



House of Commons
Science and Technology
Committee

**5G market
diversification and
wider lessons for
critical and emerging
technologies:
Government Response
to the Committee's
Second Report of
2019-21**

**Fifth Special Report of Session
2019–21**

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Science and Technology Committee

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Fifth Special Report

On 4 February 2021 the Committee published its Second Report of Session 2019–21, [5G market diversification and wider lessons for critical and emerging technologies](#) [HC 450]. On 20 April 2021 we received the Government Response to the Report, which is appended below.

Appendix: Government Response

Introduction

The Government welcomes the second report from the House of Commons Science and Technology Select Committee's inquiry into "5G Diversification and Wider Lessons for Critical and Emerging Technologies" (HC 450), published on 4 February 2021.

The Government is working at pace to create and support a more diverse and competitive supply base for UK telecoms networks, in order to increase quality and innovation, and to address the potentially significant risks to the security and resilience of our critical national infrastructure (CNI). The Government's 5G Supply Chain Diversification Strategy ('the Diversification Strategy'), published in November 2020, sets out a clear and targeted plan to address this issue. To drive early progress and catalyse the implementation of this strategy, the Government established the Telecoms Diversification Taskforce ('the Taskforce') in September 2020, chaired by Lord Livingston of Parkhead, to look at where the Government should target measures to ensure effective, accelerated and sustainable diversification. The Taskforce has now concluded its work and submitted recommendations to the Secretary of State for Digital, Culture, Media and Sport across four primary areas: the role of Government in ensuring that international standards-setting for 5G works for the UK, potential government and regulatory interventions, opportunities to accelerate the development and adoption of Open RAN, and long-term ambitions for domestic capability in future telecoms. Through this work, the Government now has a set of recommendations to consider, alongside the recommendations of this Committee, as we start to implement our strategy. The final report of the Diversification Taskforce has been published on [GOV.UK](#) and the Government is considering its recommendations and will respond before summer recess.

Similarly, the Government welcomes the focus that the Committee has placed on the implications not just to 5G, but also the parallel risks that apply to critical and emerging technologies. The Government's response sets out how these issues are being considered across Government and its agencies, the range of actions that are being taken, and how we are leveraging our convening power and working with allies to ensure our strategies are fit for purpose by being more resilient to short-term shocks and long-term challenges.

Each item put forward by the Committee is highlighted in bold, with the Government's response set out in plain text. For ease of reference, paragraph numbering in brackets refers to the order in which they are presented in the Committee's Report.

The 5G Supply Chain Diversification Strategy

1. The Government's '5G Supply Chain Diversification Strategy' outlines Government's approach to addressing the current lack of vendors in the UK's 5G infrastructure equipment market. The Government itself acknowledges that this will take time. Although the decision to forbid the use of 5G equipment procured from Huawei after 2020 was made following US sanctions announced in May 2020, the potential threat from telecommunications infrastructure supplied by foreign vendors and the concentration in the UK's vendor market have been known for many years. It is therefore disappointing that the Government and its predecessors have not already developed and started implementing a strategy for diversifying the UK's telecommunications infrastructure supply chain. *Given the scale of the challenge and the urgency of the threat, the Government should publish, within three months, a more detailed action plan for implementing its diversification strategy. This should include a breakdown of how the initial budget will be spent and a series of milestones with target dates for completion.* (Paragraph 14)

The Government agrees with the Committee's assessment of the scale of the diversification challenge and agrees that there is a need to work at pace to make early progress and build momentum as we work toward our long term ambitions.

That is why we have already taken action by commencing work to establish test facilities for new suppliers and deployment models, funded a range of Open RAN trials through the DCMS 5G Testbeds and Trials Programme, and convened international discussions to build consensus across the global market. The Government is pleased to be collaborating with Japanese supplier NEC for the NeutrORAN Open RAN testbed in North Wales, and the SmartRAN Open Network Interoperability Centre (SONIC) announced in November is on track to be open for industry testing this May.

Alongside this, the Department for Digital, Culture, Media and Sport (DCMS) established the Diversification Taskforce and engaged closely with the sector, both in the UK and globally, to seek advice on the practical actions that the Government can take to accelerate the process of diversification. The Diversification Taskforce's full report containing their recommendations to Government was published on 20 April. The report makes a wide range of recommendations across four primary areas: the role of Government in ensuring that international standards-setting for 5G works for the UK, potential government and regulatory interventions such as defragmenting spectrum or sunseting 2G and 3G, opportunities to accelerate the development and adoption of Open RAN, and long-term ambitions for domestic capability in future telecoms. The Government will respond to the findings of the Diversification Taskforce and set out the detailed steps that it will take to drive the implementation and delivery of its strategy before summer recess, including specific deliverables and milestones. This will include setting out the Government's approach to the next round of targeted research and development (R&D) investment.

2. **The Government is seeking to attract existing vendors to the UK market in order to diversify the telecommunications vendor market in the short-term. One of the major barriers faced by such companies is the requirement of British network operators for continued provision of older generations of network technology. The main proposal in the Government's diversification strategy to address this—to consider a transition away from these older technologies—is not a short-term solution.** (Paragraph 22)

3. In addition to considering the case for transitioning away from 2G and 3G technologies, the Government should propose measures within the next six months that could facilitate market entry by existing vendors in the near-term. It should consider options for addressing the barrier of operators' preference for vendors to offer older generation technologies with their 5G equipment, such as incentivising or mandating standalone 5G deployments and/or the use of protocols such as the Open X2 interface.
(Paragraph 23)

The Committee rightly notes that the provision of older generations of network technology is a major barrier to diversification. The Government recognises the benefits of a transition away from these technologies, but we recognise the challenges associated with this, including the technical complexity involved in transitioning to up to date equipment and the ongoing requirement to support users and key public services.

However, the Government is clear that progress can be made to reduce reliance on these older technologies and consequently the need for prospective suppliers to support them. The Government is working with mobile operators, suppliers, and users to set a clear roadmap for the long-term use and provision of network services, including any sunsetting or streamlining of 2G and 3G technologies. This involves gaining an understanding of mobile operator roadmaps, the needs of users and technical solutions that will enable transition away from these technologies.

The Government expects to set out next steps this summer, in order to provide operators, suppliers and users with clarity and confidence about the long-term technology roadmap in the UK.

In addition, the Government is also considering a number of policy options to help facilitate the entry of new suppliers in the nearer term. These include commercial incentives linked to the cost of introducing new vendor equipment into networks; investment to support interoperability and security testing of new suppliers; and opportunities around regulatory forbearance to incentivise operators towards trialling equipment from new suppliers and/or alternative deployment methods.

The Committee highlights two new deployment methods in particular, 'standalone 5G' and the 'Open X2' interface. The Government is committed to encouraging the development and adoption of innovative and advanced deployment methods and notes the potential value these could play in aiding the process of diversification. We will look to support research and development (R&D) in these—and other—deployment methods, in order to drive and demonstrate their performance and effectiveness. At this stage the Government's priority is to encourage competition and innovation across the market rather than to mandate or require the use of any particular technical solution.

4. The Government is right to support the development and adoption of open standards and increased interoperability as a potential means of diversifying the telecommunications equipment vendor market. It is also right to identify Open RAN as a prominent approach to achieving this, but not the only one. However, neither the success of Open RAN or any related efforts, nor the positive impact on overall telecommunications security if these efforts are successful, is guaranteed.
(Paragraph 29)

5. The Government should support Open RAN and other efforts to drive the adoption of open standards and greater interoperability. While the success of Open RAN is not guaranteed, the Government should encourage the deployment of Open RAN to ensure that the UK is not behind others in deploying this technology. However, it must continually ensure that support for these efforts is consistent not only with increasing vendor diversity but also with improving the overall security of the UK's telecommunications networks. Further, the Government must not assume that open standards and interoperability will inevitably be adopted nor that they will have the desired effect, and should pursue a range of measures designed to support market diversification and increase security. (Paragraph 30)

The Diversification Strategy set out that technologies based on openness and interoperability—such as Open RAN—have a key role to play in enabling diversification. Though Open RAN is an emerging technology, the Government recognises its potential to positively impact competition and innovation in the telecoms supply market, and in the emergence of other open network solutions.

In particular, the Government believes the UK is well placed to drive the development and deployment of Open RAN and other open technologies, noting the innovative approach of the UK telecoms market in recent years.

At the same time, the Government recognises the scale of the work required to ensure its successful implementation in the UK. That is why the Government has committed an initial investment of £250 million, to commence work to deliver our key priorities, which will include support for the necessary R&D to ensure that Open RAN meets the needs of the UK's networks.

The Government's investment will be guided by the recommendations of the Diversification Taskforce which has outlined several priority areas that require further R&D for the development of Open RAN. These are product development and engineering, systems integration, verification testing, performance demonstration and network integration, and support services. Investment in these priority areas will seek to develop the technology so that it is at least as performant, efficient and secure as today's traditional deployment methods. Investment will also foster the development of the key subsystems and software that will be required to build and operate open networks.

The Government recognises that as well as supporting Open RAN development, it is equally important to encourage Open RAN adoption. Public commitments from UK operators demonstrate that the industry is committed to open and interoperable solutions that are capable of improving competition in the supply chain and delivering more resilient and diverse networks. Vodafone has recently committed to deploy Open RAN across 2,600 sites and other UK operators are taking proactive steps to support Open RAN trials. Industry support is further evidenced by recent commitments from major European operators including Vodafone, Deutsche Telecom, Orange and Telefonica to work together to drive Open RAN development.

Finally, the Government's view is that open standards, that will enable new technologies like Open RAN, must be underpinned by industry-led and global technical frameworks that support interoperability. That is why the Diversification Strategy set out the need for a comprehensive and holistic approach to standard setting for telecoms with security and

interoperability at its heart. In particular, the Government will seek to ensure UK market interests are represented at global technical standards bodies, encourage more balanced participation by industry representatives, and enhance our strategic coordination with key partners.

6. The first live networks using Open RAN are being deployed, with one having launched in Japan last year. *The Government should evaluate these initiatives and report regularly on what lessons can be learned from foreign experiences to inform the UK's strategy for diversifying the vendor market and improving telecommunications security, with an initial report within the next six months.* (Paragraph 33)

The Government agrees that regular information sharing with international partners is crucial to informing our approach to implementing the UK's strategy for diversifying the supply chain. The example cited by the Committee of Rakuten's virtual Open RAN deployment in Japan in 2020 is one of a number of important developments in this area, and showcases the potential future ability of Open RAN solutions in enabling improved network systems integration between hardware and software. The Government also agrees that regular and productive engagement with international partners is vital to ensure we share learnings and coordinate our approaches internationally where appropriate. Recent commitments by industry players in the UK, such as NEC, help to demonstrate the practical impacts that policy alignment between international partners can achieve.

The UK is therefore actively working to foster discussion and pursue collaboration on this issue internationally. In doing so, the Government is seeking to learn from the approaches taken by other countries, and to share its own experiences and expertise on these issues. For example, the Telecoms Supply Chain Review was a world-leading comprehensive review into the supply arrangements for the UK's telecoms critical national infrastructure. In line with the recommendations of the Review, we have taken steps to introduce one of the strongest frameworks for telecoms security in the world through the Telecoms (Security) Bill and are now implementing the Diversification Strategy to grow our telecoms supply chain, whilst ensuring it is resilient to future trends and risks. The UK was the first country in the world to publish a bespoke strategy to address the challenges caused by the lack of effective competition in the telecoms supply market.

We must recognise, however, that the international debate on this issue is still developing. That is why the Government is committed to driving forward discussion about this issue on the international stage, to secure buy-in from a critical mass of international partners. We are working with our G7 partners to build international consensus on the need for diversification and to identify tangible opportunities for international partners to coordinate efforts to help deliver meaningful and long-term change to the benefit of the global telecommunications supply market. This will include a shared long term vision, and principles for telecommunications supply chain diversification.

In addition to the Government's work in multilateral fora, we have had a series of productive discussions with a range of international partners bilaterally on this issue, including the Five Eyes and Japan. These discussions are ongoing and we will continue to engage and collaborate proactively with international partners over the coming months in line with the implementation of the Government's Diversification Strategy.

7. We heard evidence during our inquiry supporting the Government's assessment that network operators' preference for vendors with proven track records acts as a barrier to potential market entrants. The Government's proposals to establish testing and validation facilities, and to reduce regulatory disincentives for network operators to integrate new vendors into their networks, align with the recommendations for addressing this barrier made by many of the contributors to our inquiry. *Following consultation with industrial and other stakeholders, the Government should report on the required scale and specification of the National Telecoms Lab, to ensure that network operators trust the equipment that it validates for integration into their networks.* (Paragraph 36)

The UK Telecommunications Laboratory ("the Lab" —formerly the National Telecoms Lab) is a key element of the Government's approach to investing in research and development activity that builds technical and commercial relationships between operators and suppliers. Work to establish the Lab is progressing at pace and we are consulting extensively with industry as part of that process. The Taskforce has also made the recommendations that the Government ensure the availability of independent testing facilities for security and verification testing. This is being considered as part of the scope and remit of the Lab.

The Lab will provide new suppliers with access to environments where they can effectively demonstrate the performance and security capabilities of their products, in an interoperable environment. A key feature of the facility will be access to end-to-end networks that are sufficiently representative of real world UK deployments, in order to provide confidence to both operators and suppliers regarding the performance of incoming equipment.

8. Measures to support research and development form a major part of the Government's '5G Supply Chain Diversification Strategy'. Nevertheless, the total funding of £250 million for initial implementation of the strategy is significantly smaller than the tens of billions of pounds invested annually in research and development by the main incumbent vendors. Coordination with existing academic and commercial research and development, with clear long-term objectives, will therefore be critical. The Government's reference to establishing a research and development "ecosystem" instead implies, however, a less strategic approach. (Paragraph 43)

9. *The collaborative research and development networks that the Government seeks to develop to support diversification of the telecommunications market should encompass relevant groups at universities and research institutes as well as small- and medium sized enterprises and large companies. The Government should aim to actively co ordinate the research and development that it supports so that participants work towards clearly-defined long-term objectives. Existing and newly-established public research facilities should be set up to support this goal.* (Paragraph 44)

10. There is strong support for the establishment of common testing facilities for new 5G infrastructure equipment, to provide a variety of services that could help to drive diversification. The National Telecoms Lab—which appears to be the main facility proposed by the diversification strategy—seems, however, to be focused heavily on security testing and validation alone. (Paragraph 48)

11. *In addition to conducting security testing and validation, the Government should ensure that the research and testing facilities established through the diversification strategy also drive market diversification by stimulating collaboration and supporting the development and commercialisation of new technologies.* (Paragraph 49)

12. *Testing facilities do not need to be situated in one physical location. The Government should ensure that any new testing facilities complement existing facilities, and are designed with potential developments in 5G technology in mind to guard against future redundancy.* (Paragraph 52)

16. **Long-standing factors have driven consolidation in the telecommunications vendor market over many years, so it is critical that the Government adopts measures to maintain market diversity as well as to drive the initial diversification. Network operators will be integral to achieving both aims. Although operators stand to benefit from a more diverse vendor market, it may not be in their interest to purchase and use equipment from a wider range of vendors. The Government's diversification strategy does not sufficiently acknowledge this fact, and provides little detail of proposed measures to ensure that it will be in network operators' interest to drive and maintain a diverse vendor market.** (Paragraph 70)

17. *The Government cannot rely solely on removing barriers to market entry to diversify the telecommunications vendor market, but must also ensure that network operators actively pursue diversification and act to maintain the diversity achieved. This will require a combination of incentives, measures to reduce operator costs, and regulatory requirements. For example, the Government could introduce business rate relief on mobile mast deployments. In order to provide certainty to the sector, the Government should publish within three months of this Report the measures it is considering to incentivise and require network operators to diversify their suppliers, with an indicative timetable for implementation.* (Paragraph 71)

The Government announced an initial £250 million of investment in research and development to drive early work on the diversification agenda. As set out in the Diversification Strategy, the early focus is to address the concentration of supply in the radio access network portion of the supply chain, by stimulating development of alternatives and building demand. As the Committee notes, the sector invests a significant amount of money in research and development on an annual basis, across the full range of network domains, and the Government's aim is to supplement that investment in a targeted and appropriate manner in order to address the lack of diversity in critical network functions.

The Government agrees with the Committee that coordinating research and development across the existing academic and commercial research and development activity is key to ensuring best value for money and to drive outcomes. The Government is committed to setting out a clear and long term vision for research and development activity that will drive the process of diversification and will build on the findings of the Diversification Taskforce working closely with industry and academia to agree priorities.

As part of this, the Government is exploring the best way of utilising existing testing facilities and testbeds across the UK. In doing so the Government is interested in the potential of a 'federated' model that decentralises activity to enable collaboration and innovation around a shared long-term vision. The Government is also developing targeted

measures for investing in projects to develop products and demonstrate their performance, as well as establishing new, independent testing facilities where necessary for verification testing and network integration.

The UK Telecoms Lab will play a central role in this developing ecosystem and will partner with other government funded initiatives such as the SmartRAN Open Network Interoperability Centre (SONIC) and with projects funded as part of DCMS's £200 million 5G Testbeds and Trials Programme. Collectively these and future initiatives—including those led by industry—will help to address research and development needs beyond security and validation and will encompass the broader supply chain and other emerging technologies. The Government is also encouraged by announcements from suppliers including NEC and Mavenir Wireless to base 5G research and innovation centres in the UK and will explore opportunities to form close links between those facilities and the broader UK ecosystem.

The Government also recognises the importance of stimulating and incentivising demand to ensure the effective commercialisation of research and to capitalise on industry's momentum in rolling out 5G. The Taskforce has recommended setting out a clear ambition for the deployment of equipment from alternative suppliers, or from Open RAN solutions, to a meaningful proportion of the network. Such an ambition has the potential to send a clear signal to the global market that the UK is serious in its commitment to a diverse, competitive and open supply chain, however it will also need to be realistic and achievable, balancing the urgency to diversify with the risk of mandating the use of technologies before they can offer the right level of customer experience. The Taskforce has also suggested that measures to stimulate the market organically are more likely to effect lasting and meaningful change than regulation at this stage. The Government is working closely with network operators to support them in actively pursuing diversification and will set out further steps before summer recess.

Finally, the Government is committed to strengthening UK capability and establishing the UK as a key player in the global supply chain and will develop a coordinated and strategic approach to research, development and innovation to drive this. In particular, the Government will focus on long-term trends in the telecoms technology roadmap, informed by an assessment of the way future networks are expected to evolve and with a focus on future connectivity needs.

13. New vendors of 5G telecommunications equipment face challenges in scaling up their production rapidly enough to meet network operator demand and compete with incumbent vendors. Although the Government's diversification strategy identifies this barrier to market entry, it defers details of any significant measures to address it until publication of a refresh to the Industrial Strategy. There appear to be good opportunities for the Government to support new market entry at the same time as driving deployment of 5G in the UK, but the diversification strategy fails to set out measures to achieve this. (Paragraph 56)

14. *The Government should align its strategy for diversifying the 5G vendor market with its support for rolling out 5G network coverage. Wherever the Government provides funds for expanding 5G coverage, it should look for opportunities to simultaneously support vendor diversification, for example by requiring the use of open standards. The Government should identify opportunities to support new market entrants scale*

their production by supporting the deployment of novel small-scale 5G deployments. It should provide details of planned measures to support diversification and expand 5G coverage in its Industrial Strategy. (Paragraph 57)

The Government's previously stated ambition is for the majority of the population to have access to 5G by 2027. All four Mobile Network Operators have launched their 5G networks and 5G is now available in 350 towns and cities across the UK. While the vast majority of 5G deployment will be led by the mobile operators, the Government is actively working to facilitate 5G deployment and, through the 5G Testbeds and Trials programme, has set out to bring forward the social and economic benefits that 5G can bring.

The Government recognises the importance of scale in facilitating market entry of new suppliers, and is actively pursuing opportunities to ensure that government funded deployments prioritise open-interface technologies and new suppliers. While the Government does not typically lead mobile infrastructure deployment, we will consider opportunities to promote diversification through connectivity and R&D initiatives. Programmes such as the Government funded 5G Testbeds and Trials, aims to accelerate the deployment of 5G networks, maximise the productivity and efficiency benefits from 5G and create new opportunities for UK businesses. Recent projects have included NEC's neutral host Open RAN testbed, NeutrORAN, and five of the latest 5G Create projects will also test out the technical possibilities of Open RAN.

The Government will also look closely at growing demand for mobile private networks and the opportunities these can provide for new scale vendors to enter the market and provide bespoke coverage solutions, as well as diversifying the supply chain.

15. The Government identified the concentration of intellectual property rights in the hands of established vendors as a barrier to market entry. It commits in its diversification strategy to working with industry bodies to address this, although the proposed work is not described in great detail. In its response to this Report, the Government should provide more details on how it intends to address the barriers brought about by intellectual property rights, and update us on early progress made against this goal. (Paragraph 60)

Intellectual property rights, and in particular Standard Essential Patents, play a key role in the design and development of telecoms radio equipment. As set out in the Diversification Strategy, in the context of 5G the commercial behaviour around both intellectual property rights and standard essential patents represents a potentially significant barrier to diversification. This was also noted by the Diversification Taskforce, which highlighted in its final report that the consolidation of intellectual property rights and standard essential patents among market leading suppliers has "the potential to serve as considerable barriers to diversification as technology suppliers staunchly protect their investment and designs".

The Government's view is that appropriate measures need to be considered to reduce these potential barriers to new entrants and to ensure that revenue from intellectual property rights is fair for suppliers and users of intellectual property rights. With regard to standard essential patents, the Government's view is that greater transparency in their essentiality and pricing could be beneficial for both licensees and licensors. The Government is considering options for monitoring the essentiality of patents.

The Government is currently considering how to approach this complex issue, including in discussions with international partners and with industry.

18. Of Ofcom's two principal duties, it has appeared to have given less prominence to "further[ing] the interests of citizens in relation to communications matters" than it has to "further[ing] the interests of consumers". Ofcom must ensure that it pursues both of its principal duties and guarantees the security of the UK's telecommunications infrastructure as well as furthering the interests of consumers. The Government should consider the case for updating its statement of strategic priorities for telecommunications, to emphasise the importance of Ofcom's duties relating to telecommunications security. (Paragraph 74)

The Government agrees that Ofcom has an important role to play in taking forward this agenda and in helping to create the right market conditions to support the process of diversification within the UK market. The Diversification Taskforce has set out its views on Ofcom's role and the importance of clarity in this area. We are working closely with Ofcom to ensure that they have the sufficient powers, where they will need them.

Following the Royal Assent of the Telecommunications (Security) Bill, Ofcom will have a more extensive responsibility to ensure the security of networks and services, together with substantial new powers to back up its monitoring and enforcement role. Clause 5 of the Bill includes a duty on Ofcom to ensure operators comply with their security duties. Those duties include compliance with:

- high-level requirements in the Bill to identify and reduce the risks of security compromises and prepare for their occurrence, with definitions of a "security compromise" set out in the Bill;
- specific security requirements set out in secondary legislation, which rest on powers in the Bill and again must be based on definitions of a security compromise;
- requirements to inform other providers of a "security compromise" to their own network or service.

The Government is also considering updating the Statement of Strategic Priorities, as suggested by the Committee.

19. The UK's telecommunications market accounts for a small proportion of the global market. International coordination will therefore be critical to the success of the UK's diversification strategy. The Government's 5G Supply Chain Diversification Strategy acknowledges this fact, and states the Government's ambition for international co-operation. However, the strategy provides little detail of plans for sustained co-ordination on industrial policy with a diverse range of countries. (Paragraph 79)

20. The Government should seek to establish a dedicated, standing forum for international co-operation on diversifying the telecommunications market, encompassing as many like-minded countries as possible and covering aspects including: research and development; adoption and deployment; standards; and overall strategy. This should

not be based on existing intelligence-sharing coalitions. The Government should set out in its response to this Report, how it intends to achieve this, a timetable for establishing such a forum and what progress it has made to date. (Paragraph 80)

The Government agrees that there is a need for international fora to coordinate and drive international collaboration on diversifying the telecommunications equipment market. The Diversification Strategy makes clear the Government's intention to build a global coalition consisting of a critical mass of the global telecoms market to ensure there is sufficient scale and partnership to effectively tackle this issue.

The Government is committed to leading the international conversation on this issue, and has identified telecoms diversification as one of its priorities for the UK's presidency of the G7, using this multilateral forum to establish international consensus and agree to future co-operation on diversifying the telecommunications market. The Government is also engaging proactively with a wide range of international partners on a bilateral basis to understand their position on diversification and identify opportunities for joint collaboration. We will continue to proactively expand this engagement, and work with international partners on tangible opportunities for cooperation as implementation of the Government's strategy develops to build international consensus for the need to address the security and resilience risks posed by a lack of effective competition in the global telecoms supply market.

A critical technologies strategy

21. There is a strong risk that the urgent security challenges faced by the UK's telecommunications sector are indicative of a wider, and growing, geopolitical development. Throughout our inquiry, we have heard of the prospect of a growing technological and regulatory divergence between China, and countries aligned with China, and other countries. This is not restricted to telecommunications or even cyber security—artificial intelligence, quantum technologies and synthetic biology are just some examples of other emerging technology sectors that will be prominent in our future economy and security, and in which there is the potential for different technical and regulatory standards to apply. The Government should not regard the problems posed by 5G addressed in this Report as a one-off, but more likely illustrative of a wider challenge. (Paragraph 85)

22. *The Government must treat the current issues in the UK's 5G vendor market as an indication of a much wider geopolitical, technological challenge. The character of the UK's response, and that of other like-minded nations, will have profound implications for future decades and beyond. We urge the Government to address this seriously, comprehensively and without delay. We recommend that within twelve months, the Government should develop and publish a White Paper setting out its assessment of the current extent of and future potential for global technological divergence, the anticipated consequences of such divergence and how it intends to address the challenges this poses.* (Paragraph 86)"

Digital and emerging technologies are reshaping economies, transforming our daily lives and our societies. As a future frontier of the global economy, there is an imperative to promote and harness this innovation, not only to power domestic growth, but also to tackle the most pressing global challenges—from public health to climate change. Whilst

new frontiers bring prosperity and wellbeing opportunities, they also raise important questions about the interaction between economic opportunity, security and ethics, and the balance between the role of the state, business and individuals.

Emerging technologies are built on an ecosystem of institutions, laws, rules and norms that comprise the international order. For emerging technologies these are loosely defined, rapidly evolving, and the source of increasing geopolitical tension. How these norms, rules, and standards are developed has, and will continue to have, far reaching effects on our society, security and future prosperity. The Government has therefore committed in the Integrated Review for the UK to be more active in shaping the open international order of the future: using our convening power and working with others to ensure it is fit for the 21st century and more resilient to short-term shocks and long-term challenges.

Building coalitions of like-minded nations around common values, including through our G7 Presidency and the Future Tech Forum will be central to our response to these challenges. DCMS is leading the G7's Digital and Tech Ministerial Track which seeks to demonstrate the need for a trusted, values-driven digital ecosystem that can enhance prosperity in a way that is both inclusive and sustainable.

Beyond the G7, DCMS is leading work on the Future Tech Forum. The Forum will seek to create a sustained dialogue with a broader set of international partners, building consensus around the core principles that guide the evolution of the international technology ecosystem, in support of shared democratic values. It will also consider how the international community can harness digital technologies to tackle shared global challenges.

In Artificial Intelligence, we are shaping emerging norms and normative frameworks as a founder member of GPAI—the Global Partnership on AI—which has a focus on ethics and responsibility. The UK has helped develop GPAI's terms of reference and memorandum of understanding for an OECD hosted secretariat, and led on establishing work plans across data governance and responsible use of AI. Within its terms of reference, GPAI adopts the UN Sustainable Development Goals (SDGs) as a central mission. Other members are: France, Canada, Australia, the European Union, (Germany, Italy and Slovenia are also independent signatories), India, Japan, Mexico, New Zealand, the Republic of Korea, Singapore, and the United States of America.

Our ability to shape future technology standards and norms, as well as to respond to the challenges brought by potential future technological divergence, will come in no small measure by the strengths of our capacity to innovate and bring new technologies to market. DCMS is preparing a Digital Strategy, and a National Data Strategy which will complement the BEIS Innovation Strategy to be published in the summer. These, together with the Defence Science and Technology Strategy, and AI Strategy will set out how the UK will achieve its goal and approach to critical and emerging technologies.

23. As part of its White Paper on global technological divergence, the Government should develop a critical technologies strategy that identifies technologies that are likely to be of critical importance to the UK's prosperity and security over the next ten to twenty years. This strategy should assess the potential opportunities and risks of these technologies,

and propose measures to seize those opportunities and mitigate those risks. It should align with other relevant strategies, such as the Integrated Review of Security, Defence, Foreign Policy and Development and the new Industrial Strategy. (Paragraph 90)

24. The Government has only recently considered the consolidation of vendors in the UK's telecommunications market as a potential risk to national security, although it is a process that has taken place over ten to twenty years. One problem appears to have been the focus on the security of the network operators and not their supply chains, including when setting the role and powers of the regulator. Although the diversification strategy now addresses vendor diversity, it still does not consider the full supply chain. Whereas other nations and regions, including the USA, Australia and the European Union, have produced strategies addressing supply chain risk across all critical technology areas, the Government's diversification strategy addresses only 5G. (Paragraph 93)

25. *In producing a national strategy for critical and emerging technologies, the Government should consider potential risks that could develop across their full supply chains.* (Paragraph 94)

28. Domestic capability in the research, development and adoption of critical technologies is key not only to economic growth and technological progress, but also to national security. It reduces dependency on foreign suppliers and governments, and allows the UK greater scrutiny of technologies for potential vulnerabilities and greater influence over the technological capabilities developed. Managing potential risks from critical and emerging technologies by supporting domestic capability will require early identification of those technologies and assessment of the UK's existing capabilities, as well as the capability of the UK's allies. (Paragraph 105)

29. *In producing a national strategy for critical and emerging technologies, the Government should assess the UK's domestic research and development capability for each technology area as well as the capability of its allies. As the Government looks to strengthen research and development in the UK, this assessment should be used to identify particular critical and emerging technology areas of strategic importance in which the UK's capability should be developed and strengthened. This support should not focus on academic research alone, but should also encompass research and innovation capability in businesses and other research institutions.* (Paragraph 106)

The Government agrees with the Committee's analysis of the need to consider the long-term plan and implications of critical and emerging technologies.

To this end, in line with the Prime Minister's vision articulated in the Integrated Review, the UK's goal is to grow the impact and influence of the UK's 'Science and Technology Power' by 2030, building a durable competitive edge in science and technology. Achieving this goal requires a whole-of-UK effort in collaboration with international partners. In this, the Government's primary role is to create the enabling environment for a thriving science and technology ecosystem of scientists, researchers, inventors and innovators, across academia, the private sector, regulators and standards bodies, working alongside the manufacturing base to take innovations through to markets.

The Government will also invest in strengthening our international science and technology collaboration, with co-creation—bringing together talent and innovation from around the

world—essential to success. A demonstration of this is the £800 million being spent to set up an independent body for high-risk, high-reward research: the Advanced Research and Invention Agency (ARIA), which will back breakthrough technologies and basic research through experimentation. This is in line with an increase in economy-wide R&D to 2.4% of GDP by 2027, an investment of at least £6.6 billion defence funding over the next four years in advanced and next-generation R&D, and an overall investment of £14.6 billion in R&D across government in 2021/22.

The UK will establish a leading role in critical and emerging technologies where there is a realistic prospect of delivering strategic advantage. These will typically be areas which will have significant societal, security and/or economic impact; where the UK is capable of establishing and sustaining a dominant position; where technical standards can reinforce and uphold our open society and/or is at risk from becoming overly dependent on certain supply chains. A new 'own-collaborate-access' framework, will guide our approach:

- **Own:** where the UK plays a leading and owning role, end-to-end from discovery to commercialisation. This will always involve elements of collaboration and access.
- **Collaborate:** where the UK is not able to establish a dominant position, but can provide unique contributions that allow us to collaborate with others to achieve our goals.
- **Access:** where the UK will seek to acquire critical science and technology from others, through options, deals and relationships.

In order to coordinate the above approach to strategic advantage through science and technology, a critical new function will be instituted in the Government Office for Science providing information, analysis, and insights to inform strategic decisions across Government Departments.

Meanwhile, the Government continues to demonstrate its support and commitment to the Tech Sector which has benefited from recent HMG support including the Future Fund, Bounce Back Loans and Coronavirus Business Loans. The Future Fund alone disbursed £1,066m in convertible loans to 1,055 innovative companies facing difficulties, including digital businesses. The Future Fund: Breakthrough, announced at the 2021 Budget will provide £375m co-invested alongside the private sector into R&D intensive firms that are looking to raise at least £20m in equity.

26. The setting of international standards is important for national economic competitiveness and technical capability. The influence of British companies and officials in global standards-setting processes is diminishing. Although the '5G Supply Chain Diversification Strategy' sets out the Government's intention to redress this in the telecommunications sector, it is not clear that there are similar plans for other important technological sectors. (Paragraph 99)

27. *In producing a national strategy for critical and emerging technologies, the Government should review the relevant global standards bodies, the objectivity of their processes and the relative influence of different countries. Similar to those measures*

outlined in its 5G supply chain diversification strategy, the Government should develop measures to build British capability and influence at standards-setting bodies for all critical technologies. (Paragraph 100)

The Government agrees that ensuring that the UK is engaged in shaping international digital technical standards is crucial to supporting the UK's economic prosperity, safeguarding our national security, and protecting the UK's norms and values now, and in the future.

DCMS, working closely with key UK stakeholders, is engaging with international digital standards bodies and like minded partners across a broad range of digital technical standards topics such as: Internet standards; artificial intelligence standards; telecommunication standards; and smart cities standards. An example of our leading work in shaping international standards is the development of European Standard (EN) 303 645 through the European Telecommunications Standards Institute. This is the first major international standard for the security of connected consumer devices, which was published in June 2020, following a voting process with representatives from over 20 national standards organisations.

The recently published Integrated Review sets out that the UK will drive forward efforts to ensure that digital technical standards developed by international standards bodies deliver for all. It also notes the importance of ensuring that transparency and accountability are embedded from the outset in the design and deployment of new technologies.

The UK must influence new technical standards in priority areas and develop new public policy approaches to technology which encourage innovation and interoperability, while protecting rights and freedoms. Through our G7 presidency, we will host the Future Tech Forum—bringing together governments, industry, academia and civil society in dialogue on a core set of principles to guide the evolution of the international technology ecosystem.

In emerging areas where standards have yet to be developed, there is an opportunity for the UK to drive the development of global technical standards, based on the needs of UK stakeholders. Quantum is a key example, in addition to other technologies such as artificial intelligence. HMG has invested in the development of quantum technologies through the National Quantum technologies programme (NQTP). The NQTP Strategic Intent document¹ identifies the need to “develop a more proactive approach to shaping standards with international partners and relevant government standards bodies”, and “strengthen our engagement in the development of international standards and benchmarking”. It is also worth noting that one of the roles of the British Standards Institution, as the UK's National Standards Body, is to lead the development of standards that support national interest.

Finally, in relation to our wider engagement on the development of important standards in international standards bodies, the Government will continue championing the industry-led multi stakeholder approach. Under our G7 presidency, a side event of over 70 participants from industry, civil society, academia, standards bodies, and government representatives, came together to discuss how to strengthen the multistakeholder system.

1 <https://uknqt.ukri.org/files/strategicintent2020/>

The multistakeholder model for standards development is essential for ensuring that standards are fit-for-purpose, representative of all stakeholders, and have an underpinning basis for trust, which is particularly important for critical digital technologies.

30. *In producing a national strategy for critical and emerging technologies, the Government should consider the security of the universities, businesses and other institutions conducting research into these technologies. Although guidance for the sector has recently been developed, the Government should monitor its implementation and stand ready to work with institutions to address any remaining challenges as appropriate.* (Paragraph 109)

The Government takes seriously the need to protect UK academic institutions carrying out research into critical and emerging technologies. We have taken direct action to support these institutions. The Centre for Protection of National Infrastructure (CPNI) and the National Cyber Security Centre (NCSC) worked closely with the sector to publish [Trusted Research](#) guidance on how institutions can protect and manage risk around their research collaborations.

The Government has taken robust action to prevent the Intangible Transfer of Technology (ITT) from research areas of concern—particularly where the knowledge acquired could support the development of foreign military programmes. The Government recently announced the expansion of the Academic Technology Approval Scheme (ATAS) which will require international researchers seeking to conduct research in proliferation sensitive areas to hold an ATAS certificate from 21 May 2021. Expanding the current scope of the scheme to include both international post-graduate students and researchers will provide the additional critical layer of security needed to protect proliferation sensitive UK research. We continue to work closely with partners across the academic sector to explore further options needed to guide and protect UK research.

Similarly, the Government recognises that many risks to academia and industry are not often immediately identifiable. Some threats are more nuanced and require a more tailored response from the Government. In October 2020, HMG launched the Digital and Tech China Strategic Communications Campaign to help UK digital and tech businesses to find clear, up-to-date information and specialist support on how to navigate China's unique marketplace in ways that reflect the UK's values and take account of national security concerns.

The Government has also worked closely with industry to provide comprehensive advice on how businesses can strengthen their organisational resilience. Through the NCSC, the Government published a practical [guide](#) which sets out the steps that small businesses can take to improve their cyber security. DCMS regular engagement with the digital sector helps to ensure this guidance is tailored, fit for purpose, and responsive to the needs of the sector.

Furthermore, the National Security and Investment Bill, currently before Parliament, proposes clear and focused reforms to the Government's powers for scrutinising investment for the purposes of protecting national security while maintaining a predictable and transparent process.