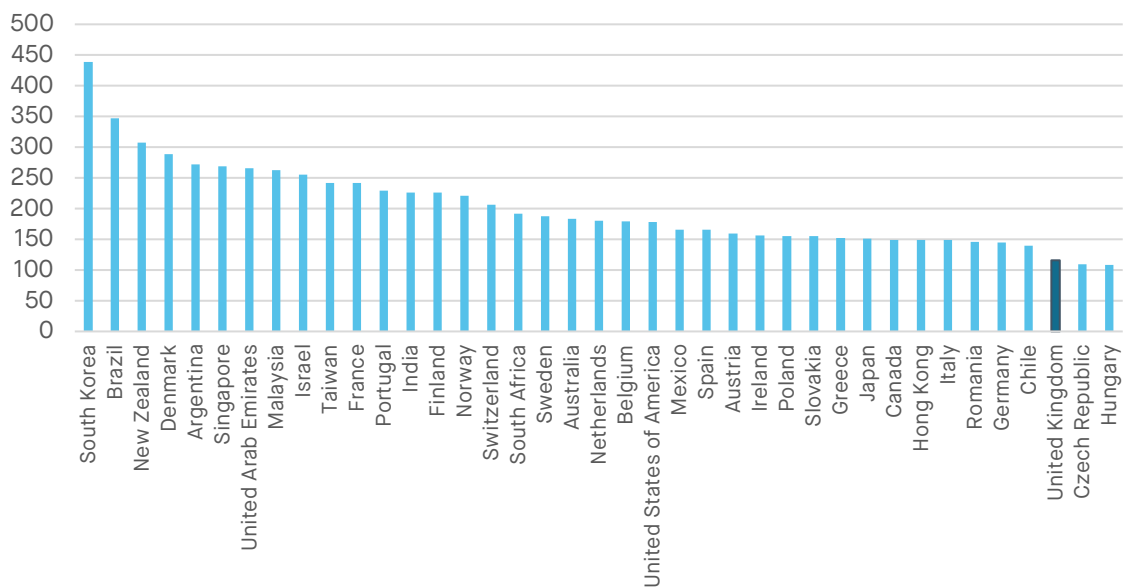
Certainly the UK trails a long way behind a large number of comparator countries. This suggests the UK could be much further along in its rollout of 5G and enjoying more of the kinds of benefits it can generate sooner, if it had followed a better policy mix and learnt lessons from other countries that are having more success.

Figure 2: 5G availability (% of time) in selected countries – July to September 2024



Source: OpenSignal (2024)

Figure 3: 5G download speed (Mbps) in selected countries – July to September 2024



Source: OpenSignal (2024)

Figures 1 and 2 highlight where the UK sits in comparison to a large sample of developed and developing economies on key 5G metrics; the proportion of time that a user typically has access to a 5G signal and the download speed that is enjoyed when a user has a 5G connection. The UK ranks 30th out of 39 countries for signal and 37th out of 39 countries for download speed.¹² Given the picture illustrated in Figures 1 and 2, it is unsurprising that, when it comes to users' quality of experience, which considers more attributes than just coverage and download speed, the UK ranks poorly too.¹³ A recent study for instance, put London bottom of 10 major cities across Europe for the quality of users' 5G experience.¹⁴

Underinvestment is a key reason why the UK is lagging behind other countries

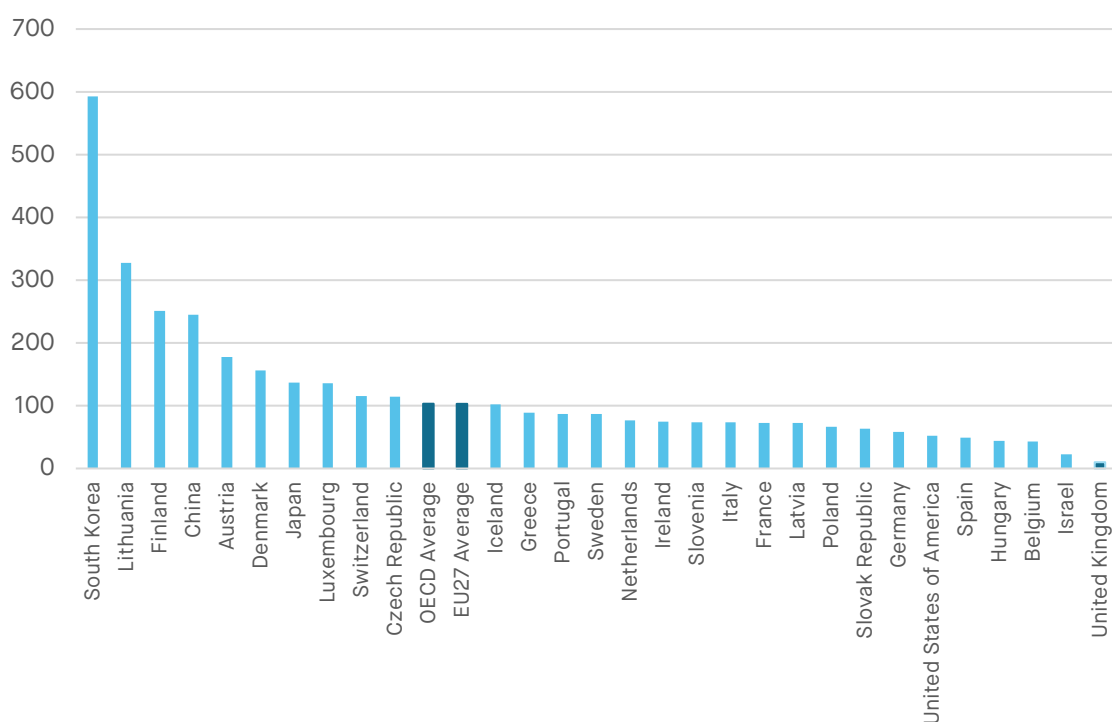
The nature of 5G means that a much more dense network of both macro and micro cells is required in order to reap the kinds of societal benefits highlighted in Figure 1.ⁱⁱ One of the experts we interviewed for this research summed up how the UK's mobile infrastructure needs to change:

"The cell sites and towers need to be built afresh, and they need to be built closer together with 5G. I think they're talking about it being every 100, 200 meters...it's a very, very short distance".

Consequently, investment in new infrastructure essential if the UK wants to achieve its 5G goals. However, the UK has been poor at investing in 5G infrastructure. For instance, as Figure 3 shows, the UK is far behind leading countries like South Korea in the number of 5G base stations per 100,000 inhabitants.^{15 16}

ⁱⁱ A macro cell describes a mobile base station using larger towers that send and receive mobile signals over long distances, i.e. up to several miles. A micro cell is the label given to smaller base stations, which transmit and boost signal in local areas, e.g. of distances between 100 yards to a mile. Micro cells are often found on existing infrastructure such as lampposts or CCTV placements, etc, whilst macro cells are usually ground-based (i.e. freestanding) or on the tops of buildings.

ⁱⁱⁱ See our first paper from this project "Growing Connections" for more on the variety of benefits that 5G could deliver to the UK. Source: <https://www.smf.co.uk/publications/growing-connections-5g-in-uk/>

Figure 4: 5G base stations per 100,000 inhabitants in selected countries in 2023

Sources: OECD (2024), Ofcom (2021) and SMF calculations

N.B. Please note the UK figure is based upon publicly available 2021 data

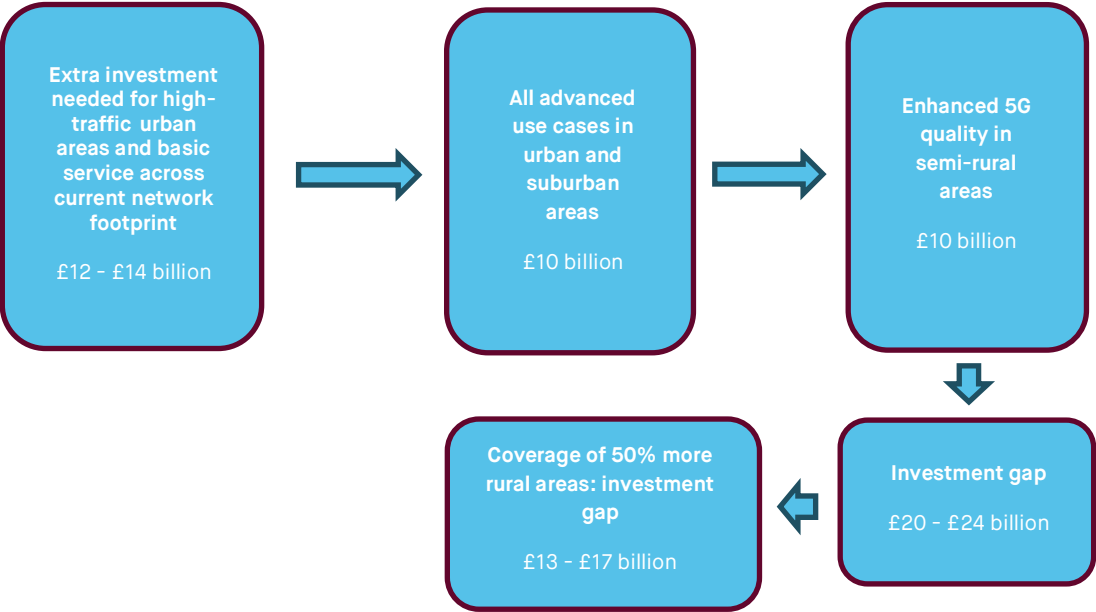
Therefore, building infrastructure which can deliver high-quality 5G to the whole of the UK may require the current number of macro and micro cell sites to double.¹⁷ In the UK, this would imply perhaps as many as 160,000 such sites could be needed for a high-quality nationwide 5G network.

In addition, much of the existing mobile infrastructure that supports 3G and 4G technology is decades old. It may not be suitable for 5G equipment or wrongly sited to deliver an effective 5G service. Therefore a considerable proportion of this legacy infrastructure may also need to be replaced increasing the amount of investment needed to deliver ubiquitous 5G even further.

The investment required to deliver high-quality 5G across the UK

To deliver the new infrastructure architecture that is needed for widespread high-quality 5G coverage by 2030 will require significant investment from the mobile industry (Figure 5). However, currently, the investment levels amongst MNOs are falling short of what many analysts have suggested is needed to achieve such a goal. Illustrating the challenging investment position is the latest Ofcom data which shows that the amount invested by MNOs in 2023 was £1.7 billion, which was below the 2018 figure of £1.8 billion.¹⁸ This raises the possibility that the £9 billion that MNOs might have been expected to invest across the remainder of this decade, had investment levels remained constant, may in fact end up being lower.

Figure 5: Estimates of the 5G mobile infrastructure investment gap

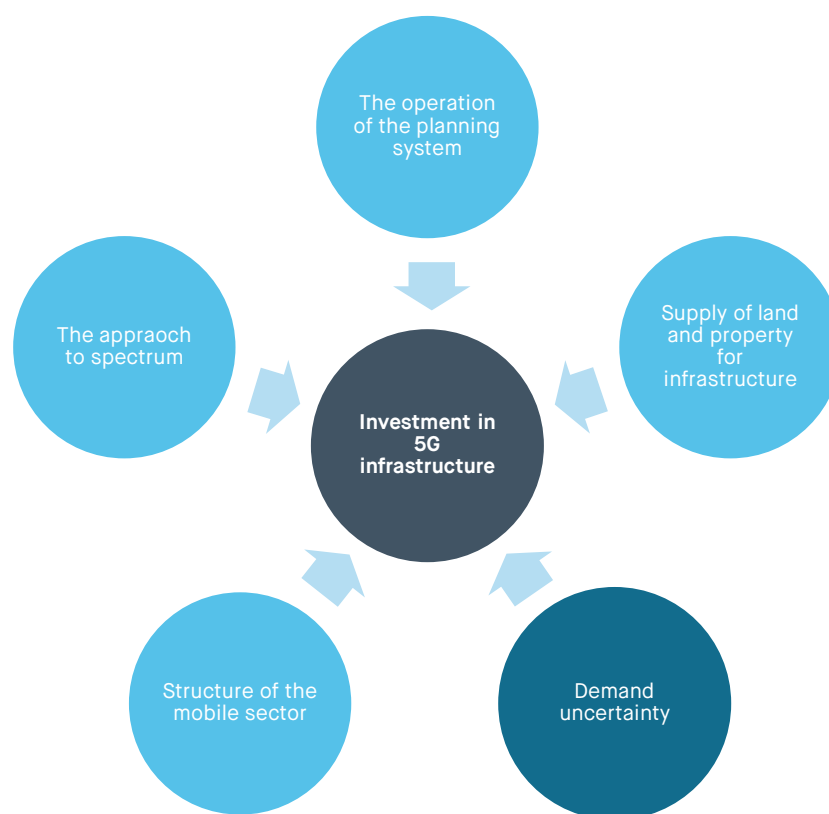


Sources: Connectivity UK (2022), Ofcom (2023) and SMF calculations

This report

The purpose of this report is twofold. First, to explore in more depth than our previous paper, the major demand and supply-side challenges deterring investment in 5G infrastructure. Second, to identify policy changes that could help ameliorate them and in turn, and in combination, facilitate a significant uptick in investment on 5G mobile infrastructure so that ultimately, the UK can enjoy the kinds of social and economic benefits that advanced and ubiquitous mobile connectivity can provide, and which we described in “Growing Connections”.

Figure 6: The key demand and supply-side obstacles to higher 5G investment levels



Source: SMF (2024)

The issues assessed in this paper should not be considered an exhaustive list of the obstacles hindering the UK's development of high-quality mobile infrastructure, but rather a study of the principal barriers where policymakers' attention should be focused in order to bring about the greatest change. For example, this report does not touch upon the effects of the Telecommunications (Security) Act 2021, UK government's decision to remove Huawei's telecommunication equipment from UK's public 5G networks by the end of 2027.^{19 20} This is because, whilst this decision is widely seen as having had a significant negative impact on operators' ability to invest in adding to the net stock of 5G infrastructure, and has consequently likely slowed the rollout of the 5G by several years, it is highly unlikely any government will undo the policy for national security reasons.

More specifically:

- **Chapter Two:** Discusses the role that uncertainty over the likelihood of sufficient demand for 5G connectivity amongst consumers and businesses is playing in holding back investment.
- **Chapter Three:** Explores how the evolution of the mobile operators market and the emergence of wireless Infrastructure Providers (WIPs) may also be contributing to the 5G investment gap.
- **Chapter Four:** Identifies how spectrum policy in the UK has likely helped lower 5G mobile infrastructure investment levels below what they might otherwise have been.

- **Chapter Five:** Sets out why recent policy changes to the Electronic Communications Code (ECC) are disrupting the supply of land and other property for mobile infrastructure sites.
- **Chapter Six:** Shows how elements of the planning system continue to be obstacles to the rollout of 5G mobile infrastructure.

CHAPTER TWO – UNCERTAINTY ON THE DEMAND SIDE

Limited prospect of high demand constrains the appetite for investment

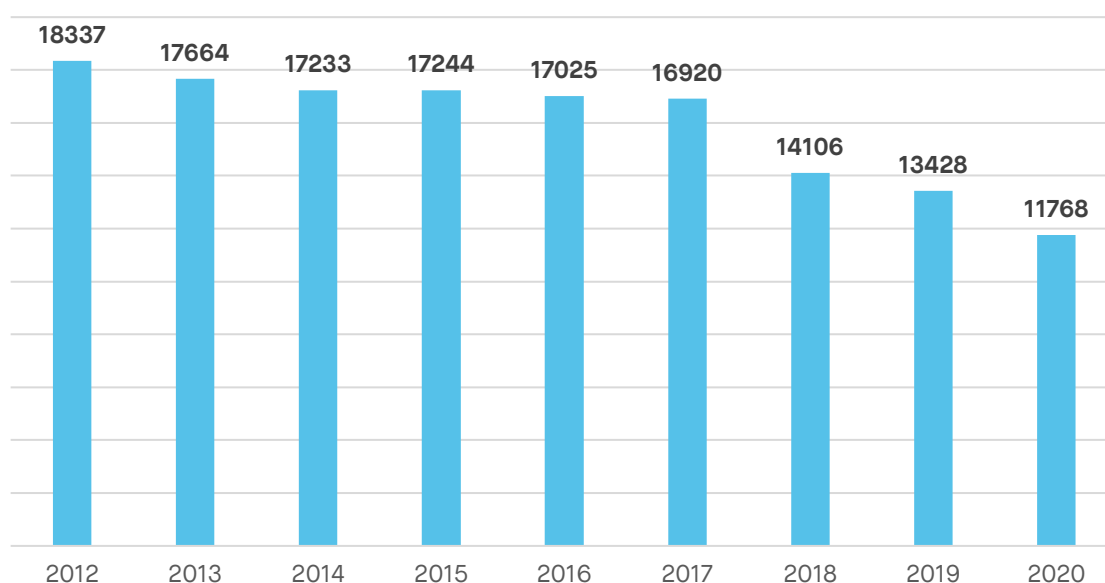
The 5G investment gap and the “chicken and egg” problem

Amongst the drivers of the investment gap is the uncertainty facing MNOs over the likelihood that sufficient demand will emerge for 5G services amongst businesses and consumers to warrant the necessary investments. This uncertainty makes significant capital expenditures that already entail a good deal of risk even riskier, which is especially acute in the economic circumstances that MNOs find themselves in (Figure 6). The last UK government recognised this ‘chicken and egg’ problem in its 2023 Wireless Infrastructure Strategy.²¹

MNO revenues have fallen by more than a third and are squeezing resources for investment

5G investment demands are significant, yet the financial capacity of MNOs to invest has been under pressure for a decade (see Figure 6). This “squeeze” was raised in a number of our expert interviews as a key barrier putting the UK’s ambitions for extensive and high quality 5G coverage by 2030 in jeopardy.²²

Figure 6: Retail revenues (£ millions) for mobile services in the UK, 2012-2020



Source: Ofcom Communication Market Report 2021

Retail mobile revenues fell from £18.3 billion in 2012 down to £11.8 billion in 2020 – a 35% decline.²³ This overall fall in revenue has been driven, in large part, by declining revenues per user, with the price of an average mobile bundle subscription decreasing by 22% between 2015 and 2021.²⁴

The return on investment for UK MNOs is comparatively poor compared to other markets

As an industry with significant fixed costs, the falling revenues have resulted in lower returns on investment (ROI) in 3G and 4G networks. Evidence indicates that UK MNO

ROI is typically less than that enjoyed by MNOs in other European mobile sectors. For example, one report has highlighted that at least some UK MNOs earn an overall 'Return on Capital Employed' (ROCE) below the cost of financing their operations.

UK MNOs' earnings before interest, taxes, depreciation, and amortisation (EBITDA) margins are generally below those of European mobile operators.^{iv 25} In other large European markets EBITDA margins are nearly double those in the UK.²⁶ That being said, by global standards, European mobile network operators are also doing comparatively poorly. For example, the profit rate of even the largest European operators is around 6%, which is much lower than the 9% enjoyed by the major US operators.²⁷ Such slim returns on investment weaken the impetus to invest and limit the amount of capital available for future investment.

A lack of appetite for 5G amongst businesses and consumers

The evidence for a large amount of latent demand for 5G services amongst businesses and consumers is weak. Indeed, the indications are that most firms and individuals are broadly content with their mobile service. However, crucially, the evidence also suggests that many do not seem to be aware of the full potential of 5G. Therefore, the degree to which high levels of demand may materialise from the private sector remains unclear for now.

Uncertainty over business demand

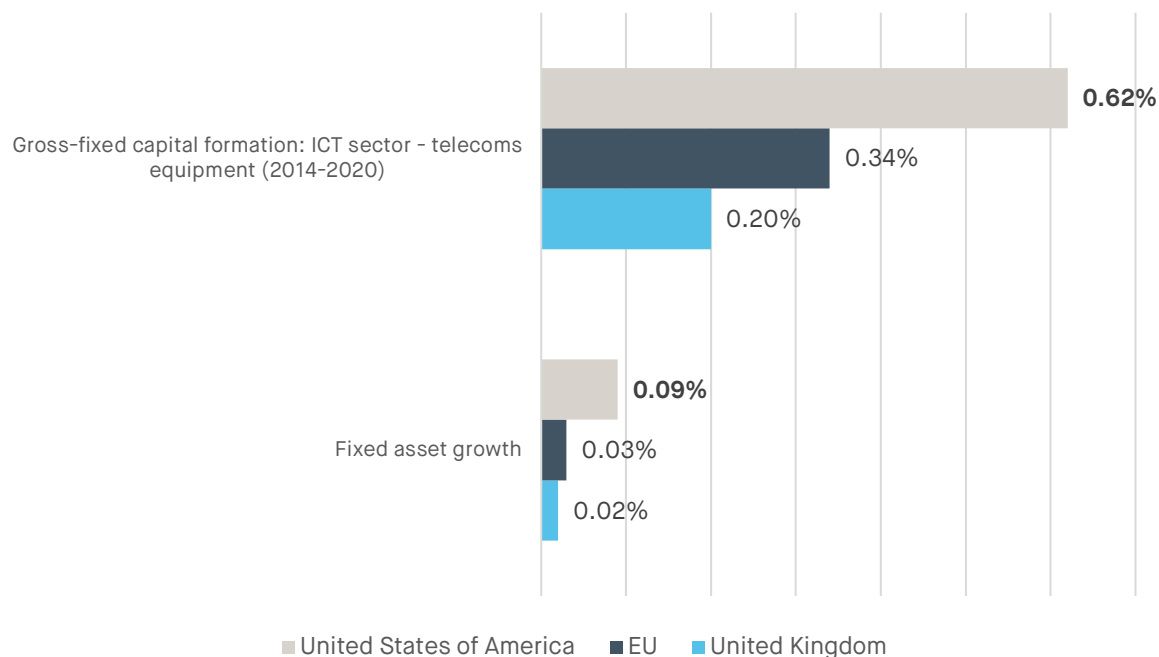
Amongst many potential business users there is not yet a compelling case for investing in 5G, for use in activities such as smart manufacturing. A key part of the reason for the absence of a clear case for upgrading to 5G is the fact that many enterprises see 4G and wi-fi as adequate for most of their needs. For example, one 2019 survey of UK manufacturing executives found that a quarter reported that 'existing network solutions cover my needs' as a key barrier to 5G take-up in their organisation.²⁸ Other research revealed that:²⁹

"...manufacturers often incorrectly believe that their existing connectivity capability already performs around 80% of what 5G is expected to deliver."

This is coupled with additional uncertainty over when might be the right timing for any investment, if it was decided by a business that 5G was needed.³⁰ This general lack of enthusiasm and the uncertainty is reflected in European Commission analysis which found that UK firms were investing much less in 5G, in aggregate, than those in the EU and the US (Figure 7).

^{iv} EBITDA (earnings before interest, taxes, depreciation, and amortization) is a metric of a company's profitability from operations.

Figure 7: Aggregate investment in 5G fixed assets by businesses and telecoms equipment by ICT firms in the USA, the EU and the United Kingdom as a % of GDP



Source: Jodar, T, et al (2023).

Further, there are long-standing suggestions that the UK has a wider structural underinvestment problem especially in relation to technology.³¹ The same Commission research found corroborating evidence for this view, as it pointed out that that capital formation levels in the UK information and communications technology (ICT) sector are substantially lower than in the EU and US.

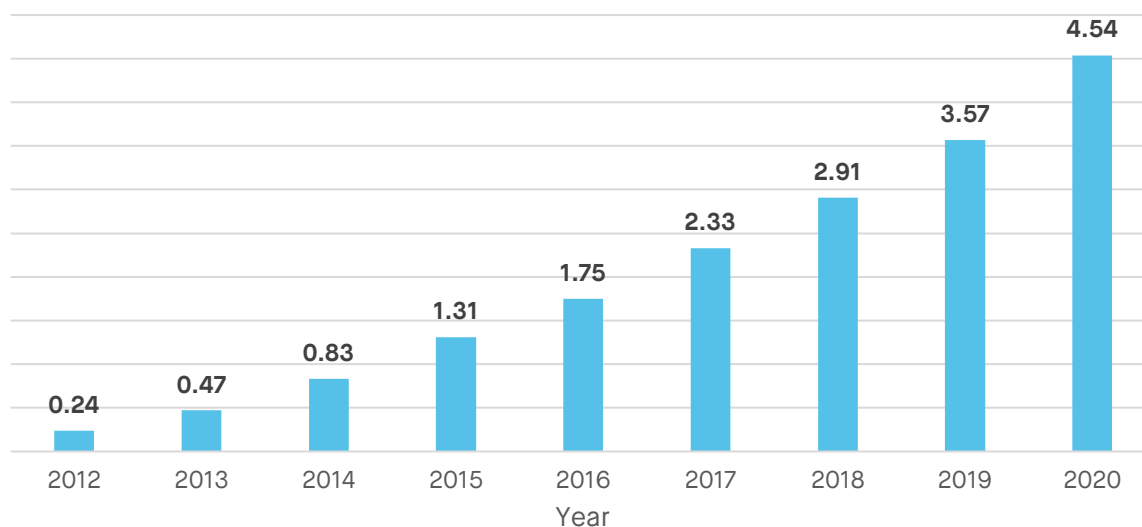
Uncertainty over consumer demand

A similar picture of uncertainty over the potential benefits for individual consumers of 5G is also evident in the UK. For instance, research indicated that the vast majority (82%) of people are satisfied with the speed of their current mobile service.³² One expert we spoke to for this report, reinforced this view. Whilst alone amongst interview participants in making this point, they argued that the existing generation of mobile technology is sufficient for likely consumer needs:

“We’ve already got all the connectivity that we need. As long as you’ve got a decent 4G signal and you’ve got decent home broadband, then actually there’s no benefit whatsoever in going any faster than we currently go.”

Difficulties in monetising 5G services

Closely connected to the overall demand challenges are the difficulties facing MNOs in monetising 5G services. At the heart of this problem are the steep falls in the price of use on the one hand, and the scale of usage on the other, which increased by more than 1700% between 2012 and 2020 (Figure 8).³³ Further, it is expected to continue to do so in the coming years with European mobile data consumption predicted to increase from 15 GB per month to 75 GB per month by 2030.³⁴

Figure 8: Average monthly mobile data consumption per user, UK

Source: Ofcom Communication Market Report 2021

There are other challenges that also feed into investment decisions around 5G infrastructure. For example, ‘network slicing’ is a feature of high quality 5G which allows an MNO to create multiple virtual networks to be customised to operate to meet the specific needs of applications, services, devices, customers or operators. This innovation raises the prospect of significant business-to-business revenues for premium specialised services.³⁵ However, it has been suggested that network neutrality regulations, which aim to ensure the traffic carried across broadband and mobile networks is treated equally regardless of user or purpose hinders the provision of such services and their monetisation.³⁶ To help clarify the current position on what is permissible, Ofcom carried out a review into net neutrality in 2023 and updated guidance.³⁷ But some argue that regulatory uncertainty persists, and that more needs to be done to maximise the potential of 5G services.³⁸

Stimulating demand for 5G to encourage infrastructure investment

A role for government

To address the “chicken and egg” problem, MNOs need to be confident there is a large amount of untapped demand for 5G. That demand does not have to be all from the private sector. One potential source of a considerable quantity of at least initial demand is the government.

Government as a consumer of 5G services

The 5G success of South Korea, is in no small part due to its interventionist approach to promotion the take-up of new telecommunication technologies, which in-turn helps serve as a catalyst for consumers and businesses to follow suit.³⁹ In that vein, South Korea has used public procurement as a “demand leader” to aid the deployment of nationally important new technologies.⁴⁰ This could provide a model for the UK to follow.

A number of experts we engaged with for this research wanted to see such a role played by the UK government. One roundtable participant argued that the government should leverage its control over the NHS and influence over other sectors to help boost demand:

“If there was more demand on the health or transport side, there may be more coverage, whether it's in hospitals or on railway lines or on highways. Some other countries are influencing those sectors more fully”.

Another of the experts we engaged with for this research also pointed the potential demand-side role the state could play:

“Government is a massive customer itself. So public procurement can be a real big tool to address demand side barriers.”

National and local government purchases around £326 billion of goods and services each year.^{41 42} Consequently, the public sector has a large economic footprint that could be used as a source of demand and therefore help reduce the uncertainty around the likelihood of 5G generating sufficient revenue streams for MNOs. A more certain demand outlook would be expected to encourage them to undertake and accelerate 5G investment.

Recommendation 1: The government should use public procurement as a tool to stimulate investment in 5G infrastructure

A clear public procurement strategy for 5G services across the public sector could help de-risk some investment in 5G network infrastructure. An example of how 5G might be integrated into public sector procurement is the funding of the provision of 5G network infrastructure in hospitals across the UK. With more than 900 NHS hospitals across the country, this would deliver a “win-win” of enhanced healthcare provision and a fillip for 5G investment.⁴³

Trials and testbeds

The previous government created the 5G Testbeds and Trials Programme to help demonstrate the potential of 5G to consumers, businesses and the public sector.⁴⁴ For example, the programme:

- Funded projects at the ports of Bristol and Felixstowe that deployed internet of things (IoT) sensors and artificial intelligence to optimise the maintenance of high value machinery, and one that involved the tracking of goods within virtual boundaries to demonstrate how 5G can help create a smart and dynamic port environment.⁴⁵
- Invested around £6 million for Industrial 5G Testbeds and Trials that will focus on advancing the deployment of 5G in industrial settings, exploring use cases such as connected precision manufacturing, virtual reality enhanced automation, and real-time data analysis.⁴⁶

All the projects in the programme were completed by March 2023. An evaluation of it identified that the deployment of 5G enabled technologies delivered returns much greater than the initial outlay.⁴⁷ Given that the “digital and technologies” sector singled out in the recent UK government industrial strategy consultation as one of eight “growth driving sectors”, the case for a government focus on developing 5G and cultivating demand for it seems to be clear. Therefore, government financial support for encouraging the take-up and spreading a better understanding of 5G amongst the private and public sectors would appear to be a wholly appropriate use of public money.⁴⁸

Recommendation 2: The government should revamp the 5G Testbeds and Trials programme and provide the relatively small amount of funding needed to continue to demonstrate use cases across different sectors

The government should seek to build on the success of the Testbeds and Trials programme and continue to highlight what 5G can do for sectors which have the potential to be significant sources of demand for the technology, such as healthcare, particularly given how many organisations lack awareness around the extent of 5G capabilities.

CHAPTER THREE – THE IMPORTANCE OF MARKET STRUCTURE FOR INVESTMENT

The best mobile telecoms market structure for investment

Whilst there is no ‘magic number’ of MNOs, most countries have either three or four dominant players. Within the EU for instance, 19 countries have three mobile operators that account for more than 95% of connections. The remaining eight countries have four players.⁴⁹ The question of the optimal number of market players in the mobile sector is a long-running one. One side suggests that fewer is better for delivering higher levels of investment. The other argues that competition through less concentrated markets deliver the best outcomes.⁵⁰

Proponents of a diffused market structure point to the benefits of competition

Advocates for less concentration point to the comparatively low consumer prices of mobile services in the UK as evidence of success. In 2016, the consumer prices and choice arguments were used to justify the European Commission’s blocking of the proposed acquisition of O2 by Hutchison (the parent company of UK MNO ‘Three’), with the Commission concluding that:⁵¹

“UK mobile customers would have had less choice and paid higher prices as a result of the takeover, and that the deal would have harmed innovation in the mobile sector”.

Further, it is not clear that having fewer players in the market inevitably leads to higher investment levels and a better network as a result. Australia and France, for example, both have markets where four MNOs compete with each other, and both are significantly outperforming the UK when it comes to 5G download speeds and availability (Figures 1 and 2).^{52 53}

The link between a more concentrated market structure and higher investment

Support for a smaller number of market players leading to higher revenues and greater levels of investment was a perspective widely held amongst the experts we interviewed for this report:

“...if you focus upon giving consumers low prices, you reduce the incentives for innovation and investment...it’s a bit of a perennial problem, because the regulators fail to understand the need to promote innovation rather than provide low prices”.

“The number of network operators can’t necessarily be four forever. If we reduce competition, there is a better return on investment that would be expected there”.

The higher mobile prices in countries like Norway and South Korea, all of which are much further ahead of the UK in 5G connectivity, would seem to corroborate this perspective.⁵⁴ Indeed, a recent analysis of network quality, investment and pricing outcomes across EU and a sample of other high-income countries found that whilst market structure is not a robust predictor of 5G coverage outcomes, three-player mobile markets exhibit better network performance and consumer sentiment

outcomes, which can be taken as reasonably reliable proxies for investment levels in mobile infrastructure.⁵⁵

The nature of the competition in the market is important

A more nuanced perspective might suggest that it is the nature of the competition that matters most. For example, if there are MNOs in the market that are too insignificant to provide any serious competition to the major players, then a merger between small struggling operators could lead to stronger competitive forces between the larger and fewer operators.⁵⁶ Indeed, to some extent the debate over the optimal number of players has been superseded by the recent decision of the Competition and Markets Authority (CMA), which will see the merger of Vodafone and Three and see the number of UK MNOs reduce by one.

Box 1: The Vodafone–Three merger raises key market structure questions

In 2023, Vodafone and Three announced their intention to merge into a single company, arguing that this move could unleash £11 billion worth of investment into the UK's mobile network infrastructure.^{57 58 59} The merger would create Britain's largest mobile operator. The CMA raised concerns that the deal could lead to higher prices for consumers and reduced investment in Britain's mobile networks. In a 2020 discussion paper, Ofcom found significant limitations with the evidence supporting the case for consolidation.^{60 61}

But in November 2024, the CMA published its 'Remedies Working Paper' which set out the measures that could be used to prevent a 'substantial lessening of competition' or any other adverse effects resulting from the merger. It found that conditions that the merged firm undertake significant investment to deliver network upgrades, alongside legally binding commitments to retain certain existing mobile tariffs and data plans for three years, as well as pre-agreed prices and contract terms for mobile virtual network operators (MVNOs), could remedy competition concerns.⁶²

On December 5th 2024, the CMA made the final decision to clear the merger between the two MNOs, on the condition that they sign up to the commitments outlined above.⁶³ This development comes shortly after a recent suggestion by the CMA that it is going to review some of its thinking towards competition policy and mergers.⁶⁴ Whether the £11 billion of additional investment materialises will be a useful benchmark against which the ongoing debate over the number of market players and its importance can be measured and the potential change in CMA thinking about merger policy.

The unravelling of vertically integrated MNOs

The growth of Wireless Infrastructure Providers (WIPs)

Another aspect of the mobile market across much of Europe in the last decade has been the emergence of WIPs, resulting in widespread third party ownership and management of much of the mobile infrastructure in many European countries.^{65 66} WIPs typically lease access to passive infrastructure to MNOs who then use it deliver their mobile services to the public and businesses.

The UK has been no exception to this trend. UK MNOs have sought to divest much of the passive infrastructure on which their equipment is sited. This has brought about the state of the market today, where estimates suggest that perhaps as much as 70% of macro mobile infrastructure sites are controlled by WIPs, and therefore independent of MNOs.⁶⁷

The possible impact of WIPs on infrastructure investment

The main significance of the growth of the importance of WIPs for 5G is there potential impact on infrastructure investment. Several factors are at play that is too early to know how they will influence investment. These include:

- The likely consequence of separating out of the building and operating of passive infrastructure from the other aspects of mobile services and their delivery, which remain in the hands of MNOs. The lessons from other network industries, where there has been vertical disintegration, are somewhat mixed, with the rail sector suggesting that separation can result in misaligned incentives and more transaction costs with the disaggregation seeing the sector miss out on lower costs where there is high usage densities.^{v 68}
- The changes to the Electronic Communications Code which has seen dramatic declines in the rents that landowners can charge infrastructure providers (see Chapter 5). As WIPs take control of more infrastructure sites, this means that these savings from rents will initially at least be enjoyed by WIPs rather than the MNOs as was originally expected.
- The concentration in the tower company sector in the UK. There are two main independent tower companies accounting for 64% market share. This significant market power may blunt the impetus to pass through the rent reductions imposed by the ECC to MNOs.^{vi 69} Indeed competition concerns about the tower sector

^v One study estimated that the fragmentation of British Rail saw operating costs rise by a third over the first decade of privatisation. Source: Andrew Smith, Chris Nash, and Phill Wheat, "Passenger Rail Franchising in Britain: Has It Been a Success?," *International Journal of Transport Economics* 36 (February 1, 2009): 33–62.

^{vi} Despite the concentration in the sector, it should be noted that some smaller WIPs do operate. Some of these however, are more focused upon supporting local private networks for specific properties or to cover defined geographic areas, such as London's underground system. By the autumn of 2023 Ofcom reported less than 20 fully operational commercial private networks, which was down by more than a quarter of the year before. Private networks are limited in number but growing and there are many providers both MNOs and others. These

have been raised by the CMA. It noted for example, in its final report on the Cellnex acquisition of Three mobile infrastructure in 2021, that:⁷⁰

"Overall, the evidence shows that pre-merger there has been limited competition in the supply of access to developed macro sites in the UK. Cellnex (previously, Arqiva) has had a very high market share and, along with high costs of switching and significant barriers to entry, this has allowed several WIPs to earn substantial profit margins."

Despite concerns at the time, there is little indication that regulators have subsequently examined the WIP market and how competition is evolving within it, nor how its market composition may be impacting investment into 5G infrastructure development.

Having noted that it is perhaps too early to know how WIPs will ultimately influence investment levels in UK mobile infrastructure, the European picture suggests there are no inherent constraints on investment from an extensive WIP sector. For example, in France WIPs control a significant proportion of sites, yet France is proceeding with its 5G rollout with much greater success than the UK.^{71 72} This suggests that any negative effect WIPs have on the UK will likely be more to do with unique elements of the UK's operating environment, whether that is the problems with the ECC, the particular structure of the tower market or other elements of the policy framework.

WIPs could make it easier to share infrastructure

Tower companies do however provide an opportunity for easier infrastructure sharing, which could help cut some of the investment costs needed to help shift the UK to the 5G "global frontier".⁷³

Box 2: Mobile infrastructure sharing

There are two main dimensions to mobile infrastructure sharing. The ownership arrangements and the equipment arrangements. For instance, the site infrastructure can be owned by an MNO and shared with other MNOs or by a third party such as a tower company, with space at a tower company site leased out to more than one MNO.^{vii} Where the sharing is of site infrastructure

networks can slice spectrum and the non-MNO operators rely upon shared access agreements to utilise local spectrum for such services. Authorisations are provided either for single base stations at a medium power level, or multiple lower power base stations. Source: "Connected Nations 2022," [www.ofcom.org.uk](https://www.ofcom.org.uk/phones-and-broadband/coverage-and-speeds/connected-nations-2022/), February 7, 2024, <https://www.ofcom.org.uk/phones-and-broadband/coverage-and-speeds/connected-nations-2022/>.

^{vii} Tower companies are described as "neutral hosts" of "passive" (wireless network) infrastructure, e.g. mobile towers. There are two main types of tower: ground-based and rooftop. The former are typically freestanding and are more common in areas with low population density. The latter, are usually sited on buildings or other structures and found primarily in high-population places. Tower companies can also operate small cell infrastructure.

such as a mast, this is called “passive sharing”, whilst “active sharing” is the sharing of equipment used to operate the network.

The potential benefits of more sharing could be significant. Sharing reduces the number of places needed in a locality for infrastructure, operators only have to cover a proportion of the capital and operating costs of those fewer sites and the consequent reduction in the number of planning processes that need to be gone through, together, imply the potential for substantial savings. Sharing could offer a way of lowering the amount of resources that MNOs or WIPs have to expend to deliver a particular amount of coverage.

One analysis of sharing across numerous European countries found substantial benefits across several domains.⁷⁴ Examining 3G rollout experiences, the research found that passive sharing was particularly associated with reductions in capital expenditure, higher profit margins, greater coverage and lower user prices.⁷⁵ Looking into 4G experiences across countries, the same study identified that active sharing was linked to wider coverage and faster download speeds.⁷⁶

A modelling exercise for the UK government suggested infrastructure sharing could help deliver substantial reductions in both capital and operating costs for 5G infrastructure. Looking at different scenarios, the sharing of infrastructure was forecast to cut capital expenditure costs by between 36% to 48% over a base scenario, depending on the exact nature of the sharing (e.g. widespread sharing of infrastructure across the network, only in rural area or small cells) and details of the scenarios used.⁷⁷ Operating costs for MNOs, the exercise suggested, could reduce by between a third and almost a half.⁷⁸

Sharing, however, will not be a panacea for facilitating the rollout of high-quality 5G across the whole UK. Modelling cannot capture all the complexities of the real world. For example, the gains on the reductions in capital expenditure from sharing have to be seen in the context of the age of the UK’s existing mobile infrastructure and the likelihood that expanding or re-using it may not be possible in many instances because it is sub-optimally sited for 5G connectivity or unsuited to certain equipment. Furthermore, it is likely that the changing nature of the telecoms market, namely the growth of Wireless Infrastructure Providers (see Chapter Three), could dilute some of the benefits that sharing delivers to MNOs and their ability to develop mobile infrastructure.

With these qualifications suggesting the benefits that accrue from sharing could be at the bottom of the range noted in the modelling above, it could still

reduce the amount that needs to be invested for the UK to achieve extensive 5G rollout by as much as £15 billion.^{viii}

A more balanced view by regulators towards the UK's mobile telecoms market structure

In several of our interviews there was an underlying concern that policy and regulation towards mobile overly prioritised short-term efficiency in the form of consumer prices and choice relative to factors such as long-term investment. This would be consistent with Ofcom's role as an economic regulator set-up to deliver market-focused outcomes for users, as was noted in a government policy paper:⁷⁹

"...the role of economic regulators should be concentrated on protecting the interests of end users of infrastructure services...by ensuring the operation of well-functioning and contestable markets where appropriate or by designing a system of incentives and penalties that replicate as far as possible the outcomes of competitive markets".

On balance, the evidence does suggest that the UK could benefit from a policy and regulatory approach that took a more explicitly positive view of the need to encourage investment. Therefore, there could be some long-term 5G benefit for the UK if the policy framework and relevant regulators took a more active and holistic view of sectoral developments and consequently, as a principle, were more willing to intervene if and when evidence emerges that key national objectives such as more investment in next generation infrastructure such as 5G are not being achieved because of how an industry such as the MNO or WIP sectors are structured and operated.

^{viii} See Figure 5 for estimates of the 5G investment gap.

Recommendation 3: Policymakers and Ofcom should do more to consider the longer term ‘dynamic’ impacts on the economy that arise from low investment in key infrastructure such as 5G, and pay particular attention to the potential effects on investment and competition caused by the alteration of the telecoms value chain with the divestment of mobile infrastructure by MNOs to WIPs

A judicious rebalancing in the policy and regulatory approach to the mobile sector could reap long-term infrastructure investment dividends especially in the context of the UK’s market-led environment and the need for significant investment from operators (both MNOs and WIPs) to finish off the UK’s 4G rollout and shift the UK to a new generation of mobile technology. The government should launch a consultation on how this might be delivered, including whether the legislation that governs the communications industry needs amendment.

Furthermore, Ofcom and the CMA should launch a joint study of the ongoing impact of WIPs on the dynamics in the mobile sector in order to provide a baseline for a regular monitoring exercise into how their growth is influencing investment in 5G infrastructure. This could be particularly useful in spotting any potential negative developments given the CMA, as recently as 2021, raised concerns about Cellnex Telecom’s acquisition of CK Hutchisons’s passive infrastructure.⁸⁰

CHAPTER FOUR – THE IMPACT OF SPECTRUM POLICY ON 5G INVESTMENT

Spectrum policy has focused upon efficiency not investment

Another cause of the 5G investment gap and therefore a key reason why the UK has experienced a lacklustre rollout of 5G so far is the approach taken to spectrum. In broad terms, spectrum policy consists of the auction of portions of the UK's electromagnetic spectrum to MNOs for a fixed period of time. After that initial period expires, continued use is ensured through a system of annual fees. A key impetus behind this approach has been to prioritise efficient use of spectrum over other goals such as investment, as one of the experts we interviewed for this project noted:

“...the theory is... if they have to pay for the spectrum, they will have higher incentives to utilise it efficiently...”

However, as the same expert pointed out, this misunderstands how MNOs operate:

“...in reality, operators don't have a function within the company... [asking whether] we are utilising these resources efficiently or not. You get the spectrum...then you build a network... such mechanisms have little positive impact on the functioning of the mobile sector in the UK”.

The potential for a more balanced approach was implied in the spectrum statement which accompanied the previous government's 2023 Wireless Infrastructure Strategy. It stated that spectrum policy should balance consumer objectives with the need to promote innovation and investment.⁸¹ However, this belated recognition has not yet been reflected in policy changes.

The connection between the cost of spectrum to MNOs and 5G infrastructure investment

Reducing the cost of spectrum licences could boost investment in mobile coverage and quality

The available evidence suggests that a spectrum policy which reduced the cost of spectrum to MNOs could boost the levels of investment made by MNOs at least, in the speed and extent of 5G coverage. For instance, empirical work testing the relationship found that:⁸²

- Higher spectrum prices are linked to poorer customer experience.
- Lower spectrum costs are associated with better wireless connectivity scores.

In other words, the expenditure by MNOs on spectrum costs diverts resources away from investment in infrastructure.⁸³ This relationship between spectrum costs and investment was reinforced in a number of the expert interviews that help inform this project. For example, one of our interviewees pointed out that the UK's 3G experience was a clear illustration of the high cost of spectrum constraining investment in a new generation of mobile infrastructure:

“...the 3G auctions really took a lot of money out of the mobile industry in the UK, and that held back the investment...a lot of money went into the government’s hands...[but]...that led to a relatively slow 3G rollout”.

This insight prompted a number of those we spoke with to suggest that spectrum policy could and should be changed to be more encouraging of investment. One expert put it in the following terms:

“...the current approach does not take into account the investment side... And if, for example, we want to make sure some of the networks are sustainable, there may need to be some cost reduction in the license regime compared to what is being paid today”.

There are a wide variety of approaches to spectrum across countries

Spectrum policy varies considerably between countries (Table 1). A number of countries look to prioritise the encouragement of investment in greater and better quality coverage. For instance, as one report which looked into comparative spectrum policy in various countries summarised that some require:⁸⁴

“...licence obligations...with fees replaced with indirect costs (i.e. the costs of investment)”.

As the report further noted:⁸⁵

“An advantage of this approach is that policy objectives relating to investment or innovation can be achieved through including them in licence obligations”.

Countries like France, Portugal, the US and Norway have all awarded or renewed spectrum licences on the basis of investment obligations and performance requirements rather than auctions and fees, or at least have reduced fees in lieu of specific infrastructure investments (see Table 1).

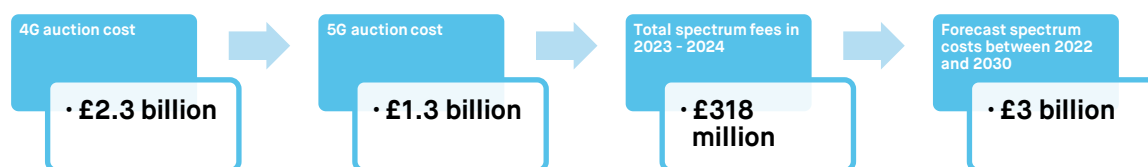
Table 1: The different approaches to spectrum policy in selected countries

Country	Overall approach to spectrum	Nature of the requirements	5G rollout compared to the UK
France	Renewal auctions waived and no fees in return for meeting coverage requirements. ⁸⁶	Renewal of the licence dependent on coverage obligations being met. ⁸⁷ Specific obligations include improving nationwide reception quality, each operator deploying at least 5,000 additional cell sites and upgrading all sites to 4G to cover a million more	5G users in France can expect 5G coverage around 50% more of the time than their UK equivalents. French 5G users are typically able to download data 126Mbps faster than British users.

		people and all rail and road corridors. ⁸⁸	
Portugal	No fees and licence renewal based upon investment commitments.	Coverage improvement benchmarks that require MNOs to provide mobile services to 100 parishes of 100Mbps or more. ^{89 90}	5G signal around 50% more often than UK users. Download speeds around 114 Mbps faster than the UK.
United States	No fees for licence renewal but there are investment obligations for MNOs.	Licence renewal comes with spectrum use requirements and network infrastructure obligations, and is made on the basis of the conditions previously agreed to by MNOs being met. ⁹¹	5G signal about three times more often than UK users and enjoy. Typical download speeds that are 62Mbps faster than the UK.
Norway	Discounts on auction prices for investment commitments.	For their portion of the 700 MHz to 2100 MHz spectrum MNOs committed to delivering specific regional coverage obligations, e.g. transportation corridors such as railway lines and roads have coverage. ⁹²	5G reception about 14.7% of the time, compared to 10.8% in the UK. Download at 220.5Mbps, compared to 115.8Mbps in the UK.

Abolishing auctions and annual spectrum fees could free-up resources for infrastructure investment

If the spectrum allocated to MNOs in 2018, for example, had not been done through an auction process and instead had been administratively distributed in return for investment commitments, more than £1 billion of extra finance would have been available for investment in infrastructure.⁹³ Further, no longer charging the annual fees that are currently levied on MNOs could release up to £3 billion for investment in next generation mobile infrastructure by 2030. In combination, the UK could have seen more than £4 billion more invested in 5G between 2018 and 2030, which could have closed the anticipated investment gap by between 16% and 20%.

Figure 9: The cost of acquiring spectrum for MNOs

Sources: BBC (2013), Financial Times (2021), Analysys Mason (2022), Ofcom (2023) and Clark and Rankl (2024)

N.B. Please note that the assumption on spectrum costs is that fees remain at the 2023-24 level across the period. In all likelihood there would be some increase over time.

The duration of spectrum licences and the effect on MNO investment in infrastructure

The empirical evidence on the link between spectrum licence duration and infrastructure investment is more mixed than that for the cost of spectrum. One study found what it described as a:

“...strong positive correlation between average licence duration and tangible investment per capita”.⁹⁴

The same study estimated that for every extra year a licence for spectrum was granted in the cases it examined, it induced around £1.30 in average per capita investment in mobile infrastructure. In a given year in the UK, that would imply additional investment of about £85 million, or £850 million over a decade.⁹⁵

That there is a positive link between licence duration and investment was also the view of a number of our interviewees, too. Several argued that the UK approach to licence duration was discouraging investment. For example, one noted that long licence terms are more certain and create more scope for MNOs to use spectrum assets to raise external capital:

“...as soon as you've got spectrum for many years, you can borrow money against it. It's an asset on your balance sheet...”.

In addition, it is notable that licences of at least 20 years duration are recommended by the intentional mobile industry body the GSMA. Two decades is also the minimum requirement set out in the European Electronic Communications Code (EECC) that EU Member States have to follow.⁹⁶ In Spain, for instance, the EECC has resulted in the Spanish authorities introducing 20 year length licences with the opportunity for a 20 year extension and with the possibility of further renewal after that.^{ix} The EU approach of trying to deliver certainty over both the length of the initial period and

^{ix} The law included a provision by which current mobile spectrum license holders could ask for an extension of all existing licenses of up to 10 additional years with a maximum of 40 years total duration, with the possibility of renewals once the extensions expire. The changes in Spain are widely seen as enabling the recycling of the spectrum allocated for 3G to 5G use and the expansion of 5G coverage. Source: Spain extends mobile operator spectrum licences by 10 years – 5G Observatory

the length of the renewal has been seen in a number of quarters as likely to be positive for investment because of the reduction in uncertainty that it brings.⁹⁷

However, despite the high degree of consensus, a 2023 study suggested that the relationship between the duration of spectrum licences and capital investment levels in mobile infrastructure was more ambiguous.⁹⁸ Although, it should also be noted that no negative impacts of longer licencing have been observed.⁹⁹ Therefore, whilst it is too early to be definitive about the difference that longer spectrum licences can make, what can be said is that experimenting with them is likely to have little downside and could deliver benefits.

A new approach to spectrum policy that emphasises investment

The balance of evidence indicates that a different spectrum policy could help to close the investment gap and make an important contribution to helping the UK move much closer to the “global frontier” of 5G coverage and quality. It can do this by trying to learn lessons from the spectrum policies of other countries where those policies more closely reflect the accumulated evidence. More specifically, such lessons involve reducing the amount of resources absorbed by spectrum costs and bringing more certainty to holding and renewal of spectrum licencing.¹⁰⁰

Recommendation 4: The government should overhaul spectrum policy by eliminating annual fees levied on MNOs in exchange for clearly defined 5G investment guarantees, replace future auctions for a system of spectrum allocation based upon agreed investment plans and licences that are at least 20 years in length and which are renewed on the grounds of past performance and future promises

If eliminating fees and auction costs, alongside altering the length of licence awards, are to deliver concomitant increases in investment, then this reformed process will need to place either investment, coverage and quality requirements, or a combination of the three, onto those MNOs that benefit from the changes.¹⁰¹ This will necessitate a stronger oversight role from the regulator to ensure the right benchmarks are agreed and that they are met. To ensure compliance, the regulator will need a tool-box of powers to ensure compliance, including the power to terminate a licence where failure is persistent and significant.

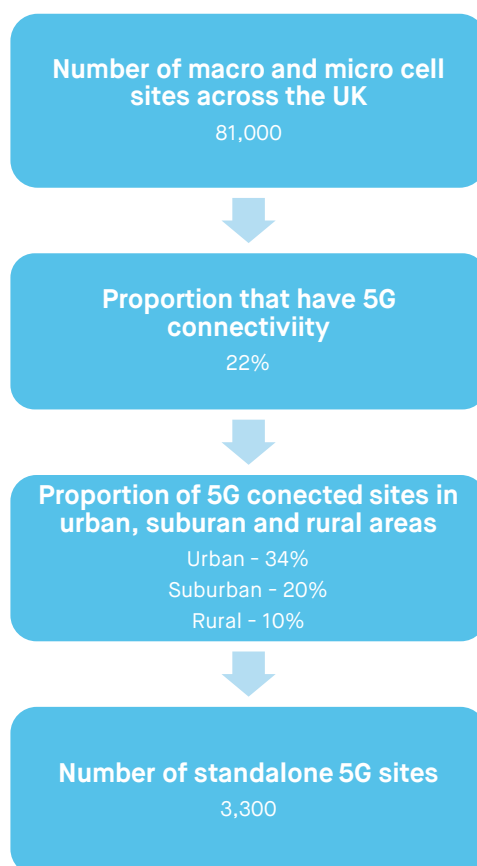
CHAPTER FIVE – ENSURING A SUFFICIENT SUPPLY OF LAND FOR MOBILE INFRASTRUCTURE

5G requires more sites for mobile infrastructure

The demand for land for mobile infrastructure

To ensure the country achieves ubiquitous 5G over the next decade, considerably more sites for mobile infrastructure will be needed, even if infrastructure sharing is used more widely. This makes the supply of land for sites an even more vital component in the success of the UK's 5G rollout than it was for the spread of previous generations of mobile technology.

Figure 10: The UK's mobile site network, 2023



Sources: Ofcom (2024) and National Infrastructure Commission (2024)

Existing sites may not be easily changed to 5G use

The macro and micro cell density necessitated by 5G means that the number of sites needed for infrastructure may need to double.¹⁰² A further factor that needs to be considered by policymakers is that some of the current sites being used for 3G or 4G may not be suitable for 5G equipment or for sharing. Consequently, policymakers cannot assume that legacy 3G sites for instance can be turned into 5G sites. Rather, it seems likely that in some instances additional new sites may need to be found where a direct replacement of infrastructure is not possible. The significant uptick in demand for land and other property for siting 5G infrastructure therefore makes it

imperative that there is sufficient interest in supplying it from private providers and the public sector.

Past policies may have “chilled” the supply of land

Counter-productive effects of efforts to reduce the costs of accessing land

To ameliorate what many described as the “ransom rents” that some private landowners and public bodies charged MNOs and WIPs for siting mobile infrastructure on their property, in 2017, the then government aligned the rules on land valuation for mobile infrastructure sites with those charged for other types of national infrastructure.¹⁰³ Prior to the 2017 reforms to the ECC (see Box 3) the “ransom rent” problem was seen as particularly egregious in rural areas, as was highlighted by one expert contributor to our roundtable:

“...if a landowner has thousands of acres, that is effectively a monopoly of that area and that becomes a reference point for others... rents had become very inflated...[with]...arbitrary additional charges for upgrading and all that...the huge premium was a massive threat to the roll out of supply”.

Box 3: Key changes to the ECC brought in through the Digital Economy Act 2017

The ECC is a set of rules that are aimed at helping facilitate the installation and maintenance of electronic communications networks.¹⁰⁴ Revisions to the ECC, brought in through the Digital Economy Act (DEA) 2017, aimed to make it easier for mobile infrastructure to be built by cutting the cost of accessing land for MNOs and WIPs and, in particular, deal with the issue of “ransom rents” charged by some landowners.¹⁰⁵ It looked to do this through:

- Widening the definition of a “Code Operator” to include WIPs, bringing third party infrastructure owners such as tower companies within scope of the code.
- Introducing a new valuation system for the rent landowners receive for allowing communications infrastructure to be built on and operated from their property. It required that the amount of rent that can be charged reflect the value of land without the presence of telecommunication equipment.¹⁰⁶
- Creating a dispute resolution procedure to try and make it easier to resolve disputes between infrastructure providers and property owners where they arise.

UK rents appear to be broadly in-line with those of several other countries

Analysis published in 2013 suggested that the typical rental cost for an operator was £5,570 per year (the equivalent of £7,600 in 2024 prices).¹⁰⁷ However, it is not clear

that UK average rents prior to the ECC were significantly out of line with those in other European countries, as the Law Commission observed in its 2013 report into the topic.¹⁰⁸ More recent data shows that in 2020, average land rental costs for macro sites in Germany were around €5,000, €8,000 in Spain and €12,000 in Greece.¹⁰⁹

Whilst the UK does not appear to have been an outlier, nevertheless, it should be acknowledged that such averages in any country disguises considerable variation. This variation is often driven by factors such as topography, population density, the proximity of other public infrastructure, the strength of demand for the same land or building space for alternative purposes or the power disparities between the negotiating parties. Consequently, as the Law Commission acknowledged, the risk of “ransom rents” did need to be dealt with.^x Overall however, the Law Commission judged that the best way forward was a market based approach, tempered with ameliorations that would help avoid any exploitation of monopoly land situations.^{xi 110}

Eschewing the Law Commission’s market based approach

The government did not follow the Law Commission’s recommendation. It expected the ECC changes to reduce the costs of rent by around 40% for MNOs, suggesting that the reform could save £709 million over 20 years, or around £35 million per annum.¹¹¹ The latter equates to 0.3% of total MNO revenues in 2020, suggesting only a small financial gain was expected. The impact on rents has been more dramatic.¹¹² Consequently, one analysis has estimated that site providers have lost as much as £209 million a year in additional income.¹¹³ As one participant in our roundtable argued, in many instances the losses were experienced by:

“...hospitals, it’s councils, its sports clubs, it’s a local farmer for whom that three or five grand actually means quite a bit...”.

Further, the evolution of the mobile infrastructure sector through the emergence and growth of WIPs (see Chapter Three) creates additional ambiguity over the extent to which the gains that significantly lower rents generates for infrastructure owners will feed through into new and improved infrastructure. Certainly, the tower companies

^x Section 1.57 of the ECC provides operators with the right to “*upgrade...their apparatus so long as those changes have no adverse impact or no more than a minimal adverse impact on the appearance of the apparatus and imposes no additional burden on the Site Provider*”. Source: “Electronic Communications Code,” www.ofcom.org.uk, February 26, 2019, <https://www.ofcom.org.uk/phones-and-broadband/telecoms-infrastructure/electronic-comm-code/>.

^{xi} Recent economic modelling implied that this approach would perhaps have had a larger positive impact on GDP than the one the government implemented through the ECC both prior to and after the proposed expansion under the PSTI Act 2022. For example, it suggested that the current ECC arrangements over land valuation or extending them in the PSTI Act 2022 could see a £2 billion negative impact on GDP in the same year such changes were implemented. Over ten years the same exercise predicted a GDP loss of £7.4 billion from the current ECC approach and £6.2 billion if the extensions go ahead. Source: Pushpin Singh, “Douglas McWilliams, Deputy Chairman of Cebr, Explains More about Our Research for Protect & Connect,” *CEBR* (blog), May 18, 2021, <https://cebr.com/reports/douglas-mcwilliams-deputy-chairman-cebr-explains-more-about-our-research-for-protect-connect/>.

are not under any obligation to reinvest the savings they may now be benefiting from. Further, as noted in Chapter Three, there are unanswered questions about whether the concentrated nature of the UK's WIP sector will hinder the emergence of a dynamic infrastructure service that supports the country's connectivity ambitions.^{xii}

Box 4: The impact of the ECC valuation rules on providers

It has been reported that the typical fall in rents for land for the siting of mobile infrastructure has been as large as 70% rather than the 40% anticipated by the government.¹¹⁴ And, whilst this figure disguises some variation, nevertheless, what is clear is that there have been some substantial falls, which have caused considerable problems for those previously receiving higher rents for hosting mobile infrastructure, which have included churches and sports and social clubs.¹¹⁵ For example:

- Widely covered in the press was a story of a former Wiltshire farmer seeing the renewal offer under the revised ECC from a tower company for two masts on his land fall by 95%. The £17,000 he was previously receiving for two masts on his property were the main form of income for the landowner.¹¹⁶
- Another story that was extensively publicised focused upon a Yorkshire church that relied on renting space on its tower for two mobile phone masts for a quarter of its annual income (£14,000) and regularly used the revenue to cover annual repair costs. However, an MNO, utilising the terms of the revised ECC valuation regime, cut the rent offer by 93%. This would have made it impossible for the parish to continue to cover its annual maintenance costs alongside its other expenditures, according to a parishioner quoted in the article.¹¹⁷
- A third illustration of the impact of the ECC is that of Hillingdon Hospital in London which experienced an 89% drop in income from the mobile infrastructure it hosted. In addition, it had to pay the MNO it had the hosting arrangement with £300,000 after losing a dispute over a new rental agreement in 2020.¹¹⁸
- A less well known example comes from HomeGround, a property management company overseeing around 200,000 properties across England and Wales. A number of the residential buildings that they manage host mobile infrastructure. However, the ECC changes have seen rental income fall by around 80% with operators reportedly challenging statutory legal and surveyors' fees, leaving landlords with unrecoverable costs. The situation has deteriorated in 19 instances to the extent that litigation has been initiated.

^{xii} A competitive WIP sector would see Tower Companies pass on at least a portion of the rent savings to MNOs or reinvest them to expand their market share. However, the CMA has observed how concentrated the WIP sector appears to be and this could lead to a tendency to sweat assets rather than reduce leasing prices or make infrastructure investments.

The unfolding consequences of the ECC for the supply of land for mobile infrastructure

For those concerned about the UK's mobile connectivity and the rollout of 5G in particular, perhaps the most significant impact has been somewhat of a “chilling” effect on the supply of land (see Box 5).

Box 5: The unintended consequences of the ECC statutory valuation framework

A number of organisations have observed disruption to the market for land and other property for mobile infrastructure sites since the revised ECC's implementation. For instance, the British Property Federation (BPF) described the emergence of a “...hostile environment between landlords and operators”.¹¹⁹ The Law Society of England and Wales have broadly concurred with this view, pointing out that:¹²⁰

“The...presumption in favour of operators has resulted in site providers being on an unequal footing when challenging decisions, with many reacting with obstruction, unwillingness to cooperate and litigation”.

The previous government acknowledged that problems had been caused by the ECC changes:^{121 122}

“Although the introduction of the statutory valuation framework in the 2017 Code reforms has reduced deployment costs for operators, we recognise that this has had an impact on the willingness of occupiers and site providers to agree, or renew, Code rights”.

One analysis found that since the ECC reforms, 8 in 10 negotiations for sites under the ECC regime took longer than the expected 6 months, with a typical length of 11 months.¹²³ Others report that the impact has been even more significant with negotiations now lasting up to 18 months – three times longer than that presumed when the ECC changes were made.¹²⁴ A summary of responses from stakeholders to a recent consultation exercise on possible further changes to the ECC highlighted that:¹²⁵

“...stakeholders have reported that negotiations do not always progress smoothly and agreements can take a long time to complete. This is holding back homes and businesses from accessing better mobile coverage...”.

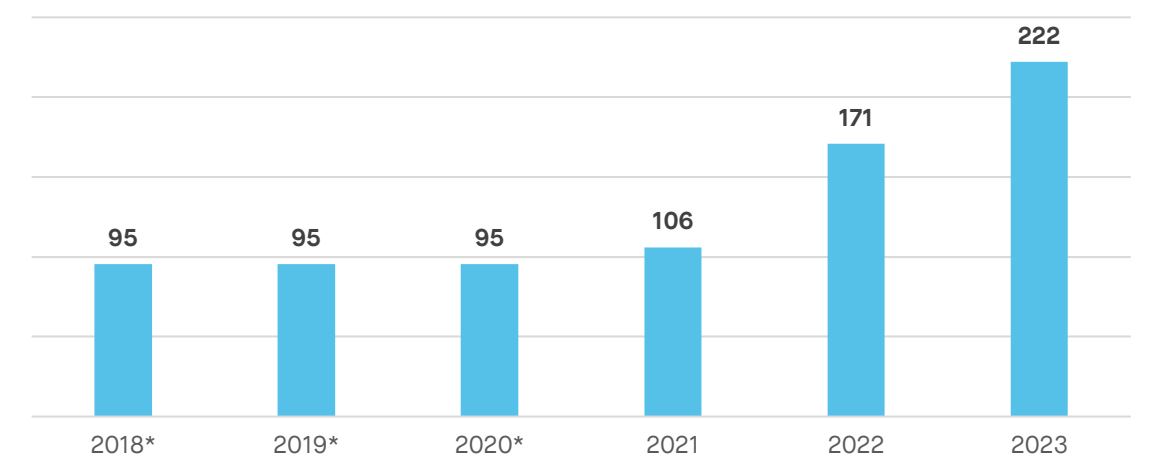
An economic analysis of the impact of the ECC changes plus the likely consequences of extending their coverage to arrangements currently outside its scope through provisions in the Product Security and Telecoms Infrastructure (PSTI) Act 2022, indicated that the 5G rollout would slow down. It estimated the impact could be 27% fewer (9 million) people with

5G coverage than would otherwise have been the case in the short-term, and 1.2 million less in the medium-term.^{xiii xiv 126}

The growth in land access litigation

The “frictions” that have emerged around the supply of land for mobile infrastructure after the ECC reforms have resulted in significant growth in litigation, with at least 785 cases being referred to the Upper Tribunal (Lands Chamber) in England and Wales between 2018 and 2023 (Figure 11). From 2021 to mid-2023, the number of ECC cases referred to the Upper Tribunal (Lands Chamber) grew by 109%.^{xv} The disputes that reach the litigation stage are those that have become the most difficult to resolve and have therefore likely persisted for the longest period of time. As such, and as the wider evidence touched upon in Box 5 indicates, the cases going into the tribunal system are probably the “tip of the iceberg”.

Figure 11: Land access disputes referred to the Upper Tribunal (Lands Chamber) in England and Wales



Source: Upper Tribunal Lands Chamber Telecommunications Users Group meeting minutes - 12 October 2023 - Courts and Tribunals Judiciary

*Figures for 2018, 2019 and 2020 are averages of the number of disputes during the period 2018-20

^{xiii} The PSTI Act 2022 enables the extension of the land valuation provisions of the ECC to be extended to 15,000 more arrangements which are currently governed by the Landlord and Tenant Act 1954.

^{xiv} The Act extends the new valuation regime to approximately 15,000 rental agreements between operators and site providers that are governed by the Landlord and Tenant Act 1954 and the Business Tenancies (Northern Ireland) Order 1996. Source: “Sir Chris Bryant Speech at Connected Britain 2024,” GOV.UK, September 12, 2024, <https://www.gov.uk/government/speeches/sir-chris-bryant-speech-at-connected-britain-2024>.

^{xv} Scotland has also seen 22 ECC cases decided by the Scottish Land Tribunal, including nine in 2024 alone. Source: Electronic Communications Code [Decisions: The Lands Tribunal for Scotland]

The future trajectory of disputes under the ECC

Further, experts on the Upper Tribunal Lands Chamber Telecommunications Users Group estimate that, if the provisions of the PSTI Act 2022 are implemented, then the number of annual referrals to the tribunal is likely to double. The analysis from the Upper Tribunal Lands Chamber Telecommunications Users Group indicates that in the first full year of implementation, the tribunal could see around 600 referrals. If the latter trend continued for the rest of the decade, there could be as many as 9,000 cases annually by 2030–31. The accumulated cost implications of so many tribunal referrals could be substantial. For instance, a full tribunal case can incur costs upwards of £100,000, in addition to the time spent on the dispute.^{xvi} Even going to mediation could cost the disputing parties around £10,000 for advice and the mediation service. The cost is not just the direct financial burdens of a dispute that has gotten to the point where it has to enter the tribunal system. It is also the opportunity cost of people and resources being diverted away from more productive alternative tasks.

However, it should be acknowledged that one of the experts at our roundtable argued the post-ECC market for land could be showing some signs of settling after the disruptions caused by the changes, and therefore there might be a drop-off in tribunal referrals in time:

“... there have been disputes, but operators are suggesting that...the market is beginning to level...things are improving”.

If the market is “settling down” the evidence for this would no doubt begin to be seen in reductions in the number of referrals to the Upper Tribunal (Lands Chamber) in the coming months and years. Time will tell if this is the case. However, currently the balance of evidence suggests the problems with the ECC (see Box 5) remain significant and there is a real prospect that they could worsen if its provisions are extended.

Despite some divergence in views over the likely future trajectory of ECC disputes, at our roundtable an element of consensus was found, when one expert suggested that there were good points on both sides and that a synthesis of the perspectives could be reflected in a reformed ECC:

“...the way it’s been approached by government has thrown the baby out with the bath water...instead of trying to do something about how it was functioning, to get the balance right, they decided that everyone who owned a site was guilty. In fact, it’s more complex than that and we’re going to end up with fewer pieces of infrastructure rather than the more that we need”.

^{xvi} This is the estimate for litigation provided to us by AP Wireless.

Boosting land supply through making more public sector property available

Learning from how other jurisdictions tackle land scarcity

To ensure there is sufficient land and buildings and other relevant property on which to build the greater density of mobile infrastructure needed to rollout high-quality 5G across the whole country, evidence from other countries suggest that there is a key role for public land, buildings and other public infrastructure in facilitating it. The important contribution of the public sector to facilitating 5G rollout is recognised in the EU's Gigabit Infrastructure Regulation. It places requirements on Member States to boost access to public land and buildings to help facilitate the spread of 5G across the EU.¹²⁷ More specifically, it introduces an "access obligation" to public sector owned or controlled infrastructure, including public buildings.

Further, as was observed at our expert roundtable, countries like Denmark offer publicly owned land at low cost to operators in order to encourage them to utilise it to build mobile infrastructure:

"...in Denmark the presumption is public land is available for minimal rents, so we should look at Denmark to see what are they doing and we can learn lessons".

The British state could lead by example and ease land supply constraints

The government (central and local) owns a considerable amount of land and property across the UK.^{xvii} With public land directly under the control of national or local government, there is an opportunity for leadership by example over land supply. For instance, in urban and suburban areas where buildings may have to be used to host mobile infrastructure the current limitations on the use of government owned property is unhelpful, as was noted by one of the expert we spoke to for this project, who argued that:

"...if we're looking at putting more cells in a city to fill in not spots, then things like access to government buildings, would make a big difference, which at the moment you can't do...you're not allowed to put mobile masts on them..."

The same principle extends to publicly owned amenities such as "street furniture" for which it can also be difficult to place mobile infrastructure such as aerials on. Yet, facilitating densification particularly through the deployment of many more micro cells is key to achieving widespread high-quality 5G coverage in the UK.¹²⁸ Therefore, changes which opened up more opportunities for deployment on public sector assets, would seem to be one way of easing the land supply issues the UK faces.

^{xvii} In 2019-20 estimates suggested central government alone owned £459 billion worth of land and property. Source: GOV.UK. "Whole of Government Accounts, 2019-20." <https://www.gov.uk/government/publications/whole-of-government-accounts-2019-20>.

Tackling land supply issues as part of a “new deal for 5G”

The balance of evidence suggests that the unintended consequences that have resulted from the ECC changes need to be ameliorated if the UK is to have an effective market for the land for the placing of mobile infrastructure. There are also precedents, particularly from other jurisdictions, for a more prominent role for public land and other property in facilitating easier 5G rollout. Therefore, as part of the “new deal for 5G” proposed in this report, measures to improve the flow of land made available for mobile infrastructure are central. In conjunction with the planning reforms outlined below in Chapter Six, these changes could lead to a notable uptick in the speed with which and the amount of 5G mobile infrastructure that can be rolled out.

Recommendation 5: The government should reform the ECC valuation regime so that there can be a fair distribution of the economic gains from the use of land for mobile infrastructure between land providers and MNOs and WIPs

A revised ECC should repeal the current valuation rules and replace them with a “modified market” approach whereby the economic value is shared evenly between the parties to the arrangement and not wholly captured by one side or the other. Such an approach, by adjusting the incentives facing the parties involved, would preserve a substantial amount of the impetus for providers to offer-up a land or a building for mobile infrastructure, while helping to reduce the risk that “ransom rents” are likely to re-emerge as a problem. It would also enable MNOs or WIPs to hold onto some of the value and use those savings for reinvestment in infrastructure.^{xviii} Further, as the Law Commission itself highlighted when it reported on its findings in 2013, the Royal Institute of Chartered Surveyors (RICS) “red book” provides a useful basis on which to make agreeable decisions about appropriate valuation.¹²⁹

^{xviii} How to capture the uplift in the value of land used for development has been a long-running debate. While it has mostly focused on how the state can capture some of the value through taxes or other levies, the principle of sharing the uplift in value between different parties is the one that underlies this suggestion. Although in this instance, the sharing is between those directly party to the arrangement. Source: “Land Value Capture - Housing, Communities and Local Government Committee - House of Commons.” <https://publications.parliament.uk/pa/cm201719/cmselect/cmcomloc/766/76605.htm>.

Recommendation 6: The government should commission a mapping exercise of public and private land in the UK to identify suitable places for potential mobile infrastructure and create a “presumptive permission” status for it

The government should task the National Infrastructure Commission (NIC), the MNOs and relevant WIPs to undertake a comprehensive mapping of potentially suitable sites for new 5G infrastructure. This should be done with a strong emphasis on looking for opportunities for sharing passive infrastructure. The digital assets management workstream that is part of the Digital Connectivity Infrastructure Accelerator programme, might provide a starting point for such an exercise. The results should be made public.

The public land and property identified through the mapping exercise should be awarded a “presumptive permission” status for the siting of mobile infrastructure. The creation of “presumptive permission” could be modelled on the EU’s approach, which sets the default position as one of allowing the infrastructure subject to narrow but clear exceptions for risks such as security and health.

CHAPTER SIX – THE OPERATION OF THE PLANNING SYSTEM AND THE BUILDING AND UPGRADING MOBILE INFRASTRUCTURE

New and more dense infrastructure is vital for widespread 5G coverage

5G infrastructure requirements multiply existing challenges with the planning system

The siting of mobile infrastructure has been a long running challenge in the UK. When more infrastructure is needed per square mile of land, as is required if the UK is to have widespread high quality 5G coverage, the existing difficulties are multiplied further. If, as is suggested in Chapter Five, twice as much infrastructure is needed for high quality ubiquitous 5G, this indicates that the demands on the planning system could be twice as great as those for the 4G rollout, which in-turn, will put considerable additional pressure on a planning system already under significant strain.

Planning is interconnected with issues of topography and land supply

The challenges associated with planning are complicated by factors such as topography. This is because, for instance, the environment places limits on the efficacy of mobile infrastructure such as masts. This can mean that for a given amount of desired signal coverage more infrastructure is likely to be required to deliver it, than would be the case if the geography were easier, as one of our expert interviewees noted:

“...we know that the notional distance covered by a cell isn't the actual distance covered...it's impeded by a series of physical factors...which cause major issues, and that varies by geography”.

Therefore, in addition to the technical need for more infrastructure to deliver widespread, high quality 5G, there are environmental considerations which further multiply the quantum of infrastructure needed to deliver 5G.

Easing the planning process for mobile infrastructure

Attempts to tackle planning obstacles in the past have met with limited success

Despite numerous efforts since the 1990s to tackle the planning obstacles to mobile infrastructure construction, many difficulties remain. This was observed by several of the experts we interviewed for this report:

“... planning has been reviewed several times by governments, going back to 1990... and it's helped with some cost reduction, but the planners still get in the way”.

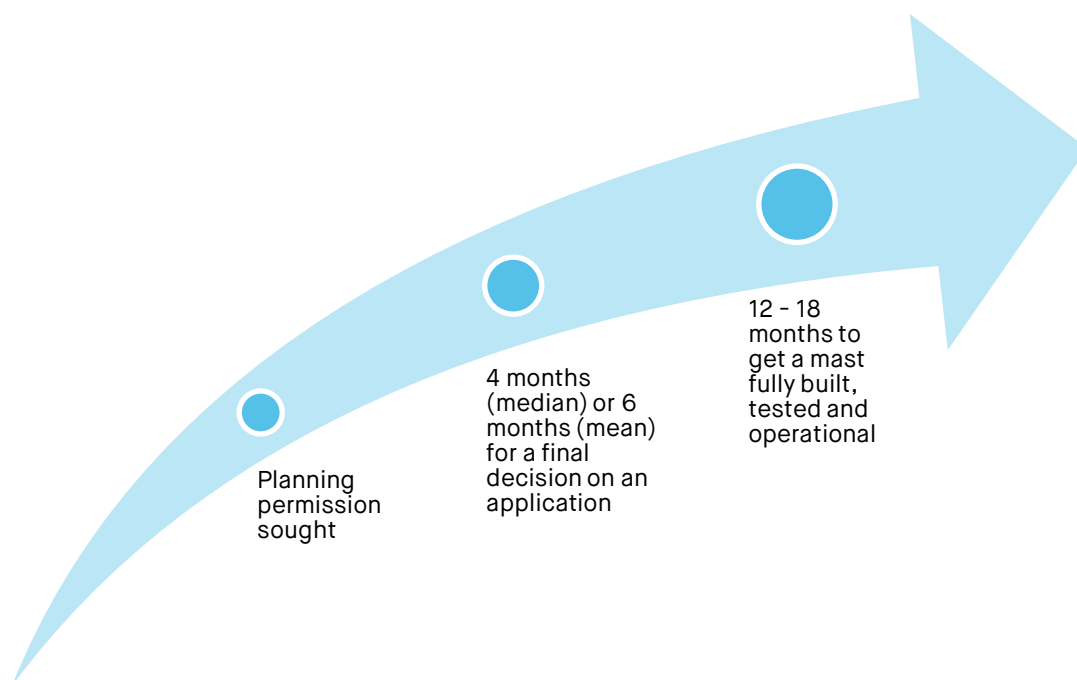
“... there's been lots and lots of goes at improving planning in the past... so it's something that's been tried for a long, long time. The fact that it's still an issue...means is incredibly difficult to deal with...”.

The original expansion of permitted development rights to include some mobile infrastructure was an important easement cutting the time and cost of erecting

mobile infrastructure that fell within particular limits.^{xi} However, the impact to date has been limited, as another one of the experts we interviewed noted:^{xx}

“...there's been some changes over time shifting the assumption towards operators being able to use land, rather than having to prove that, but clearly it's not really worked well”.

Figure 12: The timeline for an operational mobile phone site



Sources: Mobile Infrastructure Forum - MobileUK (2023) and Vodafone (No date given)

It has been pointed out by MNOs that the optimal height for a mast is 50 metres. More such infrastructure at this height would help speed up the UK's 5G rollout, deliver greater coverage from a single mast and more capacity. However, such large infrastructure would be required to go through the full planning process and would no doubt be controversial for many. This would likely lead to the timeline for operationalising infrastructure becoming more extended. Indeed, there would be a real risk that more infrastructure would end-up stuck in the planning stage for much longer. There are already a small but not insignificant proportion of cases

^{xi} For instance, expanding the dimensions of masts that fell within the permitted development rules by two metres (or 50%) in width and five metres in height. Further, the revised rules allow the height of masts already in place to be increased by up to five meters. The changes also enable new masts to be built taller, increasing the maximum height to 30 metres in unprotected areas and 25 metres in protected areas. Buildings that host towers can now have them up to six metres high without prior approval from planners. Source: GOV.UK. "New Laws to End Mobile Coverage 'No Bar Blues.'" Accessed December 10, 2024. <https://www.gov.uk/government/news/new-laws-to-end-mobile-coverage-no-bar-blues>.

^{xx} One reason for this is revealed in estimates from the government at the time of the measure's introduction. These suggested that the permitted development rights would only apply to around one in ten mobile infrastructure sites at the time. Source: GOV.UK. "Mobile Connectivity in England," May 3, 2013. <https://www.gov.uk/government/consultations/mobile-connectivity-in-england>.

that take 18 months to get planning permission.¹³⁰ It seems probable that 50 metre masts would lead to more examples of this.

Speeding up the planning process, e.g. cutting the mean amount of time an application takes to receive a decision from six months to three could see more than 300 new cell sites given planning permission and put in place each year. This could result in an additional 1,500 5G cells in place by 2030 than would otherwise be the case.^{xxi}

The causes of the ongoing problems in the planning system

Local authority planning capacity

The organisational capacity of local authority planning services is one reason why the planning process does not move as swiftly as it otherwise might. Capacity has reduced in-part because of resourcing constraints, which declined by a seventh between 2010 and 2023 across England.¹³¹ In Scotland and Wales, the cuts were more dramatic with the former seeing reductions of 38% and the latter a decline of 50%.¹³² More than one of our interviewees raised the under-resourcing of planning departments as a key cause of planning problems. They argued that:

“...I don't want to knock all planners when I say this, but generally there is a planner shortage...”.

“...many planning teams are, to be fair to them, under-resourced and few of them are particularly customer friendly, frankly...”.

Local authority planning capabilities

Another problem with the planning process identified by MNOs is the lack of specialist knowledge amongst planners and planning committees about the challenges of building and operating a mobile phone network. MNOs for example, have pointed to unfamiliarity amongst planners and councillors with key concepts such as “mobile coverage” on the one hand and “mobile capacity” on the other.¹³³ The industry argue that understanding the differences between these is important to being able to make considered decisions about the appropriateness of particular mobile infrastructure applications.

This is compounded by, in many local authorities, the absence of an understanding of the “bigger economic picture” into which individual mobile infrastructure

^{xxi} This conclusion is based upon the assumption that each year around 1,300 new standalone 5G cell sites are put in place. This indicative figure is taken from reported data in Ofcom's Connected Nations report 2024 which suggested that between 2023 and 2024, the number of standalone 5G sites had grown from 2,000 to 3,300 sites. To double the total number of cell sites across the UK from the 81,000 highlighted in Figure 10, it could take as long as 62 years, if they were built at the annual rate of 1,300 per annum. Halving the mean time it takes decide a planning application could see the number of years needed to double cell sites fall to 50 years. Source: “Connected Nations 2024,” www.ofcom.org.uk, December 5, 2024, 20, <https://www.ofcom.org.uk/phones-and-broadband/coverage-and-speeds/connected-nations-2024/>.

applications fit. This point was made by several of the experts we talked with for this research:

“...there aren’t enough planners who understand the balance to the economy of having a new site versus not having a new site... not enough planners out there who understand the basics... by that I mean a planner understanding shortage...this is a problem that still needs some attention”.

It is also consistent with evidence produced by the mobile industry, which found that, in a survey of local councillors across the UK, just over 4 in 10 reported that their council had a digital infrastructure strategy in place.¹³⁴ This implies that nearly 6 in 10 local authorities do not consider issues of mobile connectivity from a strategic perspective and therefore are unlikely to have much of an idea of current and future local demand for such services or how infrastructure in that locality can contribute to the UK achieving ubiquitous high quality 5G coverage in the coming years.

Box 6: Digital Champions

Digital Champions are embedded in many local authorities. Their role is to help key decision-makers in local government take a more strategic view of digital infrastructure (including mobile connectivity). It has been pointed out that those councils with Digital Champions tend to be around four times more likely to have an effective planning approach to mobile infrastructure. Further, the same report observed that:

- Councillors in councils with Digital Champions were three times more likely to agree that their local authority prioritised connectivity.¹³⁵
- Planning approval rates for mobile equipment were typically higher where there were Digital Champions or similar schemes operating.¹³⁶

Despite the advantages of a Digital Champion, the same research found that less than a third of the councillors that were surveyed as part of it reported that the authority they were part of had an assigned Digital Champion.¹³⁷ Although, it should be noted that, given the resource constraints many local authorities face, they may lack the funds to finance a full-time Digital Champion role, despite the potential utility of such a function to localities as well as the wider regional and national economy.

Uncertainty in the planning process

The lack of capacity and the capability limits help contribute to the uncertainty in the planning process for applicants.¹³⁸ The considerable variation in the efficiency and consistency of planning decision-making about mobile infrastructure, between local authorities and across the nations of the UK, is perhaps most clearly reflected in the substantial geographical differences in the proportion of permissions granted. For instance, in London the approval rate is around 4 in 10 applications.¹³⁹ This is in stark contrast to some other cities where the rate is as high as 9 in 10.¹⁴⁰ The unpredictability is detrimental to investment.¹⁴¹

Somewhat in contrast to the UK's current approach, the importance of reducing uncertainty is central to the EU's Gigabit Infrastructure Regulation, which requires Member States to have clear and consistent planning rules.¹⁴² A more certain planning system that, for example, raised the proportion of planning applications that are accepted by 10 percentage points from around 8 in 10 on average to approximately 9 in 10, could see more than 160 additional cell sites built each year or around 800 more between 2025 and 2030.

Further, there is evidence from a successful experiment in the West Midlands showing how fostering more cooperation between MNOs and local authorities can deliver significant dividends, including a more certain and swifter planning process. (see Box 7). This experience may provide a model for the rest of the UK to follow.

Box 7: Infrastructure Accelerator programme pilot

The Infrastructure Accelerator in the West Midlands 5G project brought together MNOs and local authorities to help develop a more cooperative relationship over the construction and upgrading of mobile infrastructure.¹⁴³ The ultimate ambition was to minimise friction in the process, increase the speed with which decisions can be obtained and reduce uncertainty. The results from the pilot were encouraging. For instance, an analysis of its impact found that:¹⁴⁴

- Planning approvals grew, with 79 sites approved that in the absence of the scheme were likely to have been rejected.
- The approach is estimated to have saved up to 6 months on the time it took to upgrade mobile infrastructure sites.
- It made it less likely that applications end up in tribunals, perhaps saving as much as £500,000.

Rebalancing the rules to favour more mobile infrastructure construction

Improving the planning system for mobile infrastructure will require looking again at the National Policy Planning Framework (NPPF). The NPPF is a set of criteria that informs and shapes the work and decisions of planning authorities. Our interviewees noted that some of the terms of the NPPF are in tension with each other. For instance, on the hand the NPPF highlights the importance of supporting digital infrastructure while, on the other, indicates the amount of infrastructure should be minimised. In the context of 5G in particular, where a more a much more dense network of cells is required to deliver ubiquitous high-quality coverage, the absence of a clearer steer on what should be prioritised can help sow uncertainty for planners and councillors about what kinds of decisions can and should be made in which circumstances.

The NPPF's efforts to balance different priorities, alongside the limited extension of permitted development, still leaves a good deal of autonomy for local authorities over planning. In contrast, the EU's EECC and Gigabit Infrastructure Regulation together

embed a more one-sided approach by requiring Member States to more clearly favour digital infrastructure over other considerations.^{145 146} For instance:

- The Gigabit Infrastructure Regulation requires Member States to operate a default authorisation requirement alongside time limits for final decisions in all mobile infrastructure planning applications, it limits fees for applications and requires the introduction of compensation schemes for operators to claim against when planning authorities fail to meet their obligations.¹⁴⁷
- The EEC makes it much more difficult for planning authorities to refuse the placing and operation of small cells on public physical infrastructure.¹⁴⁸

Scope for more of a focus on sharing infrastructure in the planning system

Sharing can cut the cost of building mobile infrastructure where it is practical to implement it (see Box 2).^{149 150} Indeed, the UK has slowly moved in the direction of more tower sharing. For instance, the Shared Rural Network (SRN) programme that aims to deliver 4G to the whole of the UK utilises such an approach, while Vodafone and O2 cooperate on sharing through their Cornerstone joint venture.¹⁵¹ As noted in Chapter Three, it is possible that WIPs will enable much greater amounts of infrastructure sharing because there are incentives for WIPs to maximise their revenues from towers. Therefore, embedding a preference for sharing where possible into the planning process could help make the remaining rollout of 4G infrastructure and the spread of 5G infrastructure smoother and quicker.

Overhauling the planning system as part of the “new deal for 5G”

While ameliorative measures have been implemented to try and speed-up the planning process for digital infrastructure such as mobile sites, many problems remain, which are amplified in the context of the greater infrastructure needs of 5G. Therefore, in conjunction with the actions needed to improve land supply, the “new deal for 5G” that we propose also includes an overhaul of those aspects of the planning system that are limiting the ability of MNOs and WIPs to upgrade existing, or build new, mobile infrastructure. Modest improvements in speed and certainty could result in more than 480 additional 5G sites a year, or cumulatively, over 2,400 by 2030.

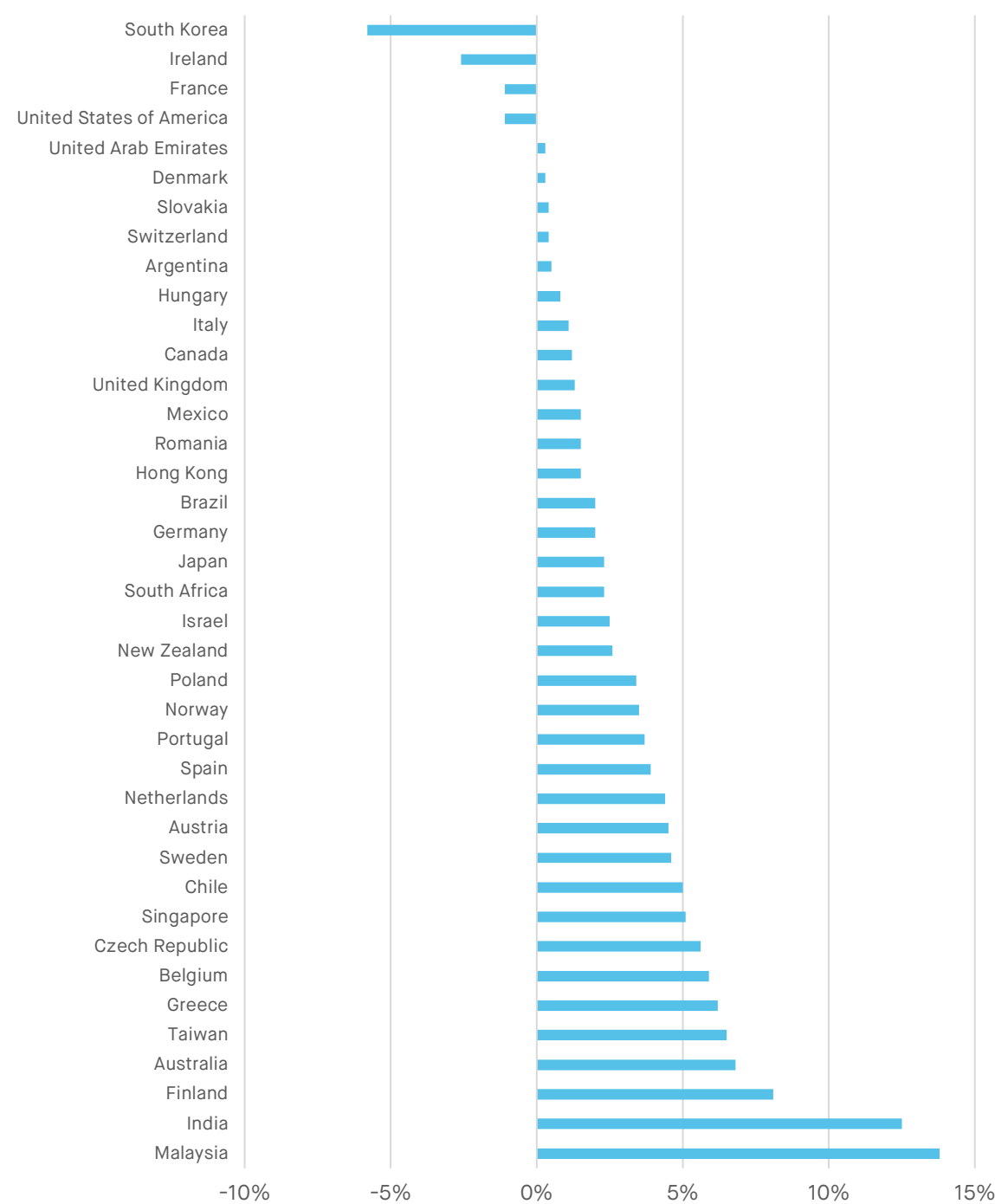
Recommendation 7: The government should introduce a package of measures to overhaul those aspects of the planning system that hold back mobile infrastructure development

To deal with the uncertainty in the planning process, the lack of planning capacity and knowledge amongst planners and planning committees about digital infrastructure in local authorities, encourage a broader and more strategic perspective on mobile infrastructure and to encourage sharing where appropriate, the “new deal for 5G” needs to:

- Require the adoption of good practice through mandating planning authorities to implement their own version of the model developed in the West Midlands through the Infrastructure Accelerator. This facilitated a more consensual and speedier approach to the 5G infrastructure siting, construction and upgrading.
- Compel all councils to produce a digital strategy (and regularly update it) and have a Digital Champion that oversees its development and implementation, a position that has shown to be associated with a more effective planning process for digital infrastructure and better outcomes. This will require some funding from central government to cover the costs. The presence of a Digital Champion does not guarantee a more consistent and positive approach from local authorities towards mobile infrastructure questions. However, if it is senior enough and the Digital Champion position is complemented by a similar councillor role at Cabinet level, the likelihood is that it will help bring more understanding of the importance of 5G and reduce some of the variation in the approaches of local authorities.
- Revise the NPPF to more explicitly support the building and upgrading of mobile infrastructure by encouraging applications to be considered in their wider context of contributing to regional and nationwide coverage and the long-term societal and economic gains that widespread high-quality 5G coverage for example, could deliver. There should also be a preference embedded in the NPPF that will encourage planners to facilitate the sharing of infrastructure where possible.

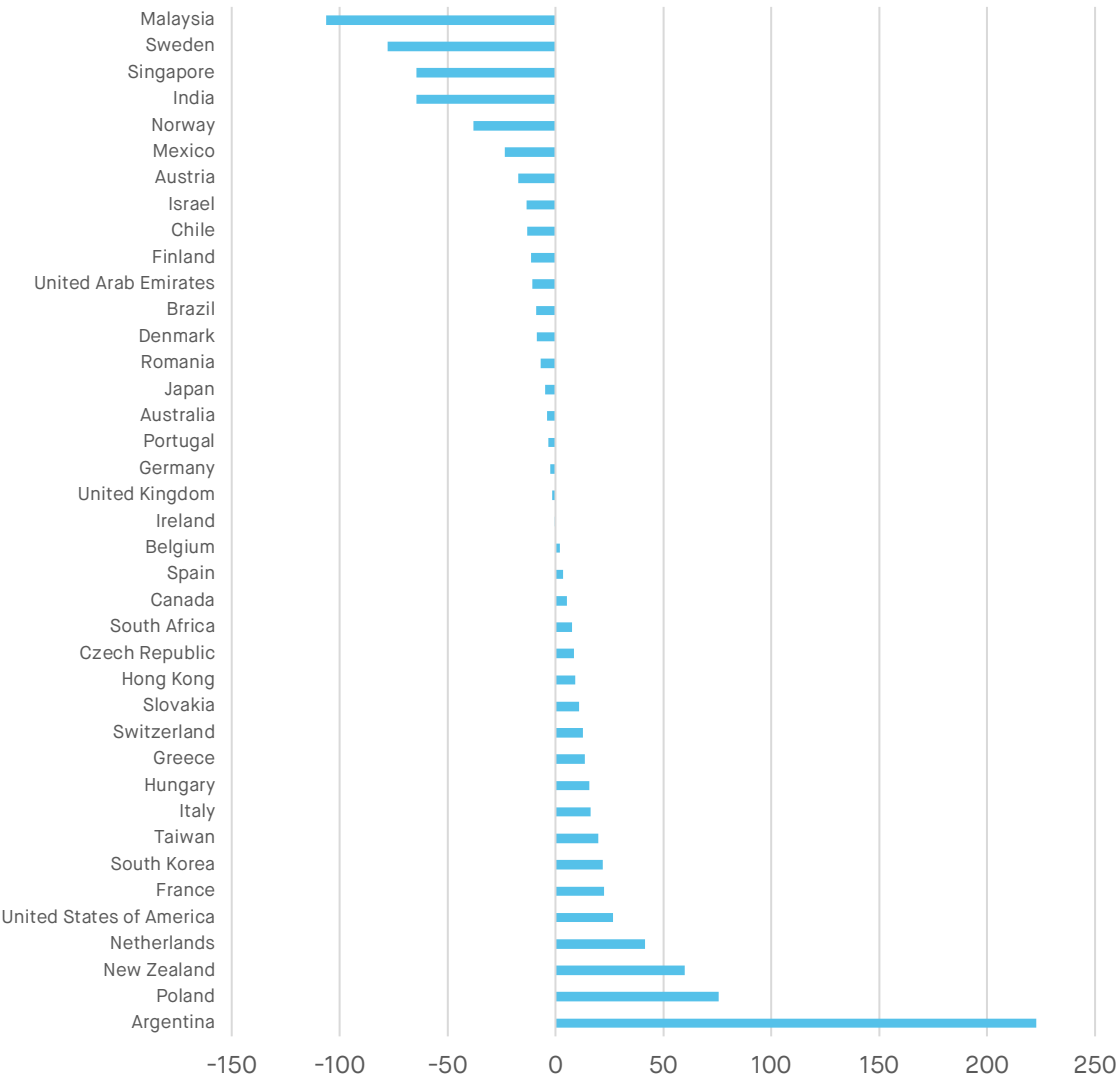
ANNEX 1: CHANGES IN 5G COVERAGE AND DOWNLOAD SPEEDS
BETWEEN Q3 2023 AND Q3 2024

Figure 14: Change in the proportion of time with 5G coverage between Q3 2023 and Q3 2024 in selected countries



Source: Open Signal (2024)

Figure 15: Change in download speeds (Mbps) between Q3 2023 and Q3 2024 in selected countries



Source: Open Signal (2024)

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