Telecoms Supply Chain Diversification Advisory Council Report

Government response

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Ministerial Foreword

The primary mission of this government is to drive economic growth. Delivering on this mission means ensuring that individuals and businesses have access to high-quality connectivity, which serves as the foundation of our modern, digital economy. It is now almost as vital as electricity and water.

Given this reliance, it is essential that the technologies delivering our connectivity are secure and resilient. This includes ensuring that we have a healthy, competitive telecoms supply chain – both to drive innovation and to avoid the risks that may arise from acute market concentration. In the broader digital sector, last year's Crowdstrike incident, which led to IT outages world-wide, showed just how disruptive it can be when something goes wrong with a supplier to which we have high exposure.

The previous government took steps to begin addressing these risks in the telecoms supply chain, but government and industry still have more to do. I am grateful to the Telecoms Supply Chain Diversification Advisory Council for their report.

I accept the Council's recommendations and in this response outline how the government will take action to implement them across the short, medium and long term.

We do not see any trade-off here between security and growth. They are mutually reinforcing.

With a strong research base in telecoms that ranks as the third in the world and a range of existing and emerging suppliers of advanced connectivity solutions already based here, we believe the UK can be a leading place for the development of these technologies.

Our ambition over the next 10 years is to be a home for more of these companies – from growing university spin-outs and scaling start-ups to global firms undertaking their technology development in the UK. That will give us a more resilient and competitive supply chain in our mobile networks; help us build sovereign capabilities in tech that is used by our defence forces, emergency services and so critical for our security; and it will stimulate growth, productivity and high-quality jobs.

That is why the government has identified Advanced Connectivity Technologies as a growth market within the Digital and Tech sector in the forthcoming Industrial Strategy. We will work across government to pull the levers we have to us to support it.

Realising this ambition and addressing the risks will also rely on a strong relationship with industry, as crucial drivers of the innovation that will develop a stronger UK ecosystem of companies and talent. We will work in partnership with the mobile network operators to deliver the measures set out in this response. To ensure all our efforts are well-targeted and informed by those both developing and deploying these technologies, we will establish a new Advanced Connectivity Technologies Council.

The security and resilience risks to our digital infrastructure are significant, but the economic potential that will be unlocked by cutting-edge connectivity is vast. Guided by the Telecoms Supply Chain Diversification Advisory Council's recommendations, the government will work to advance secure, resilient and innovative digital infrastructure and the technologies that enable this, now and in the future.

Sir Chris Bryant MP
Minister of State for Data Protection and Telecoms

Introduction

The Telecoms Supply Chain Diversification Advisory Council ('the Council') was established in 2021 to advise the government on telecoms diversification policy, building on the 2020 5G Supply Chain Diversification Strategy and recommendations of the 2021 Telecoms Diversification Taskforce Report.

The Council was commissioned by the previous government to produce an independent report that was submitted to the Minister of State for Data Protection and Telecoms in September 2024. The objective of the Report was to review the latest evidence and provide a revised set of recommendations to address current risks from dependence on a small number of suppliers in telecoms supply chains.

The Council submitted recommendations across four areas. First, it called for interventions in the Radio Access Network (RAN), identified as a critical area of market concentration and

which was the primary focus of the 5G Diversification Strategy. Second, it suggested measures to tackle concentration in other parts of telecoms networks, especially in the mobile core. Third, it highlighted risks in subcomponent supply chains, where hidden concentrations may exist despite diversity at the level of finished equipment. Finally, it called for additional ecosystem-wide measures that would be required for greater diversification of telecoms supply chains, specifically: regarding the UK's engagement with international partners and technical standards bodies to shape the global market and on skills development.

The government welcomes the Council's report and accepts its recommendations. We will implement its recommendations, while ensuring our approach keeps pace with technological and market developments. Where the recommendations have spending implications for government beyond March 2026, these will be considered as part of the forthcoming Spending Review.

This response outlines our plan to give effect to the Council's proposals.

Importance of telecoms supply chain security and resilience

The government recognises the crucial importance of secure and resilient telecoms supply chains in safeguarding the nation's telecoms networks – which are part of our critical national infrastructure. Minimising risks to our telecoms networks through the technology that makes up their supply chain is essential for ensuring reliable connectivity to people and businesses across the country. Given much of our economy relies on high-quality digital connectivity, it is also pivotal for the government's first mission: driving economic growth.

Following the UK Telecoms Supply Chain Review in 2019, which identified several security and resilience risks within the telecoms technology supply chain, the previous government introduced the Telecommunications (Security) Act 2021 to better protect the UK's public networks and services. The Act established a stronger telecoms security framework which places new security duties on public telecoms providers and introduced new national security powers to limit or control the use of high-risk vendors in UK telecoms networks.

The UK is now on a path towards complete removal of Huawei from the UK's 5G networks by the end of 2027, which will improve security and resilience. The government continues to work with telecoms operators as this is implemented and is committed to continually reviewing the legislative framework to keep pace with security threats.

The 2019 Supply Chain Review also outlined the UK's current dependence on telecoms technologies from only a few companies, particularly in important parts of the networks: the RAN and mobile core. The Council's Report notes that efforts to improve security by removing high risk vendors have exacerbated this concentration risk in the short-term. This is not unexpected; the previous government's 5G Supply Chain Diversification Strategy (2020) noted this was an issue that would require long-term efforts to address. **The government recognises that despite notable improvements in the security of our networks, we are still bearing risks from market concentration in technology supply chains, and that**

these will require continued focus from the government, industry, and the telecoms research ecosystem.

This dependence on a few suppliers can make UK networks more vulnerable to disruption from malicious or accidental causes such as software errors, cyber-attacks (including attacks by state actors), or commercial failure of an equipment provider. This concentration of vendors means the impact of any disruption is more likely to be amplified and felt by multiple UK mobile network operators (MNOs).

As detailed in the Council's Report, the cyber threat to the UK telecoms sector remains severe. Telecommunications companies are among the highest priority targets for both state-sponsored actors and financially motivated cyber criminals.[1] Increased geopolitical tensions, difficult commercial conditions, and rapid technological change has meant that the challenge we face continues to evolve. Recent examples of the potential for real world disruption are evidenced by the Russia-originated cyber-attack on the Ukrainian network Kyivstar in December 2023[2] and the China-linked hack on US telecommunications firms at the end of last year.[3]

Networks are also vulnerable to disruption from non-malicious causes. The recent CrowdStrike incident highlights the disruption that can be caused by over-reliance on a single vendor, estimated to cost the UK economy around £2 billion.[4] In 2021, Canadian mobile operator Rogers experienced a widespread outage due to an error in an Ericsson software update.[5]

The government is committed to action, working closely with industry, to address these risks.

Assessment of the current market of technology suppliers

This government accepts the Council's evaluation of the current UK telecoms supply market.[6] The UK's 5G RAN market remains highly concentrated and we should expect it to remain so in the medium term without further intervention.

The previous government aimed to increase diversity of technology supply in a single part of the network (the RAN), primarily through the £250 million Open Networks Programme (see **Annex A)**. Launched in 2022, the Programme aimed to accelerate the development and deployment of open interface architectures, like Open RAN, by helping the sector improve the technical maturity of these technologies, thereby fostering greater vendor diversity in the

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[1] NCSC, Annual Review 2024 https://www.ncsc.gov.uk/collection/ncsc-annual-review-2024
[2] Ukraine mobile network Kyivstar hit by 'cyber-attack', BBC, December 2023 https://www.bbc.co.uk/news/world-europe-67691222
[3] What to know about string of US hacks blamed on China, BBC, December 2024 https://www.bbc.co.uk/news/articles/c86w2evj05do
[4] The UK cost of the CrowdStrike Incident, Kovrr, August 2024 https://www.kovrr.com/reports/the-uk-cost-of-the-crowdstrike-incident
[5] Rogers blames Ericsson software upgrade for wireless outage, LightReading, April 2021 https://www.lightreading.com/wifi/rogers-blames-ericsson-software-upgrade-for-wireless-outage; Rogers Outage, CBC, April 2021https://www.cbc.ca/news/business/rogers-outage-1.5992954
[6] As outlined in paragraphs 37 and 38 of the Report, https://www.gov.uk/government/publications/telecoms-supply-chain-diversification-report-and-recommendations

equipment market over the current decade. This was accompanied by other policy and regulatory interventions, such as an agreement with operators to sunset legacy 2G and 3G networks, to reduce barriers to entry to the UK market.

Since then, Open RAN technology has matured and is beginning to be deployed globally. By 2028, some market analysts project that Open RAN will account for more than a quarter (26%) of global RAN revenues.[7] Leading technology vendors, such as Nokia and Ericsson, have agreed deals to supply equipment compliant with standards specified by bodies such as the O-RAN ALLIANCE - working in partnership with other vendors - to major operators such as AT&T in the US[8] and Deutsche Telekom in Germany.[9]

The government welcomes the adoption of Open RAN solutions but notes that many deployments to date involve a limited number of vendors – limiting their ability to deliver resilience, security and innovation benefits associated with a more diverse supply chain.

We therefore want to work with vendors, operators and others across the ecosystem to enable truly multi-vendor deployments.

The UK has been a pioneer in demonstrating and testing Open RAN in networks, with Vodafone UK and Samsung deploying Europe's first wide-scale commercial Open RAN deployment in 2021.[10] All UK MNOs have participated in projects within the Open Networks Programme, and several new vendors have established activities in the UK. We agree with the Council that the primary challenge now is transitioning from smaller-scale trials and demonstrations to large-scale public network deployments.

Furthermore, the government acknowledges that new security and resilience risks in other parts of the network have emerged, particularly reliance by most of our operators on a single supplier of technology in the mobile core. ‑ The market concentration picture in Operating Support Systems (OSS) and Business Support Systems (BSS) and telecoms cloud may also pose concerns. The mobile core has not been the focus of government interventions to date and given that these procurement decisions in relation to the mobile core were made within the last two years, this situation is expected to persist for at least the next five years.

Additionally, the government accepts the concerns highlighted regarding vulnerabilities in the supply of critical subcomponents, as many vendors source these from similar markets, with a significant portion originating from Southeast Asia. This is a risk shared by many other technologies, including semiconductors, artificial intelligence (AI), advanced robotics and quantum computing.

The government recognises that market and technology trends have the potential to create more diverse, secure, and resilient supply chains. However, additional action is needed both to manage short-term risks and to prevent similar issues reoccurring in the

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[7] Dell' Oro Group Inc, July 2024 Advanced Research Report Open Ran Market Forecast Vol.5 No.2
[8] AT&T, December 2023 https://about.att.com/story/2023/commercial-scale-open-radio-access-network.html
[9]Nokia, November 2024 https://www.nokia.com/about-us/news/releases/2024/11/27/nokia-wins-new-deal-with-deutsche-telekom-to-roll-out-large-scale-commercial-o-ran-network-in-germany/
[10]Samsung, June 2021 https://news.samsung.com/global/samsung-to-bring-open-ran-to-europe-with-vodafone-uk

long-term – as well as continue to assess and respond to the wider threat picture to our networks.

Executive summary: Government approach and headline commitments

This government response outlines our approach to managing risks across the UK's telecoms supply chains. It sets out three strands of action which will run concurrently: taking action to manage near-term risks (over the next three years), supporting market and technology trends to reduce risks in the medium-term (over the next five years), and preventing similar issues from reoccurring in the long-term (over the next 10 years). These strands are underpinned by cross-cutting actions to build a dynamic telecoms ecosystem and through the establishment of a new collaborative partnership between industry and government.

As a signal of our commitment to strengthening the security and resilience of our telecoms supply chains and grow the UK's industrial capability in the technologies within them, we will champion these technologies as a growth market in the forthcoming Industrial Strategy. Our support for the sector is backed by further investment of nearly £60 million, which includes funding for our world-class lab infrastructure and R&D in 2025/6.

The government will now refer to the range of technologies that will deliver cutting-edge connectivity as 'advanced connectivity technologies'. These technologies, which we previously described as 'future telecoms', include advanced terrestrial wireless and optical communications, non-terrestrial networks, software for networks management and emerging technologies such as quantum communications. They are essential for telecoms networks, but are also deployable in other domains like transport and enterprise networks, and defence and security settings. Given the increasing reliance across the economy on the connectivity that these technologies enable – as well as breakthroughs in their development that will have impacts not just for the future, but in the near term, such as the integration of AI – we judge that 'advanced connectivity technologies' better reflects their relevance and scope.

Our approach:

1. Taking proportionate and effective action to manage near-term risks (over the next 3 years) by strengthening collaboration with MNOs and global-scale vendors, security testing network equipment, and contingency planning so that we are better prepared in the event of potential supply chain disruptions.

- **Further invest in government-funded testing facilities, to ensure the technology in our networks is secure and resilient and drives innovation.** This includes the cutting-edge UK Telecoms Lab (UKTL), which undertakes testing and research to assure the security and resilience of technology deployed in our networks now and in the future. By complementing security testing the MNOs undertake themselves, this lab will help give confidence to operators to deploy innovative technology, while also supporting our efforts to address skills gaps in telecoms cyber security and increase the

UK's influence in technical standards setting relevant to security. The separate SONIC Labs (SmartRAN Open Network Interoperability Centre) will continue to offer a vendor neutral, interoperability testing lab space to support emerging vendors in the advanced connectivity sector, to develop and demonstrate the deployment-readiness of their open network solutions.

- **Working with global vendors to support their critical role in supplying the UK and growing our ecosystem.** We recognise the significant role global vendors play now – and will continue to play in the future - supplying the UK's networks, shaping, and developing advanced connectivity technologies, and as customers of innovative technology used in the finished solutions they provide. We are committed to making the UK an even more attractive environment for these companies to operate and invest in through making Advanced Connectivity Technologies a growth market in the forthcoming Industrial Strategy.

2. Advancing market and technology trends towards greater openness and interoperability over the medium term (over the next 5 years) by investing in R&D and encouraging the adoption of multi-vendor solutions.

- **Accelerate open and interoperable technologies through finalising our Open Networks Programme (Annex A).** We will draw the insights from projects run over the past 3 years and provide short extensions to selected projects - helping bridge the gap between development and deployment of open and interoperable technologies.

- **Ensure government interventions to support rollout and public procurement of connectivity solutions help deliver secure and resilient supply chains, where feasible.** For example, this includes considering how open and interoperable solutions or UK-developed technology could be deployed to meet public sector connectivity needs.

3. Preventing similar issues from reoccurring in the long term by expanding UK industrial capacity across advanced connectivity technologies (over the next 10 years), leveraging the benefits of the forthcoming industrial strategy, and supporting a thriving ecosystem of firms in the UK.

- **Promote the development of advanced connectivity technologies in the UK**. This funding will be directed through UK Research and Investment (UKRI)-delivered funding into technologies where the UK can play a greater role in the future global supply chain. This will target technology areas that build on our existing academic and industrial strengths, offer the most promising growth markets, and can deliver important national security and defence capabilities.

4. Promoting cross-cutting measures to support the telecoms sector build more secure, resilient, and innovative supply chains by working with international partners, strengthening participation in standards setting and continuing to support skills development.

- **Work actively with like-minded international partners to build more secure and resilient telecoms supply chains.** We will explore joint R&D projects and work on a bilateral and multilateral basis with allies to shape the development of new technologies.

- **Shape the technical standards that will define the next generation of advanced connectivity technologies in line with our priorities and values.** We will bring together key stakeholders from across industry and government to ensure these technologies meet our priorities, including interoperability and openness.

- **Support the sector to develop the skills needed to adopt secure and resilient supply chains and drive innovation.** This includes steps to identify skills gaps, support cross-technology skills initiatives and targeted interventions to promote specific telecoms skills, such as through Centres for Doctoral Training.

5. Partnering with industry to enhance the security and resilience of our supply chains and adopt more UK-developed innovation in our networks. This involves:

- **Reaching a new agreement between government and the Mobile Network Operators (MNOs)** on the development and deployment of advanced connectivity technologies. This will include our respective ambitions and commitments to ensure a secure, resilient, and innovative telecoms supply chain.

- **Establishing a new Advanced Connectivity Technologies Council to provide independent advice to government** on how our support to the sector can best drive growth, improve connectivity and strengthen supply chain security and resilience. This will be made up of representatives from those developing technology solutions, network operators and other key sectors using these technologies.

This response indicates the government's commitment to ensuring secure and resilient supply chains in the technology that delivers our connectivity. It sets out some concrete first steps and an overarching approach to addressing this long-term challenge. Funding beyond 2026 will be subject to settlements in Spending Review 2025, but the government recognises that ensuring the resilience and security of the telecoms supply chain will require sustained efforts.

1. Taking proportionate and effective action to manage near-term risks (over the next 3 years)

The government remains committed to using and updating the Telecommunications (Security) Act 2022 regime as necessary to keep our networks secure and resilient. However, the use of the powers under the Act to restrict the use of Huawei equipment on national security grounds has increased our reliance on a small number of technology vendors, which poses different security and resilience concerns. This was expected; and it has always been clear that addressing this will require long-term efforts to promote a more dynamic, healthier market. This means, in the short term, we will be carrying concentration risks in the mobile core, RAN, and at subcomponent level. **It is therefore essential that government takes robust and proportionate steps to manage these risks.**

Working with global telecoms technology providers

Summary of the Council's recommendations:

The Council's report underscores the importance of engaging with key global-scale vendors such as Nokia, Ericsson and Samsung, to ensure they continue to operate in the UK market, work with government on matters relating to the security of their equipment and to accelerate the deployment of multi-vendor Open RAN solutions. Effective cooperation with these firms is vital not only because of their substantial presence in the UK and their widespread use across our networks, but also their role in the global market and the important role they play in the development of new technologies.

The Report encouraged continued collaboration between the government and these vendors on open and interoperable solutions, including via involvement in groups like the O-RAN ALLIANCE[11], to demonstrate how their technology can be used in a more diverse supply ecosystem through multi-vendor solutions.

Government response:

The government recognises the crucial role of global-scale vendors in the UK telecoms market in delivering the equipment vital for the UK's connectivity and shaping future generations of technology. Ericsson has committed to a 10-year, multi-million-pound investment in a UK-based 6G R&D centre, focusing on hardware security and network research.[12] Nokia's £600 million market presence in the UK is bolstered by the innovative work of Nokia Bell Labs in Cambridge. Meanwhile, Samsung have chosen the UK to be the home to their European headquarters and R&D Institute and one of their global AI research centres.[13] Other global telecoms vendors, including Airspan[14], Mavenir[15], NEC,[16] Rakuten[17] and Toshiba[18], also have notable presence in the UK.

Advanced Connectivity Technologies will be a growth sector in the forthcoming Industrial Strategy, indicating that we will take a cross-government approach to support the sector, making the UK an attractive place both to start and grow these businesses and for inward investment.

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[11] A global alliance comprising operators, vendors and academic institutions aimed at promoting open and interoperable solutions. https://www.o-ran.org/

[12] Ericsson, November 2022 https://www.ericsson.com/en/press-releases/3/2022/ericsson-in-multi-million-gbp-6g-research-program-investment-in-the-uk

[13] https://research.samsung.com/aicenter_cambridge

[14] Airspan to build Open RAN lab for 5G innovation in UK, Capacity Media, May 2021 https://www.capacitymedia.com/article/29otd6mddjpstgg9btxxc/news/airspan-to-build-open-ran-lab-for-5g-innovation-in-uk

[15] UK gets more Open RAN investment, Mavenir gets Koch, Telecoms.com, April 2021 https://www.telecoms.com/open-ran/uk-gets-more-openran-investment-mavenir-gets-koch

[16] NEC gets a piece of the UK's 5G bonanza, Telecoms.com, October 2020 https://www.telecoms.com/5g-6g/nec-gets-a-piece-of-the-uk-s-5g-bonanza

[17] Rakuten symphony expands operations in Europe, Rakuten, February 2022 https://global.rakuten.com/corp/news/update/2022/0214_07.html

[18] Toshiba, November 2023 https://www.toshiba.eu/quantum/news/toshibas-journey-from-research-to-commercialisation-of-quantum-technologies/

We aim to deepen the R&D and investment footprint of global-scale vendors in the UK, building on their existing strengths, so that it is commensurate with the size of their share of the UK market and the government's ambition for the sector. The Department for Science, Innovation and Technology (DSIT) will work closely with the Department for Business and Trade (DBT) and the Office for Investment (OFI) to showcase the UK's attractive investment offer and support inward investment. This includes:

- **Globally competitive financial incentives**, including the lowest corporation tax in the G7, alongside uncapped R&D tax credits and the Patent Box regime, which offer reduced tax rates on qualifying income.

- **Access to top talent** through our world class universities and flexible visa options, including the Global Talent Visa and Skilled Worker Visa.

- **Seamless investment support** through the strengthened Office for Investment, which offers tailored services, including planning and skills triage services to support major investors.

- **Dynamic Capital Markets,** with opportunities to unlock billions of capital investment through the new National Wealth Fund and pension reforms, making the UK a hub for Initial Public Offerings.

- **Strong international partnerships.** The UK's associate membership of Horizon Europe and international partnerships, such as the Global Coalition on Telecoms (with the US, Australia, Canada, and Japan), offer further routes for telecoms technology vendors to engage with us in cross-border R&D and international policy development.

We want to work closely with these vendors and operators to ensure their offerings are as secure and resilient as possible, including through engagement with the National Cyber Security Centre (NCSC) and the UKTL. As we seek to manage risks from market concentration, we will engage with them to draw insight into how the market is developing to help inform government's approach.

We welcome both Ericsson and Nokia's endorsement of Open RAN since the previous government's 5G Supply Chain Diversification strategy was developed. However, Open RAN is not an end in itself; its benefits will only be realised if there is a move towards more genuinely multi-vendor systems. We want to see Nokia and Ericsson remain key providers to UK networks, as part of a healthier supply chain that drives resilience and innovation – working in partnership with other scale and emerging vendors. We welcome their participation in the government-funded Open Networks Programme in recent years, indicating how government and global vendors are already collaborating. **We re-state the UK Open RAN Principles – backed by many of our international partners – as the desired end state for this technology and propose to work with global scale technology vendors as partners in developing technology in line with this framework.**[19]

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[19]Open RAN principles, gov.uk, April 2022 https://www.gov.uk/government/publications/uk-open-ran-principles/open-ran-principles

Security testing

Summary of the Council's recommendations:

The Report emphasises the role of security testing in addressing risks associated with the current concentration of vendors in the UK RAN and core markets. The Council recommends that the government work closely with operators and the largest vendors, Nokia and Ericsson, to rigorously test the security of RAN and core equipment through neutral-testing infrastructure like the UKTL.

Government response:

The government welcomes the Council's recommendations on security testing in the UK RAN and core markets and is committed to ensuring the technology we use in our networks now and in future is as secure and resilient as possible. **To support this, the government has confirmed continued funding for the UK Telecoms Lab in 2025/26.** The UKTL is a unique publicly owned facility focused on improving the security of telecommunications in the UK. It aims to enhance the ability of both government and industry to predict and manage security risks by:

1. Conducting advanced security testing and vulnerability research on technologies currently deployed in UK networks or those which may be deployed in the near future;

2. Growing a cohort of UK telecoms cyber security professionals; and

3. Partnering with industry to shape global telecom security standards.

UKTL is delivered by the National Physical Laboratory, overseen by DSIT, and operated in partnership with NCSC and Ofcom to evaluate technology which is currently or could soon be used in UK networks. **DSIT will continue to work with the partners above to ensure UKTL focuses on the technology areas most relevant to security and resilience of our critical national infrastructure (CNI), and industry priorities in the future.**

UKTL will leverage its near-representative test network to conduct security testing and research on critical infrastructure equipment including core and RAN from both existing and Open RAN vendors to support more secure deployments and a diverse range of suppliers. UKTL's work with Open RAN vendors will test secure interoperability functionality and compatibility with existing solutions – helping give operators confidence to deploy this technology. UKTL will expand its availability as a facility for collaboration and a space for operators and vendors to work together on security, resilience, and secure interoperability – as well as skills development.

Contingency planning

Summary of the Council's recommendations:

The Council recommends the government work with operators on contingency planning to assess their readiness for potential supply disruptions and encourage a more consistent approach to supply chain visibility and preparedness across the industry. The Council advises developing and modelling contingency scenarios to assess the impact of significant disruptions to vendor operations, including the ability to switch between vendors when necessary.

Government response:

Government will work with industry to undertake contingency exercises so we are as prepared as possible to mitigate and recover from disruption should it occur.

Government already works closely with the telecoms industry to disseminate best practice and policy advice to further enhance the sector's resilience through the Electronic Communications Resilience and Response Group (EC-RRG), chaired by industry with the secretariat provided by DSIT. There are established and extensive plans in place for working with the telecoms industry during an incident, including through the National Emergency Plan for Telecoms (NEAT) which is managed by the EC-RRG.

To build on our existing activity, **government will cooperate with operators, vendors, DBT and the NCSC to explore contingency exercises that would help ensure the continuity of critical services in scenarios such as major vendor supply disruptions or software failures.**

Leveraging cross-government efforts to strengthen supply chains

Summary of the Council's recommendations

The Report highlights the significant risks posed by critical dependencies in the supply of subcomponents within telecoms equipment supply chains, including in the supply of semiconductors. It highlights the value of information sharing to provide early warnings of potential supply chain disruptions, and value of leveraging existing cross-government structures to improve collaboration and visibility of these issues.

Beyond seeking security and resilience at the vendor level we recognise that security of supply for sub-components is also important. The government is committed to ensuring that risks to telecoms supply chains are embedded in cross-government efforts to improve the security and resilience of supply chains. **Work is underway to assess where supply chains critical to the UK's economic security and resilience could be vulnerable to disruption** – including those in the growth driving sectors outlined in the industrial strategy. The government will work with business to address these risks, building the conditions required to deliver secure growth.

2. Advancing market and technology trends towards greater openness and interoperability over the medium term (over the next 5 years)

Improving the security and resilience of our networks in the medium term depends on operators deploying a greater range of vendors and technologies, supplied by a competitive and innovative market for advanced connectivity technologies.

To date, government has focused on accelerating open and interoperable solutions, such as Open RAN, as the primary lever for promoting a greater range of vendors in the RAN. We assess that the technology is now maturing, with government-funded R&D having helped support this trend (see **Annex A**) and the UK having played a leading role in international trials.

The main barriers to Open RAN adoption at scale in UK public networks are now commercial. The government will help address these by providing an interoperability lab for new providers to test their solutions, working with operators to address skills challenges, considering supply chain resilience objectives in government's own adoption/roll-out and procurements, and working with operators so that their procurement strategies take a multi-vendor approach into account. The government is working with academia and industry to identify and address the key barriers to deployment, such as those summarised recently by the Digital Catapult.[20]

Investment in R&D to support open and interoperable solutions

Summary of the Council's recommendations:

The Report underscores the government's role in fostering Open RAN development through strategic investment in R&D. It highlights how the Open Networks Programme has attracted private investment, addressed technical challenges, and enabled small and medium-sized enterprises (SMEs) and specialist companies to expand their capabilities in the sector.

Recognising that commercial barriers, including multi-vendor integration, now pose the greatest challenge to Open RAN adoption, the Council calls for greater coordination between labs, including SONIC Labs and the UK Telecoms Lab, and industry operators, ensuring a structured testing pipeline that supports vendors at all stages.

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[20]Digi Catapult, Feb 2025 https://www.digicatapult.org.uk/publications/post/barriers-to-open-ran-adoption-how-can-we-overcome-them/

Government response:

The Open Networks Programme – alongside other public and private R&D investments – has helped to improve the technical maturity of open and interoperable products and solutions and addressed technical challenges related to interoperability. Annex A outlines how the Open Networks Programme has helped accelerate the development of Open RAN and contributed to supporting the UK's telecoms research and industrial ecosystem. **The government will draw insight from all the projects supported to inform our approach to open and interoperable solutions. We have also committed extending a small group of projects from the Open Networks Programme to allow them more time to deliver benefits.** This includes projects that help bridge the gap between development and deployment and demonstrate the benefits Open RAN can deliver.

SONIC labs will also continue to receive government funding and support from Ofcom. The vendor neutral interoperability lab will continue into 25/26, supporting interoperability testing for emerging companies. The government is extending its funding so that it can continue to serve as a trusted and reliable environment for vendors testing Open RAN products. We will also be building on its potential by exploring how it can support wider testing activity. Ofcom also works with SONIC to draw insights from the lab's research to inform Ofcom's regulatory approach. The government is committed to working with regulators, like Ofcom, to remove regulatory barriers to economic growth.[21]

Promoting adoption of multi-vendor solutions

Summary of the Council's recommendations:

The report underscores the need for robust Open RAN certification processes to ensure performance standards, highlighting their importance in building operator confidence and supporting internal testing. It advocates for certifications that are rigorous, reliable, and tailored to specific deployment scenarios, ideally developed within a global, industry-led framework.

Additionally, the report supports exploring alternative adoption pathways, such as private networks, densification layers, and public procurement of advanced connectivity solutions, to unlock new opportunities - particularly for smaller players.

Government response:

The government commits to promoting the development of an industry-led Open RAN certification programme in partnership with existing standards and specification organisations, such as 3GPP and the O-RAN ALLIANCE. By assuring compliance with an agreed set of requirements, certification can make it easier for Open RAN suppliers of all sizes to innovate and enter the supply chain – and give confidence to their customers that solutions will work as intended.

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[21]Chancellor calls on watchdog bosses to tear down regulatory barriers that hold back growth, gov.uk, January 2025 https://www.gov.uk/government/news/chancellor-calls-on-watchdog-bosses-to-tear-down-regulatory-barriers-that-hold-back-growth

In January 2025, the UK contributed to the publication of the Open RAN Certification Principles as part of the Global Coalition on Telecoms (GCOT).[22] These voluntary guidelines provide a framework for the Open RAN ecosystem stakeholders to develop a robust, comprehensive certification programme for Open RAN equipment, which recognises the importance of security and performance. To work most effectively any certification programme will need to operate internationally and be industry-led.

The Council recommended that at least one UK lab becomes an Open Testing & Integration Centre (OTIC) to support certification. **SONIC had now been approved by the O-RAN ALLIANCE and become an OTIC,** allowing it to support industry led certification and badging in the UK and work with international lab counterparts as part of the OTIC network in line the UK's Open RAN principles and the GCOT Open RAN testing and certification principles.

Recognising the importance of international collaboration to further vendor diversification, **SONIC labs has signed MoUs with both Tawain's ITRI (Industrial Technology Research Institute) and India's CDOT (Centre for Development of Telematics) and collaborates with Germany's I14Y lab.**[23] These agreements outline a commitment to work closer together on Open RAN testing, share information and findings, and undertake complementary activity to further mutual objectives to test and demonstrate the maturity of the technology.

The government recognises that new entrants may initially seek to enter the UK market by supplying the growing number of private networks – which could allow them to offer smaller deployments as they scale. This can also provide a means of demonstrating their performance and capability, to give confidence to operators that they can be deployed in public macro networks. **The government will work with emerging vendors and operators to discuss how this pathway could support a broader range of vendors in the public macro network in future.**

Ensuring citizens and businesses across the UK have access to the connectivity they need is key to driving growth and connecting communities. This can include direct public procurement of connectivity solutions to deliver public services, or government support to promote take up of technology by other sectors like energy and rail. **We will ensure that government action to support rollout and uptake of connectivity solutions takes account of supply chain security and resilience.** This will involve considering if interoperable solutions or UK-developed technology could be used to meet connectivity needs, which could drive demand for these technologies and help drive diversity in the supply chain. This will ensure that government interventions to deliver connectivity support multiple policy aims, where possible, delivering as much benefit as possible for each pound of public money spent.

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[22]GCOT Open RAN Principles, January 2025 https://www.gov.uk/government/publications/global-coalition-on-telecommunications-open-ran-certification-principles/global-coalition-on-telecommunications-open-ran-certification-principles
[23]Digital Catapult, September 2024 https://www.digicatapult.org.uk/apply/events/meet-us-at-the-i14y-lab-summit-2024/

3. Preventing similar issues from reoccurring in the long term by expanding UK industrial capacity across advanced connectivity technologies (over the next 10 years)

It is important that we work towards more secure and resilient supply chains for the technology currently deployed in our networks. However, the government recognises that the technology used to deliver connectivity is changing rapidly. This is being driven by emerging trends such as greater use of artificial intelligence, softwarisation, integration of non-terrestrial networks (NTN), and advancements in quantum encryption and communications technologies. These trends create new opportunities to improve the security and resilience of our networks. For example, network of networks comprised of different technologies should provide greater resilience and could result in a wider range of suppliers providing connectivity. However, there are also risks of new market concentrations emerging, with new forms of dependency and proprietary technologies taking hold.

The UK became dependent on a small number of technology firms in the current generation of connectivity technologies in part because our domestic industrial base reduced as the global market consolidated. Growing the UK's industrial base in the technologies that will deliver connectivity in future will help avoid similar risks arising, while also driving economic growth by allowing the UK to take advantage of new market opportunities. It will support our national security by ensuring the UK has domestic capability in technologies that are also critical for security and defence. These combined growth and security benefits are why advanced connectivity technologies have been identified as a growth market in the Digital and Technologies sector in the forthcoming Industrial Strategy.

Expanding UK industrial capacity

Summary of the Council's recommendations:

The report emphasises the need to expand the UK's industrial capability in telecoms technology to strengthen supply chain diversification and competitiveness. It calls for greater investment in the domestic industrial base to reduce reliance on a small number of suppliers occurring again in future generations of technology.

The Council recommends targeted R&D investment beyond the Open Networks Programme, focusing on higher technology readiness levels to bridge the gap between early-stage research and real-world deployment. This would help the UK develop practical, scalable telecoms solutions with global competitiveness.

The report also highlights the importance of anticipating emerging technologies, such as AI, quantum computing, and cloud integration, which are set to reshape network infrastructure. These are areas where the UK could establish a competitive edge and provide more resilience by introducing integration of different network technologies, like NTN.

Government response:

Alongside measures to diversify supply chains, supporting UK capability in telecoms can also help mitigate the risk of market concentration emerging in future technologies. This effort can drive economic growth and deliver broader security and resilience benefits, including sovereign capability for sensitive applications for the military.

The UK has a strong, existing foundation in advanced communications technologies and according to analysis by the Government Office for Science is one of the world's leading countries for academic publications and start-ups in this field. The UK's existing ecosystem includes emerging businesses who are developing solutions to run the networks of tomorrow and clusters of expertise across the UK, from photonics in Scotland and the south of England, to the and the growing compound semiconductor cluster in Wales and the South West of England.[24]

We have invested £70 million over the last two years to support UK R&D activities, like those listed above, to develop next-generation connectivity technologies. This has allowed us to create three Future Telecoms Research Hubs encompassing 25 universities, developed jointly with and funded through the Engineering and Physical Sciences Research Council (EPSRC): Imperial College London-led Communications Hub for Empowering clouD computing Applications and Research (CHEDDAR), the University of Oxford-led Hub on All-Spectrum Connectivity (HASC), and the University of Cambridge-led Network of Networks hub, TITAN. The three Hubs are supported by the Joint Open Infrastructure for Networks Research (JOINER) project led by the University of Bristol – which gives our researchers access to a test network that reaches across the nations and regions of the UK.[25] This complements expertise in other existing strong research institutions, such as the University of Surrey's 5G/6G Innovation Centre and the Scotland 5G Centre.

We have also collaborated with Innovate UK to support innovative UK companies and partnerships through providing investment to consortia comprising business and academia. The first phase of investment included early-stage support programmes like iCure to increase the rate of spinouts from universities and accelerate knowledge transfer from the research base to industry and later stage R&D funding to drive advancements in technologies that can

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[24] https://tradeandinvest.wales/key-sectors/compound-semiconductors?gclid=e2fbe060959d111341e687a8a0b87432&gclsrc=3p.ds&msclkid=e2fbe060959d111341e687a8a0b87432&utm_source=bing&utm_medium=cpc&utm_campaign=Compound%20Semiconductor&utm_term=compound%20semiconductor&utm_content=Semiconductor

[25] In line with UKRI's remit, these initiatives were funded based on merit and quality of bids. These university Hubs tackle research challenges across three key areas: network-of-networks, wireless and wired spectrum and cloud & distributed computing for telecommunications. The initiative aims to facilitate large-scale experimentation, fostering collaboration and driving innovation across the telecoms ecosystem and beyond. The Hubs have established joint governance through a federation model allowing them to create a shared IP pool and coordinated contributions to standards bodies, furthering the UK's participation in these fora.

be integrated into prototypes and system solutions across the telecoms stack.[26] This investment into UK companies and capabilities has helped develop technologies that reduce costs and latency and drive energy efficiency, which will support telecoms networks to better meet the connectivity needs of the public and businesses and reduce running costs for our operators.

The government is committed to further collaboration with the EPSRC, to support the Hubs, and with Innovate UK initiatives, allocating an additional £28 million investment through the Future Telecoms Technology Missions Fund for FY 25/26.

To date, government has used the term 'future telecoms' to describe the range of advanced technologies that will deliver connectivity in the future, encompassing advanced terrestrial wireless and optical communications, non-terrestrial networks, and other emerging technologies such as quantum communications. **We will now refer to these as 'advanced connectivity technologies', which we think better reflects the broad range of technologies that are already - or will be soon - integral to delivering the connectivity that will underpin our future economic growth.**

The dual importance of advanced connectivity technologies in supporting growth and improving national security and resilience means it has been identified as a key growth market within the Digital and Technologies sector of the Industrial Strategy. Analysis from the Government Office for Science recognises the enormous economic potential of the sector, identifying it as one of the top 10 technologies supporting the government's five missions.

Growing the UK's share of the global advanced connectivity technologies market would allow us to reap more of the benefits of this growth area. The government is ambitious and confident about the UK's potential, but we are also realistic about the role the UK can play in what is a highly globalised market. That is why **we will focus our efforts on growing the UK's contribution tothe global advanced connectivity technologies market over the next 10 years in targeted areas – focusing on those that build on our existing academic and industrial strength, offer the most promising growth potential and can support the capabilities we need for national security and defence.** As the Advisory Council recommended, we will also consider how greater UK industrial capability could help mitigate concentration risks in supply chains that have already been identified, such as in Radio Frequency (RF) components.

The forthcoming Industrial Strategy will set out more detail on how the government will drive growth in advanced connectivity technologies.

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[26] https://www.ukri.org/news/major-future-telecoms-research-boost-announced/

4. Cross-cutting measures to support the sector to build more secure, resilient and innovative supply chains

In the preceding sections, the Council provided a range of recommendations to drive progress towards more diverse, resilient and secure supply chains. Successfully implementing these recommendations will require government to make best use of international partnerships, strengthen the UK's role in standards setting and develop our skills base to support this plan in the short, medium, and long term.

Working with international partners

Summary of the Council's recommendations:

The report notes the UK's relatively small share of the global telecoms market (based on population size), recognises that the telecoms supply chain is global and procurement decisions are often made at a pan-European level. It recommends the government continue its work with international partners to establish consistent policies, provide clear signals to the market and reduce barriers to market entry for new vendors.

It acknowledges the UK's progress in this area and highlights its leadership in multilateral initiatives to endorse open and interoperable approaches to networking. The report also notes the value of strengthening bilateral relationships with international partners and maximising the benefits of the UK's associate membership of Horizon Europe.

The Council recommends building on this progress by leveraging new and existing international agreements to identify and fund R&D activities, encouraging greater collaboration between UK government-funded labs to improve capabilities and minimise duplication. It also emphasises the value of commercial diplomacy and UK thought leadership on openness and interoperability, particularly around emerging risks within the telecoms sector.

The Report also highlights the role of trade and inward investment in supporting UK capability building and attracting global scale RAN vendors to undertake more of their activity in the UK. It calls for the government to consider funding mechanisms that will support UK companies developing Open RAN and other advanced connectivity technologies to scale and ways to help firms showcase their products and find export opportunities.

Government response:

The government is committed to working closely with international partners to influence the global market, address joint challenges and shape the development of technology in line with our shared values.

The government will continue its work in multilateral settings such as the G7 and Global Coalition on Telecommunications (GCOT) to signal to the market the commitment towards open and interoperable networks. DSIT has played a central role in GCOT, chairing the Coalition's steering group during its first year and leading the future telecoms workstream. Together with GCOT partners we have published principles on Open RAN Certification and on the adoption of AI in the telecoms sector. DSIT will continue to work with GCOT partners and industry to ensure that telecoms networks are designed and deployed in a way that prioritises security, resilience and innovation.

We will continue to collaborate closely with like-minded countries, bilaterally – developing practical partnerships on advanced connectivity on the back of agreements we have signed, including with the US, Republic of Korea, Japan, India, Sweden and Finland. **This will include greater knowledge-sharing and network-building amongst our innovative businesses.**

We will pursue joint R&D partnerships where we have complementary interests and make the most of our associate membership of Horizon Europe, for which the UK government has launched a new campaign to boost participation.

Shaping technical standards development

Summary of the Council's recommendations:

The Council emphasises the need for the UK to strengthen its role in technical standards to shape future telecoms technologies and support a more diverse supply chain. Recognising the ongoing development of 6G standards, the growing convergence of telecoms with AI and satellite communications, and the impact of developments in quantum (including post quantum cryptography and quantum networking), the report underscores the need for proactive horizon scanning to uphold openness, interoperability and security in the standards development process.

To achieve this, the report urges the government to improve coordination across departments, deepen collaboration with industry and academia, and build technical expertise within DSIT. While progress has been made through increased engagement with key Standards Development Organisations (SDOs), the report calls for a longer-term commitment to sustain influence.

The report recommends early government engagement in SDOs and closer collaboration with international partners to shape 6G standards effectively. It also stresses the need to address intellectual property challenges by improving Standard Essential Patent (SEP) licensing transparency, increasing patent filings, and ensuring regulatory clarity.

Government response:

The government recognises the crucial role that industry-led global standards play in the functioning and development of telecommunications technologies. We understand the importance of improving the UK industry and research participation in SDOs to ensure that

future generations of technology evolve in a manner that aligns with our objectives and create growth opportunities for UK companies. This includes ensuring that advanced 5G technology is developed and deployed in a way that enables greater resilience through interoperability, and that these principles are embedded into 6G from the outset. **We welcome the fact that interoperability was recognised as an important feature of future mobile communication technologies as part of the International Telecommunication Union's 2030 framework for International Mobile Telecommunications (ITU IMT 2030 Framework) and we now want to see this translated into technical standards for 6G**.[27]

It is important that we leverage the full range of UK talent to influence technology standards and ensure that government and industry's combined efforts are coordinated to achieve maximum impact. To support this, **the government will continue to develop and strengthen mechanisms to bring together those working in advanced connectivity technology development.** This includes promoting routes to encourage information sharing and to remove potential barriers to participation, building on the work done through the British Standards Institution (BSI), other ecosystem-wide initiatives like the UK Telecoms Innovation Network (UKTIN), and linking our funded research and development programmes into standards activity.

The government accepts the need for a coordinated approach to standards development across government, and across technologies, with telecoms considered in coordination with standards on cybersecurity, AI, quantum and other relevant areas. **DSIT will work closely with other departments and agencies to align approaches to participation and long term influence in digital standards development.**

We will also continue to champion opportunities for international collaboration on standards development, making best use of initiatives like GCOT and Horizon Europe to compare approaches with like-minded partners and build support for common priorities. We will build on good working relationships with partners in fora like the ITU, where DSIT and Ofcom are already working closely to advance priorities, including vendor interoperability.

The government agrees with the significance placed on acting early in the standards development process and taking a strategic, coordinated and long-term approach to influencing standards development. DSIT will explore how this can best be integrated into the government's wider approach to digital standards and the Industrial Strategy.

The government also recognises the need to develop greater internal technical expertise, particularly in the specialism of technical standards and telecoms technologies. We will explore how best to improve the recruitment and retention of staff with specialist technical knowledge and continue to cooperate with wider government-funded initiatives like the UKTL, which bolster the technical expertise available for policy teams to engage with.

The government recognises the importance of intellectual property frameworks associated with standardised technologies such as telecoms, and how those frameworks

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[27]International Telecommunication Union, November 2023 https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2160-0-202311-I!!PDF-E.pdf

must balance the interests of innovative businesses to protect and access relevant IP, particularly with respect to standards development.

We are pleased that Council noted the ongoing work of the Intellectual Property Office (IPO) in this area.

The IPO has now launched a first of its kind SEPs Resource Hub, which provides a guidance on global standardisation and its interaction with IP frameworks.[28] The Hub aims to be a 'one stop shop' for businesses in the UK seeking guidance on navigating the SEPs ecosystem, SEPs and their relationship with standardisation; licensing of SEPs; dispute resolution and remedies; and on worldwide sources of information. The Hub has been developed in collaboration with industry, academia, SMEs, SEP holders and implementers/licensees. It will be updated over time, adding the latest SEP information, and latest SEP case law in the UK. Additionally, the IPO is undertaking an evaluation of the Hub where it will assess the Hub's impact and usefulness for UK businesses and plans to engage industry directly during the evaluation process.

The Hub is part of a package of non-regulatory interventions launched by the IPO with a focus on supporting growth, boosting efficiency and productivity. **The IPO continues its engagement with standard development organisations, including on improvements to IPR policies.** The IPO continues to take a technical lead on SEP discussions by collaborating internationally with counterparts and regulators to influence policy making in this global ecosystem and to ensure the UK's interests are best reflected. The IPO also continues to explore ways of ensuring there is increased transparency on pricing and essentiality of SEPs, and how efficiency can be improved in SEP licensing dispute resolution. This may include policy options that could require regulatory intervention, which would be subject to further public consultation.

Developing a skilled workforce

Summary of the Council's recommendations:

The report examines how the availability and distribution of skills and expertise within the ecosystem influence operators' ability to build and manage their networks effectively. It acknowledges the existence of critical skills gaps within the UK telecoms sector, which hinder efforts to diversify telecoms supply chains – especially given the additional skills needed to deploy open and interoperable solutions.

These gaps stem from a mix of systemic factors, such as workforce demographics and industry attractiveness, and acute challenges, including the emerging skills profiles needed to implement open and interoperable solutions, which require a mixture of engineering and software expertise.

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[28] https://www.gov.uk/government/collections/seps-resource-hub

The Council welcomes existing efforts, including the UKTIN Talent Programme, Engineering & Physical Sciences Research Council (EPSRC)-funded Centres of Doctoral Training (CDTs), as well as findings from the skills study conducted as part of the Open Networks Programme.

The Council recommends that specific skills associated with open and interoperable systems, such as systems engineering and software development, are covered in government interventions (including advisory bodies). It suggests using R&D initiatives to promote skill-sharing and development, including secondments, fellowships, and joint long-term planning with industry. It also suggests learning from international centres of excellence, such as those in Malaga, Spain, as a model for the UK to further build domestic expertise.

Government response:

The government acknowledges the critical importance of skills within the telecoms ecosystem, particularly new skills needed for open and interoperable networks. Many of these are also essential given broader changes occurring in telecoms networks, such as the greater role of software as part of 'virtualisation'. **We will develop an effective skills pipeline, so the sector gets the skills it needs. This will involve ensuring that skills gaps are identified and future needs forecast,** foundational skills like computing and engineering are given appropriate focus in the education system, the sector is easier to navigate for prospective employees, specific skills gaps are addressed, and that the government's wider interventions in the telecoms ecosystem through R&D and labs support telecoms careers and skills.

We agree with the Council's assessment that technological developments will change what skills the telecoms sector needs, including those required to support open and interoperable solutions. The Council's findings mirror those from work undertaken as part of the Open Networks Programme to identify skills needed to support Open RAN, which also emphasised the importance of software skills and the rapidly changing nature of the skills gap. **Understanding the skills the sector will need in the future is key to appropriately targeting interventions.** The government has already worked with the sector and funding bodies to project skills needs. This includes the Future Connectivity Workforce Fore-sighting Projects with Compound Semiconductor Applications (CSA) Catapult and UK Research and Innovation (UKRI)'s Workforce Fore-sighting Hub. We will work with Catapults and UKRI to assess the outcomes of this work and how it could be used to target further interventions, which could involve adapting current courses or developing new ones to help people reskill and/or upskill in areas needed by the advanced connectivity sector. We will also continue to support efforts to forecast skills needs as the sector and workforce evolves.

Many of the foundational skills required by the telecoms sector are shared with other critical technologies, such as AI. It is important that the education system focuses on these skills to provide a pool of talent for the telecoms sector. **We commit to integrating telecoms skills into cross-government initiatives to ensure workforce development meets the sector's evolving needs.** This includes:

- Supporting Skills England to coordinate efforts between government, industry, and the education sector to identify and address skills gaps by working closely with the Industrial Strategy Council and the Migration Advisory Committee.

- Shaping changes to technical education in response to these skills needs, which could include the types and accessibility of training supported by the Growth and Skills Levy.

- Contributing to the ongoing Curriculum and Assessment Review, which will deliver an education framework that strengthens foundational skills in areas like computer science, better preparing students for further study and careers in high-demand technology sectors, including advanced connectivity.

- Exploring greater alignment with existing government programmes, such as CyberFirst, to ensure we produce a steady pipeline of tech talent to start filling the skills needs of Advanced Connectivity Technologies.[29]

The government recognises that telecoms career pathways can be difficult to navigate and understand. That is why we will continue to work with the sector to help prospective employees understand the sector's specialisms and required skills, building on the work of the Telecoms ICT Industry Career Framework launched in May 2024, developed by The Institute of Telecommunications Professionals (ITP).[30]

The government recognises that telecoms career pathways can be difficult to navigate and understand. That is why **we will continue to work with the sector to help prospective employees understand the sector's specialisms and required skills,** building on the work of the Telecoms ICT Industry Career Framework launched in May 2024, developed by The Institute of Telecommunications Professionals (ITP).[31]

The telecoms sector requires very specialist expertise. To help develop this, the government has worked with ESPRC to fund a Centre for Doctoral Training in telecoms, named FORT (Future Open Secure Networks) (FORT). Led by the University of Surrey and Queen's University Belfast, CDT-FORT is supporting a community of postgraduate researchers who will influence the roadmaps of future open networking and security technologies, ensuring that the UK maintains its digital sovereignty in telecommunications and enhances its position as a key player in the global ecosystem. Building on the fore-sighting work mentioned above, and working closely with UKRI, we will look at the case for supporting further CDTs in advanced connectivity technologies.

The government's actions to support the UK's broader telecoms ecosystem also help create and support careers in advanced connectivity technologies and promote cross-fertilisation of skills, ideas and personnel between government-funded institutions, academia, and industry. Investment in R&D and labs such as the UKTL and SONIC directly support the creation of a pool of technical experts – especially in important areas like telecoms security and open networking. The UKTL is developing a skills programme specifically focused on security. This

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[29] CyberFirst is an extracurricular programme led by the National Cyber Security Centre to inspire and support young people, aged 11-25, pursue a career in cyber and wider tech. It has reached over 360000 children and includes measures such as summer courses, competitions, online learning provision and an undergraduate bursaries scheme https://www.ncsc.gov.uk/cyberfirst/overview

[30] https://www.theitp.org/careers-framework/

[31] https://www.theitp.org/careers-framework/

includes a structured graduate programme and a dedicated facility to support knowledge dissemination, which is planned to open in the next year.

5. Partnering with industry to enhance the security and resilience of our supply chains and adopt more UK innovation.

The government knows that we can only strengthen the security and resilience of our advanced connectivity supply chains and build a stronger UK sector by working closely with industry. That is why we are strengthening our partnership through a new Memorandum of Understanding with all UK Mobile Network Operators and establishing a new Advanced Connectivity Technologies Council to help us deliver on the commitments set out in this response.

Establishing a new agreement between government and Mobile Network Operators

Summary of the Council's recommendations:

The Council recommends the government work closely with operators to promote supply chain diversity in future procurement cycles and closely monitor market concentration across all aspects of the network. The Report identifies access to the data required to track the market and assess attendant security and resilience risks as important issues. It recommends that the government develops a better understanding of the factors influencing operators' network deployment choices and works with them to assess and mitigate concentration-related vulnerabilities.

Government response:

The government **will reach a new agreement with all Mobile Network Operators on the development and deployment of advanced connectivity technologies.** This will include our respective ambitions and commitments to ensure a secure, resilient, and innovative telecoms supply chain. We expect this to cover:

- **Cooperation to mitigate current risks** through:
  - Regular engagement between MNOs and government – including appropriate data sharing - to enable government and industry to assess how risks from supply chain concentration are developing.
  - Partnering on contingency planning exercises to test the sector's readiness to mitigate and recover from possible disruption.

- o Operator support for security testing and research, working with the UK Telecoms Lab, to ensure our current networks are as secure and resilient as possible.

- **Building more secure and resilient supply chains** through:

  - o A commitment from the MNOs to consider the supply chain security and resilience implications of procurement choices, including adopting multivendor strategies, wherever feasible.

  - o A commitment from government to help MNOs address any challenges they face when seeking to adopt new scale vendors and Open RAN in their networks, for example, through support to address skills gaps.

- Support for the UK advanced connectivity ecosystem through:

  - o Cooperation to support innovation in advanced connectivity technologies, including R&D investment by government and trials and adoption of innovation by the operators.

  - o Strengthened government and operator coordination on and participation in international standards setting.

Establishing a new Advisory Council

Summary of the Council's recommendations:

The Council recommends that the government maintain its long-term commitment to developing diverse, secure, and resilient telecoms supply chains by continuing to seek independent advice from the sector. As the tenure of many current advisory council members ended in autumn 2024, the Report advises government to consider a single advisory body with a broader remit for advanced connectivity policy to ensure coherence and prevent fragmentation in future diversification efforts.

Government response:

We will establish a new independent Advanced Connectivity Technologies Council, consisting of sector experts. This Advisory Group will seek to cover the breadth of advanced connectivity technologies the government is looking to support and provide independent advice to the government on how best to collaborate with the sector to implement the government's priorities, as outlined here and to be further elaborated in the forthcoming Industrial Strategy.

Our intention is that the Council should have a diverse membership, including those developing advanced connectivity technologies, representatives of major UK operators and other vertical sectors that will be using these technologies.

We will ask that the new Council will consider supply chain security and resilience as a fundamental aspect of their remit, ensuring it is integrated into overall strategy and decision-making, rather than treated as a standalone issue.

List of abbreviations

Acronym	Meaning
3GPP	3rd Generation Partnership Project
AI	Artificial Intelligence
BSI	British Standards Institution
BSS	Business Support Systems
CDT	Centre for Doctoral Training
CHEDDAR	Communications Hub for Empowering clouD computing Applications and Research
CNI	Critical National Infrastructure
DBT	Department for Business and Trade
DSIT	Department for Science, Innovation and Technology
EPSRC	Engineering and Physical Sciences Research Council
GCOT	Global Coalition On Telecommunications
HASC	Hub on All-Spectrum Connectivity
IMT	International Mobile Telecommunications
IP	Intellectual Property

Acronym	Meaning
IPO	Intellectual Property Office
IPR	Intellectual Property Rights
ITU	International Telecommunication Union
ITP	Institute of Telecoms Professionals
JOINER	Joint Open Infrastructure for Networks Research
MNOs	Mobile Network Operators
MOU	Memorandum of Understanding
NCSC	National Cyber Security Centre
NTN	Non-Terrestrial Networks
Ofcom	Office of Communications
OFI	Office for Investment
ONP	Open Networks Programme
OSS	Operations Support Services
OTIC	Open Testing and Integration Centre
R&D	Research and Development
RAN	Radio Access Network

Acronym	Meaning
RF	Radio Frequency
SDOs	Standards Development Organisations
SEP	Standard Essential Patent
SMEs	Small and Medium-sized Enterprises
SONIC	SmartRAN Open Network Interoperability Centre
STEM	Science, Technology, Engineering and Mathematics
UKTIN	UK Telecoms Innovation Network
UKTL	UK Telecoms Lab
UKRI	UK Research and Investment

Annex A: The Open Networks Programme

Introduction

One of the primary levers the government has deployed to support the diversification of the telecoms supply chain to date is to promote new technology and market trends that will allow a greater range of vendors to enter the RAN market, while also delivering competition and innovation benefits. These efforts have focused on advancing open and interoperable technologies like Open RAN, which break down RAN equipment stacks traditionally provided as an end-to-end solution by one vendor, into individual parts with open interfaces between them. This allows companies to provide part of a RAN solution, and for operators to choose solutions comprised of equipment from several vendors that best meet their needs.

The £250 million Open Networks Programme, launched in 2020, is the government's R&D programme to support open and interoperable technologies. The programme has three objectives:

- **Accelerate open-interface products and solutions** – ensuring they are truly interoperable, performant, and sustainable – to support our long-term vision for a more open and innovative telecoms market.

- **Incentivise and derisk accelerated deployment in the UK** – to encourage and accelerate network operators to adopt and deploy open network solutions.

- **Develop an internationally recognised UK telecoms ecosystem** – positioning the UK as a leading global market and focal point for research into open network technology.

The programme is made up of seven interventions:

Intervention	Objective	Outcomes achieved
FRANC	The Future RAN Competition was set up to accelerate the development of 5G Open RAN solutions, attract new 5G RAN suppliers and foster professional collaborations.	Increase in Technology Readiness Levels (TRLs) of between two to four for each product or solution in the portfolio. 38 new masters or PhD graduates and 43 hirings or promotions within teams.
SONIC	Independent telecoms laboratory to provide professional, end-to-end testing for groups of telecom equipment vendors and their products in various ways to better understand the challenges and possibilities of Open RAN.	Facilitated the testing of 22 different commercially viable Open RAN end-to-end multi-vendor systems, using 59 products from 20 different vendors. Supported 150+ strategic engagements across a range of industry dissemination events and workshops.
UKTL	Established to support government and industry to mitigate cyber security risks posed to telecoms critical national infrastructure. UKTL's security testing and research are targeted at improving the security of deployed telecoms equipment, minimising the risk of major outage, and improving security, resilience, and efficiency of service through support for supply chain diversification.	Established a world leading multi-vendor Foundation Network with carrier grade technology in a secure testing environment, including a first-of-its-kind integration involving Rakuten Open RAN. Unique insight into UK live network vendor deployments and associated research. Improved alignment of ORAN vendors with the Telecoms Security Code of Practice.

UKTIN	Established to make the UK telecoms and innovation landscape easier for new and existing participants to navigate opportunities, understand government priorities and improve sharing of information while providing industry feedback to the programme.	UKTIN has 6000 members and hosted 19 events. It has helped bring the ecosystem together and was involved in supporting the formation of consortia involved in half of the ONE projects. Over 160 SMEs have signed up to the UKTIN innovation platform with 43 businesses engaging directly in an innovation or investment workshop.
FONRC	Developed to enable universities to work with large RAN vendors, and other telecoms organisations, to conduct R&D to drive the openness and interoperability of future network architectures.	Average increase of two TRLs of each product or solution in the portfolio and over 67 publications on key topics. 22 jobs created and 14 new PhD/masters theses produced.
UK-Republic of Korea R&D project	Developed in collaboration with the Republic of Korea, the project focused on opportunities to improve the power efficiency of 5G Open RAN systems. This can deliver cost benefits to operators and support sustainability goals.	Produced the world's first reflective and transmissive Reconfigurable Intelligent Surface which is attracting commercial interest. Deepened relationship between UK and Republic of Korean industry and academia partners, who continue to collaborate.
Open Network Ecosystem (ONE)	Set up to fund projects that will develop a range of software and hardware products that will enable enhanced development and adoption of open and interoperable technology; as well as the opportunity to apply for funding for demonstrations of Open RAN technologies in high demand density environments.	Average TRL increases to date of two for each product or solution in the portfolio with six High Demand Density Deployments such as Three deploying Mavenir small cells in Glasgow. Roughly half of ONE projects have developed products and undertaken trials with some involvement from one or more of the UK mobile operators.

Through these interventions the Government's view is that the Open Networks Programme has successfully helped address many of the technical barriers to Open RAN deployment and provided a strong foundation to further build UK industrial capability in advanced connectivity technologies.

Progress against objectives

Objective one: Accelerate open-interface products and solutions – ensuring they are truly interoperable, performant, and sustainable – to support our long-term vision for a more open and innovative telecoms market.

A key aim of our interventions has been to drive open and interoperable solutions to technical maturity, so that they move up the technology readiness level (TRL) scale from research towards commercially viable products. This is critical for these solutions to be viable for deployment in networks.

The Open Networks Programme has been successful in delivering projects that have, on average, moved products or solutions two places up the TRL levels toward commercialisation.

Some projects targeted higher-TRL projects, aimed at:

- Showcasing open and interoperable solutions in different demand environments:
- High demand density areas (4x4 MIMO solution) like stadiums, stations and shopping centres
- Smaller, more agile deployments such as rural areas to provide reliable coverage
- Allowing more efficient RAN deployments (through the Open RAN Distributed Unit)
- Demonstrating the new features and capabilities that open and interoperable networks can provide, such as smart energy efficiency (RIC simulation platform and xApps).

Benefits demonstrated include potential deployment cost reductions of between 40-80% and energy savings of up to 80% across different components – which could deliver real benefits to operators and improve the sustainability of the telecoms sector. Many of these products have progressed through the programme into deployment scenarios as part of the ONE competition.

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AURA (Project Agile Universal Radio Architecture) – Small cell Radio Unit development

This project, led by Parallel Wireless, is developing an energy efficient small cell radio in line with BT's product specification. The hybrid product development includes a range of partners including the Compound Semiconductor Catapult and Cardiff University. Following lab trials

and live trials, work will continue towards real world 2G/4G/5G commercial deployments after the programme.

Other projects have focused on lower TRL examples of nascent technology that offers promise for delivering more interoperable networks in the future, working with large vendors like Nokia, Ericsson and Samsung. These includes examples such as:

- MATRIC (Multiple Access Technologies RIC) developed by project REASON which integrates all the access technologies into one platform so it can allocate resources based on the network and user requirements, for example combining different technologies such as Wi-Fi, 4G/5G, and satellite connections to provide the best service;
- Several new patents were developed by project TUDOR in Integrated Sensing and Communication (ISAC); and
- YO-RAN developed cutting-edge tune-able radio filters for 5G frequency bands as well as cell-free massive MIMO technology (for use in very high-density demand areas).

Objective two: Incentivise and derisk accelerated deployment in the UK – to encourage and accelerate network operators to adopt and deploy open network solutions.

The second objective of the Open Networks Programme is to help firms demonstrate the technical maturity of their products, to give confidence to buyers that the technology is ready to deploy.

One way it has done this is by promoting relationships between new market entrants and potential customers through R&D collaboration, to encourage future deployments. The ONP projects have helped build new relationships and consortia with emerging RAN suppliers. This includes supporting RAN equipment vendors like NEC to work with Freshwave[32], DenseAIR with West Sussex Country Council[33]; Samsung[34] and BT; and Mavenir to work with VMO2[35] and Three.[36] Several new suppliers of system subcomponents and network applications have

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[32] https://www.nec.com/en/press/202310/global_20231016_01.html

[33] https://denseair.net/shared-broadband-infrastructure-to-empower-worthing/

[34] https://research.samsung.com/news/Samsung-R-D-Institute-UK-announces-participation-in-REASON-project-funded-by-DCMS

[35] https://news.virginmediao2.co.uk/6561-2/

[36] https://www.mavenir.com/blog/a-world-first-three-uk-open-ran-small-cell-trial-for-high-density-coverage/

also undertaken new collaborative R&D activities in the UK such as Cisco and Neutral Wireless[37], Parallel Wireless and ARM[38], TIP and Amdocs[39].

The programme hassupported smaller, emerging firms and universities to collaborate with established players, to leverage the benefits of innovation and economies of scale. Examples of collaborative research and development it has supported between both large and small organisations, include:

- Partnerships between Microsoft and the University of Edinburgh under the Toward AI[40] and PerceptRAN[41] projects have been successful in developing an Open RAN RIC to allow different Apps to improve capability or add new features on Open networks.

- ARIANE[42] has brought different software providers together with multiple RIC providers to work on integration and app development in BT Adastral park - to lower barriers for developers wanting to make innovative apps for multiple platforms.

- NEC and Freshwave have been working together in the Navigate[43] project to deploy a neutral host small cell solution in City of London to allow multiple MNOs to improve coverage for their users.

- Best of British RAN[44] project, led by Telet Research, has worked with innovative UK companies like Accelercomm and CellXica to design, develop and manufacture a 5G cell in the UK for use in High Demand Density areas.

Our ultimate aim is to support the greater adoption of Open RAN in our public macro networks, to support greater diversity of supply and support innovation. That is why involvement of all UK MNOs has been critical. About half of ONP projects have developed products and undertaken trials with at least some degree of involvement from one or more of the UK mobile operators – to test technologies that have the potential to be deployed in the public macro network. MNOs were full partners in 14 of the 34 projects.

High Demand Density deployments

The programme has six scale High Demand Density (HDD) deployment trials to actively test innovative products and solutions in different deployment types and commercial models. Three of these deployments have carried live public mobile traffic focused on small cell layers being

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[37] https://newsroom.cisco.com/c/r/newsroom/en/us/a/y2024/m02/cisco-mobile-world-congress-empowering-global-service-providers-with-ai-ready-infrastructure-to-win-the-enterprise-with-innovative-business-services.html

[38] https://www.parallelwireless.com/press_release/parallel-wireless-marks-a-worldwide-first-5g-open-ran-sw-runs-on-both-arm-and-x86-powered-dus-in-bristol/

[39] https://www.amdocs.com/insights/blog/ariane-project-accelerating-ran-intelligence-across-network-ecosystems

[40] https://uktin.net/navigate-uk-telecoms/government-funded-projects/towards-ai-powered-and-secure-carrier-grade-open
[41] https://uktin.net/PerceptRAN
[42] https://uktin.net/ARIANE
[43] https://uktin.net/navigate
[44] https://uktin.net/navigate-uk-telecoms/government-funded-projects/best-british-ran-development

undertaken at MNOs' own laboratories, test sites or at the edge of their networks such as a neutral host site or private network connected to the public network.

To accelerate the adoption of these technologies, it is crucial to instill confidence in operators and other potential customers that they are ready to be deployed. This assurance can be achieved through rigorous lab testing, which is essential for demonstrating the reliability and scalability of these innovations. However, small companies often face significant challenges in accessing the necessary infrastructure to test and showcase their technologies on a commercial scale. SONIC labs has played a key role in facilitating this testing by 22 different commercially viable Open RAN end-to-end multi-vendor systems, using 59 product offerings from 20 different vendors (both large and small). This has taken place across four cohorts of interoperability testing and validation projects to assess the maturity of Open RAN products and systems and demonstrate the capability of this open ecosystem in its four different testing sites.

Objective three: Develop an internationally recognised UK telecoms ecosystem – positioning the UK as a leading global market and focal point for research into open network technology.

The third objective of the Open Networks Programme is to drive growth in the UK telecoms ecosystem, helping to build some of the foundations for growing the UK's industrial capability in advanced connectivity technologies. This includes galvanising industry and academic partners in the sector around shared objectives, strengthening the UK's participation in standards development, developing the skills needed for the sector to thrive, building on our research strengths to move towards greater commercialisation – including through filing patents, and attracting international firms and partners to invest and participate in the UK ecosystem.

YO-RAN (Yorkshire Open RAN) – Yorkshire ecosystem development

A good example of the development of UK capability has been the emergence of the local telecom technology ecosystem in Yorkshire around the YO-RAN project. This involves a strong collaboration between two local universities – the University of York and University of Sheffield – and companies such as ADTRAN[45], BT, AQL, Slipstream and Radio Design, who are all conducting advanced R&D in the region. Project partners are also rolling out a significant testbed network in the region. The advanced connectivity cluster in Yorkshire was boosted further in 2023 when the new National 6G Radio Systems Facility, funded by EPSRC, was launched at the University of Sheffield, to provide a unique experimental platform for researching and testing current and future radio systems

The programme has also helped build a solid foundation from which to grow the UK's industrial capability in advanced connectivity technologies through the projects' generation of

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[45] https://www.adtran.com/en/newsroom/press-releases/20240917-adtran-expands-uk-operations-with-new-distribution-center

publications and patents, and strengthening the UK skills base. This includes attracting, retaining and creating over 163 new qualified personnel with 47 new Master/PhD graduates in specialised fields. Projects have produced almost 170 research outputs (including 8 patents applications/granted; supporting the development of prototypes; aiding research publications and patent/publication citations and promoting collaboration) and 9 university spin outs generated from the portfolio so far.

FONRC – Standards development

The Future Open Networks RAN Competition (FONRC) portfolio has been successful in increasing the involvement of UK organisations in standard setting. This includes:

- TUDOR making 38 standardisation contributions to 3GPP and IETF and informing the formation of the new European Telecommunications Standards Institute - Industry Specification Group (ETSI ISG) on Integrated Sensing and Communication.

- YO-RAN have been active in the O-RAN alliance, including contributing to a forthcoming technical report from their Next Generation Research Group, on cell-free massive MIMO technology.

- REASON has been pushing boundaries in its effort to combine academic and industrial research towards AI-native future communication networks and influence standards working with BT, Ericsson, Nokia and Samsung, to strengthen the UK telecoms ecosystem. Its outcomes are impacting 3GPP Release 19, open source standards and has won the National AI Award for High Tech & Telecom.

Activities like these are critical to ensuring that the UK can leverage our knowledge, innovation, and skills to increase benefits from the next generation of mobile technologies by influencing its future direction at the global level.

The UK ecosystem has also been boosted through international collaborations such as:

- SONIC labs, which has attracted many international vendors that have participated in cohort activities including those from USA, Belgium, India, and Taiwan.

- UK-RoK R&D collaboration building and developing relationships between the two ecosystems

- The involvement of international partners in ONE, FRANC and FONRC portfolios. All of these activities have supported the development and growth of the UK telecoms ecosystem which is critical due to the international nature of the telecoms sector.