UK TELECOMMUNICATIONS INFRASTRUCTURE AND THE UK’S DOMESTIC CAPABILITY

Executive summary

1. The importance of the UK’s digital infrastructure has been thrown into even sharper relief as the country responds to the Covid-19 outbreak and reliance on fixed and mobile telecommunications increases to support mass working and schooling from home. BT’s networks continue to manage this increase in demand and a reshaping of internet traffic well, keeping our customers connected at this vital time.

2. 5G technology is increasingly important today to deliver the capacity required in the network as demand for mobile connectivity continues to grow and for the future, to support new massive scale machine-to-machine connectivity, low latency mission-critical applications and wider technological advances. EE 5G coverage now reaches eighty towns and cities and the security and resilience of the network will remain our top priority.

3. 5G leadership offers significant economic advantages and the continued success of the UK’s digital economy requires a balanced, risk-based policy approach that ensures access to the best global innovation and greater vendor competition, whilst keeping critical national infrastructure secure.

4. The conclusions of the Government’s Telecoms Supply Chain Review, published in summer 2019 and in January 2020, were proportionate and evidence-based – and so broadly achieved this goal. In particular:
   - New Telecoms Security Requirements (TSRs) will be important in further strengthening the UK’s approach to cyber security, setting a higher bar for all operators in their network design, management and use of vendors.
   - The distinction the Review makes in its approach to the 5G core network and the 5G access network is valid – the security principles we apply to the core and access will be maintained even as ‘edge computing’ is introduced and core functions move physically further out in the network.
   - The three-year transition to a maximum of 35% of a HRV’s equipment in the 5G access network is challenging, however, and will not come without significant disruption and cost – up to £500m for BT alone.

5. We want to work with the Government, the security services and Parliament to ensure the transition to new HRV requirements is manageable, the industry can progress with certainty and we can continue to make significant investment in upgrading the UK’s digital infrastructure.

6. Whilst over the medium term we expect an ongoing reliance of major global vendors, the UK’s approach should allow time for exploring further supply chain diversification, including progressing initiatives that may allow domestic and smaller companies to play a greater role.

7. We would welcome increased competition, but the telecoms equipment supply market is currently characterised by high barriers to entry. These include the need
for extensive research and development, highly complex manufacturing of new technologies, together with very stringent integration and operational testing requirements from customers. The result has been that are only a small number of global players that have been able to survive and compete in these conditions – in particular, there are currently only three scale suppliers of radio access equipment in the UK market, Nokia, Huawei and Ericsson. The creation of a new UK-based competitor in such a market would require significant investment and time and would be far from a guaranteed success.

8. There are, however, potential options for introducing more diversity and domestic presence into the equipment supply chain in the UK through increased interoperability of equipment and standards for network equipment, managed and controlled introduction of new supply agreements by commercial network operators, and by investing in future UK capability in emerging network technologies such as Software Defined Networks (SDN) and Artificial Intelligence (AI).

9. We would strongly encourage the Government to ensure its policy in this space is firmly built upon the following principles:
   - Long term clarity and certainty. Designing and building our networks requires sufficient lead times for effective implementation, including the need to meet any new regulatory, legal and/or public policy obligations. Avoiding changes in requirements over the short to medium term, requiring our network design and build plans to alter, is hugely inefficient and will put at risk network performance and resilience. Setting a clear long-term ambition will also enable us to confidently support other government network priorities, such as ambitions for nationwide coverage of gigabit-capable connectivity.
   - Network integrity is paramount. The maturity, resilience and security of new providers and technology approaches is critical to ensuring we can maintain confidence in our digital infrastructure.
   - Close cooperation between government and industry – to overcome existing barriers and prioritise activity where it will have most impact.

Responses to the Committee’s questions

What led to the current lack of market competition among telecommunications equipment suppliers and the absence of a domestic supplier in the UK?

10. Telecommunications networks, both fixed and mobile, are highly complex and interconnected systems that have undergone massive evolution and development over the past decades. These networks have transformed from relatively simple electrical connections enabling voice calls to fully interconnected digital communications networks that enable and encompass digital information transfer in all its various form.

11. This transformation has come about as a result of massive levels of investment in research, development and standardisation at initially regional (e.g. GSM for first generation mobile in Europe in the 1990s) and increasingly global scale for 4G and 5G mobile.

12. To keep pace with the rapid technological change that has driven the huge advances in the capabilities of communications networks, the companies that supply this network equipment have had to invest heavily in each new generation of technology, and to seek to recoup those investments by delivering the resultant products and earning revenue across a global market. Companies that were
unable to sell their technology globally in one generation of the evolution were likely to be left behind in terms of research and investment in the next generation.

13. The successful suppliers have also been very active in global standardisation settings (in particular the ITU), establishing and driving the global standards that ensure that equipment can interoperate internationally. Again, this requires significant investment over multiple years to bring to fruition.

14. Therefore, the rapid technological evolution that has delivered the benefits we all utilise in modern telecoms networks has had the side effect of creating high barriers to entry, with very large research and development costs associated with each new generation of telecoms equipment, and the need to invest heavily in specialist skills, research and equipment in driving and defining global standards for interoperability. Very few companies globally have been able to keep pace with this development and investment cycle, resulting in consolidation of companies in Europe and across the globe.

15. The ability to make sufficient margin to incentivise sufficient R&D efforts, encourage market entry, enable growth and support scale deployment is also key. So the relative cost of doing business in the UK, including those driven by regulatory intervention, is an important consideration.

16. UK companies are, however, still very active in parts of the supply chain into the global telecoms equipment market, for example in the area of chip design and also, in BT’s case, in continuing to be active in defining and driving key aspects of the fundamental research and standardisation process to which global suppliers then build their equipment. However, there is no UK company currently with the scale to compete in the complete network equipment supply market.

17. As a result of this globalisation of the supply market, there are now very few scale telecoms equipment vendors and just three (Ericsson, Huawei and Nokia) operating in the UK market.

**What are the major barriers to entry into the UK telecommunications market are and how these could be overcome?**

18. As discussed above, the communications market has evolved and developed rapidly and consistently across the globe. This rapid development and innovation in technological equipment has required significant investment in research, development, manufacturing and global standards, resulting in consolidation of equipment suppliers. As a result, a key barrier to any new entrant to this market (UK-based or otherwise) would be the scale of investment necessary to develop, deliver and continually evolve equipment in this market. History implies that such a supplier would need to rapidly acquire scale not only in the UK market but also globally if it is to continue to be able to invest at the levels required to compete with the major players.

19. Any new equipment must also be subject to thorough testing and integration into existing networks to ensure that existing services can continue to operate effectively while new technologies are deployed. This is a complex process when introducing new versions of an existing supplier’s equipment (e.g. from 3G to 4G mobile equipment from the same supplier) but is considerably more involved when introducing a completely new supplier. Any new supplier would need to demonstrate, to very high degree of surety, the capabilities of their equipment to perform effectively in a live network environment, potentially interworking with
multiple versions of existing equipment and network variations. Such testing and confirmation takes considerable time and resource from both the supplier and the network operator as customer.

20. Therefore, new telecoms equipment products can take years to develop, requiring significant research and development, standards setting and compliance activity, in addition to the eventual manufacture, testing and deployment costs. Much of this initial research, development and testing work is speculative and “at risk” by the manufacturer and would be conducted in direct competition with other global players.

21. An industry response to consolidation in the equipment supply chain has been a drive for the development for open architectures which incorporate telecommunication standards. New approaches, such as Open RAN, offer the potential for this, although it is as yet unclear whether these will be successful.

22. The objective of Open RAN is to enable a vibrant RAN supply chain. An industry architecture is being specified through live industry groups with standardised functions and interfaces which will enable multiple vendors to produce components which can be integrated into a complete RAN solution.

23. We want to accelerate the progress of these initiatives and BT is heavily involved in the industry forum. However, in the short to medium term, we will rely predominantly on scale global vendors. We need strategic relationships with vendors and cannot allow multiple, smaller scale players into our network without full confidence that they can support the resilience and security of our networks. This will take time.

24. Greater Government action in this space would be valuable in accelerating progress. We believe it should focus on supporting operators in the following ways:
   - Targeting public funding on a number of Open RAN projects based in the UK with industry providing opportunities for commercial deployments e.g. via rural coverage programmes or dense urban small cell roll-out.
   - Encouraging major vendors who do not have a significant presence in the UK, such as Samsung, to invest in UK-focused product development that meets UK operators’ specific requirements.
   - Greater funding support, potentially through the DCMS 5G Testbeds and Trials programme, to develop a new Future Network Research Initiative (FNRI) to complement the proposed National Telecoms Lab (which will focus on the testing of security of new equipment for the UK market). The FNRI would provide the infrastructure to enable universities and companies to trial new approaches to network deployment and operation, collaborate to build to prove end-to-end solutions, test hardware and software in a scaled environment. This would help in overcoming the hurdles smaller vendors face in proving their products in the UK telecoms environment.

25. However, none of the above initiatives are likely to provide a “quick fix”. They will need to run in parallel with existing commercial plans for deployment and continue to prioritise the security and resilience of telecoms networks – anything that causes delay to the deployment of 5G and full fibre capabilities across the UK risks the wider economic benefits that such networks are expected to bring.

What is the feasibility of the Government supporting the establishment and growth of a UK-based vendor of 5G equipment?
26. Although a UK-based 5G vendor may be a desirable objective, the challenges of establishing such a company rapidly and with the commercial credentials to compete in a global supply market that has seen significant consolidation over the past decade are complex.

27. Such an approach would need to have a clear strategy for ensuring it could overcome the various barriers any such organisation would face in seeking to compete and operate in an existing market dominated by a small number of large global players. A market where a key success criterion is the ability to continue to innovate and invest in highly complex technological developments while simultaneously supporting and delivering the technology across a global market.

28. However, the benefits of digital technology to an economy are not primarily driven by the ability to supply the equipment, but rather in how the wider economy adopts and utilises the technology to drive overall efficiency and innovation across the wider economy.

29. There is therefore much that the UK can do to promote the use of digital technologies including full fibre and 5G, as well as promoting the growth of a vibrant optoelectronics industry, advances in artificial intelligence (AI) and ensuring the promotion and growth of home grown research in this key technological area\(^1\) that will enable these wider UK economy and industry benefits even though the specific network switching equipment may not be being supplied by UK companies.

30. A UK focus on ensuring UK industry and telecoms supply is best suited to this changing digital economy offers potentially significant benefits. The technical change and rate of development in this sector that has led to the current focussed supply is showing no real signs of slowing. Over the next decade the PSTN will shut, fixed lines will migrate to full fibre, mobile services will evolve to 5G and IoT services will explode. UK network operators must therefore transform their network and service capability to exploit these opportunities and offer the compelling services needed to succeed in a highly competitive environment.

31. In the core of the communications networks, Software Defined Networks (SDN) and Network Function Virtualisation (NFV) are techniques that will allow for greater control of the network in real time and they will bring about a transformation in the efficiency of network operations and the service experience customers will see.

32. The challenge is that whilst SDN/NFV may make operations simpler, they transfer complexity from the network operator into the network equipment and software to allow such things as network slicing and operations automation. Communications Providers (CPs) will have the ability to access and configure their virtual element of the network through B2B gateways and the distribution of configuration amongst more parties makes management more complex.

33. In addition, the next ten to twenty years will see the introduction of Machine Learning (ML) and Artificial Intelligence (AI) techniques in the automation of the network management plane and the interaction between network operator and CP domains. Both ML and AI have huge potential benefits, but both technologies are currently in their infancy and it is not yet known when either will be mature enough to deploy at national carrier scale.

34. For the telecoms industry, in terms of both supply and operation, to flourish in the UK it must embrace these changes and create an environment where all relevant

\(^1\) Such as that carried out by BT at our Adastral Park laboratories.
elements of the value chain can collaborate to unlock value for all participants. This is an area where BT believes the UK can seek to establish a global leadership position. As an example of what the UK could do to create and build UK capabilities in this critical global field, we are seeking to embrace this approach through the concept of the Future Network Research Initiative (FNRI) and this is, we believe, an area where UK Government can actively engage and support UK developments.

35. The FNRI would provide the infrastructure to enable universities and companies to trial new approaches to network deployment and operation, collaborate to build to prove end-to-end solutions, test hardware and software in a scaled environment. This would help in overcoming the hurdles smaller vendors face in proving their products in the UK telecoms environment.

How the UK can work with international partners (such as the ‘Five Eyes’ countries) to build a domestic capacity?

36. None of the ‘Five Eyes’ countries are active in the domestic supply of 5G base station equipment. Rather, the countries are typically pursuing multi-vendor supply routes that utilise the global supply base e.g. including Samsung, Ericsson and Nokia. How these multi-vendor approaches work in each country is likely to vary depending on the commercial make-up of the local market and the ability to utilise existing earlier generation equipment.

37. Therefore, we believe that working with international partners to ensure the effectiveness of a continuing multi supplier strategy for telecoms equipment (e.g. through standards bodies) and interoperability and open interfaces such as Open RAN should be a focus.

What measures could the UK Government take to encourage additional, established vendors to enter the UK market?

38. The telecoms market in the UK is highly competitive, with four MNOs actively deploying 5G equipment in the mobile sector and multiple companies investing in full fibre and gigabit-capable technologies across the UK. The vendor and supply agreements these companies make are key to the competitive nature of the market and the commercial success of the network operator. Therefore, any Government action to encourage additional vendors need to be complimentary to the existing commercial supply processes of the network operators.

39. Introducing new suppliers in some areas e.g. where no previous provision was in place is relatively straightforward; however, replacing an existing supplier or supplier’s equipment with a new supplier/new supplier’s equipment is significantly more complex. This is generally the situation that prevails in the UK currently as we transition from 4G to 5G across all four networks. Therefore, Government measures to introduce new suppliers will need to be managed and controlled as part of a measured plan to upgrade and/or replace existing equipment from an existing supplier. Such a replacement plan is likely to have potentially significantly different timescales to a simpler upgrade approach.

40. Although mobile equipment is subject to international standards and interoperability of handsets and equipment across the globe, there are various market specific issues that will need to be taken into account by any new supplier in the UK market, in order to ensure an orderly introduction of new suppliers into the UK market. The UK is relatively small by global market standards and thus any UK
specific or even operator specific requirements are likely to be problematic or costly for a new global supplier to incorporate, and mechanism for either dealing with such local variations in the UK market or removing them in a controlled manner would need to be factored in to any Government action.

41. Enforcing accelerated removal of one supplier from a network in favour of another “preferred” supplier is not only a potential risk to the speed of deployment of the new network capability – potentially impacting the wider UK economic benefits, but also a risk to the commercial success of an operator’s service offering in the competitive UK market.

**In what timeframe should the Government look to build domestic capacity and remove all “high risk” vendors?**

42. BT strongly supports the Government in taking sensible steps to encourage vendor diversification across the digital communications market. It must do so, however, in a way that does not compromise the performance, security and resilience of our networks.

43. We believe that the decisions set out in the recent Supply Chain Review (following a year-long assessment and based on expert advice from the National Cyber Security Centre) represent a proportionate approach, broadly in line with BT’s existing network architecture policies and with a recognition of the UK’s strong foundation on cyber security (to be enhanced further through new Telecoms Security Requirements).

44. However, the three-year transition to a maximum of 35% is challenging – due in most part to the lack of vendor interoperability across 4G and 5G technologies – and will represent a significant shift over a relatively short period of time. We estimate the cost to BT to be circa £500m. We want to work closely with the Government, the security services and Parliament to ensure that the forthcoming legislation, through the Telecoms Security Bill, continues to represent a proportionate and evidence-based approach to managing the risks of HRVs, enhances the UK’s cyber security and provides the opportunity to leverage the economic benefits of 5G as far and as fast as possible.

45. Looking to meet this 35% limit more quickly or significantly reducing this limit to be met within a similar timeframe would have significant impact. Most immediately it would have material consequences for the pace and scale of 5G deployment across the UK, create existing 4G network disruption and drive coverage outages as sites need to be taken off air and lead to greater swap-out costs.

46. This comes at a time when BT – and other operators – are in the middle of major programmes to future-proof the UK’s digital infrastructure, involving unprecedented levels of change, investment and upgrading. We are seeking to support the Government’s ambitions for nationwide gigabit-capable connectivity by 2025 through the scale roll-out of full fibre, world leadership in 5G and improved rural mobile coverage through the £1bn Shared Rural Network initiative. This includes our recent £12bn investment commitment, in the face of challenging economic circumstances, to deliver full fibre to 20m UK premises by the mid-to-late 2020s, supported by a difficult decision to suspend dividend payments to shareholders. Driving increased cost and uncertainty will put these other priorities at risk through reducing available capital.