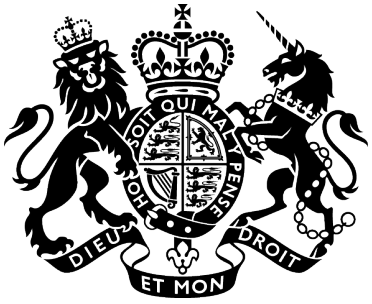
UK Government

The UK'S International Technology Strategy

CP 810



The UK's International Technology strategy

Presented to Parliament by the Foreign Secretary and the Secretary of State for Science, Innovation and Technology by Command of His Majesty

March 2023

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This publication is available at www.gov.uk/official-documents.

ISBN 978-1-5286-3539-4
E02764955 03/23

Printed on paper containing 40% recycled fibre content minimum

Printed in the UK on behalf of the Controller of His Majesty's Stationery Office

Contents

Foreword from Secretary of State for Science, Innovation and Technology

The new Department for Science, Innovation and Technology was established in February 2023 to deliver on the ambition to make the UK a science and technology superpower. The creation of this Department reflects the need to address the opportunities and challenges brought by rapid technological change, and are equipped for tackling a future shaped by technological advancement beyond our current imagination.

The Integrated Review 2023 reiterates our commitment to science and technology to drive growth and ensure the security of the British people. My department will oversee the UK Science and Technology Framework, which sets out our overarching approach and vision. Now this International Technology Strategy provides the vehicle to deliver the UK's technology ambition on the world stage.

This country is home to extraordinary technology expertise, with a flourishing tech sector, world-leading strength in cutting-edge technologies and a reputation for global leadership in developing forward thinking, agile legislation and regulation. We will continue to prioritise innovation in technology that will boost economic growth – creating jobs, increasing productivity, stimulating investment and catalysing trade.

Technology is fundamentally global – digital services and critical supply chains operate across borders. To create the free, secure, prosperous world we want to see, and we want our children to live in, we cannot act alone. It is pivotal that we work with our international partners and allies to support our shared growth, address global challenges and build momentum behind a digital and tech future that reflects our values. This strategy sets out our path to realise that vision.

Foreword from the Foreign Secretary

New technologies are revolutionising our world. Empowering people across the globe with new freedoms, knowledge and opportunities.

The tech sector is also a national asset that gives us an economic and strategic edge. We are proud to be Europe's top tech investment destination and home to the fourth largest number of tech unicorns in the world.

Authoritarian regimes have an alternative vision of harnessing technology for their own ends.

Our Strategy sets out how the United Kingdom will work with our allies and partners to ensure global technology standards are shaped by the free world.

So that technology is the positive engine of opportunity and economic growth that we want it to be.

It sets out how we are intensifying work with like-minded nations like the United States, Japan and Australia to promote the open, responsible, secure, and resilient development and use of technology. How we will protect our security from new and emerging threats such as cyberattacks and theft of intellectual property. And how we will stay on the frontier of the technological revolution.

Through our proactive approach, we can shape the technologies that will define the coming decades, including artificial intelligence, quantum and engineering biology.

To realise our ambition we are investing in our capabilities and expertise across the UK's overseas network. We will draw on the best of British – from industry, finance, academia, and civil society – and unleash the UK's full potential as a science and technology superpower, and harness the power of technology for the good of all.

Priority actions

1. Use international levers to support delivery of the UK's Science and Technology Framework, developing a cross-government implementation plan informed by engagement with priority nations.

2. Embed our principles throughout HMG's technology strategies, delivery plans and partnerships, and deliver values-based technology leadership that provides a liberal alternative to authoritarianism.

3. Create a new Technology Centre of Expertise, part of British Investment Partnerships, providing access to UK expertise to support sustainable economic growth around the world.

4. Create the world's most extensive and capable technology diplomacy network, increasing the number of UK Tech Envoys, increasing our tech expertise across our global network, and uplifting the capability of our diplomats through training, secondments and recruitment.

5. Shape the global governance of technologies, including championing the OECD Global Forum on Technology, building on the success of the UK's Future Tech Forum.

6. Establish a prioritised set of technology-based partnerships with key partners around the world, delivering mutually beneficial objectives and unlocking new opportunities.

7. Build on the UK's successful election to the International Telecommunication Union (ITU) Council, working together with partners to deliver an ITU that works for all its members, increases worldwide connectivity, and bridges the global divide. We will continue to shape the global technical standards ecosystem in line with our principles and values.

8. Develop technology solutions to global challenges through FCDO investment in mission-driven Research and Development (R&D) and technology development.

9. Coordinate across government to progress work to make the UK the best place to invest for technology and promote exports of leading UK technologies.

10. Promote the best of British technology expertise and leadership through our embassies and high commissions around the world.

Executive Summary

CONTEXT

Technology underpins our way of life: our economic prosperity; our national security and our freedom to live true to our values. In a world of accelerating technological change, increasing reliance on technology and geopolitical instability, the UK, working with partners, must protect and enhance its strategic advantages in technology.

The Integrated Review Refresh 2023 laid out our ambitions for science and technology (S&T). The UK is already a technology leader; we seek to build on this and strengthen our commercial success to cement our place as a **S&T superpower.** We will work with allies to increase freedom, openness and prosperity for ourselves and the world, counter hostile forces and promote liberal values.

This strategy sets out how we will achieve our ambitions and our vision of the UK as a centre of excellence, able to build our alliances which can win the global battle for technology influence and enable our values of freedom and democracy to thrive.

PRINCIPLES

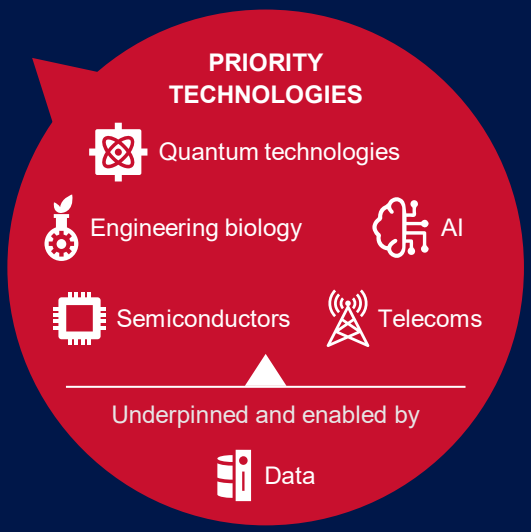
Our international approach will be guided by four principles:

- Open
- Responsible
- Secure
- Resilient

STRATEGIC PRIORITIES

Our approach will be guided by six strategic priorities:

- Priority technologies and data
- International partnerships for global leadership
- Values-based governance and regulation
- Technology investment and expertise for the developing world
- Technology to drive the UK economy
- Protecting our security interests



PRIORITY ACTIONS

1. Use international levers to support delivery of the UK's Science and Technology Framework
2. Embed our principles throughout our strategies and partnerships
3. Create a new Technology Centre of Expertise to support sustainable economic growth around the world
4. Expand HMG's Technology Envoy network
5. Champion the OECD Global Forum on Technology
6. Establish prioritised technology partnerships for mutual benefit
7. Use the UK's ITU Council seat to deliver an ITU that works for all members and increases worldwide connectivity
8. Deliver new solutions to global challenges with FCDO R&D investment
9. Work with industry to promote UK exports and attract Foreign Direct Investment into the UK technology sector
10. Promote the best of British technology around the world

IMPLEMENTATION LEVERS

To achieve our strategic priorities, we will employ the following levers:

- S&T diplomacy
- Regulatory diplomacy
- Cyber diplomacy
- Trade diplomacy
- Defence diplomacy
- Development diplomacy

Chapter 1. Britain as a technology leader

Why is being a technology leader important?

1. Technology underpins our way of life: our economic prosperity; our national security and our freedom to live true to our values. In a world of accelerating technological change, increasing reliance on technology and growing geopolitical instability, the UK, working with partners, must seek to protect and enhance its strategic advantage in technology.

2. The UK's Science and Technology Framework (S&T) sets out the ambition for the strength of the UK S&T system to be recognised internationally; by 2030, polling by the government will demonstrate that the UK is seen as one of the top three S&T nations in the world, and the leader in Europe. However, being a S&T superpower does not just mean challenging the global rankings, but collaborating more deeply with other leading nations and investing in the application of S&T to tackle the urgent global challenges facing our planet.

3. In a geopolitical climate that is increasingly adversarial, technology can be used for both benefit and harm. Autocratic regimes use technology to gain advantage in the world, suppress freedoms domestically and export authoritarian precepts. They do not subscribe to our ethical or social norms and seek to influence the development of technologies. **This strategic competition between authoritarian and liberal values will define how technologies shape our future.**

How will we approach this challenge?

4. The International Technology Strategy (ITS) positions the UK to thrive in the face of an uncertain future, reinforcing our capacity to shape how technologies will develop for national and global good. Central to this is ensuring that technology promotes our shared values of freedom and democracy. By putting our principles at the heart of our work we ensure technology develops in a way that our society values.

5. **The strategy describes our core principles for technology – open, responsible, secure and resilient.** Through these principles, we will bolster our international influence, reap the economic benefits which technology brings, and promote democracy, stability, personal freedom and privacy internationally.

Our four core principles

Open – we will promote the design, development and use of technologies which support **personal freedom and democratic values** and champion standards which enable innovation, data free flow with trust[1], exchange of ideas, and trade.

Responsible – we will support the design, development and use of technologies which support **sustainable growth** and are consistent with the **rule of law and human rights**. We will ensure data is used responsibly, in a way that is lawful, protected, ethical and accountable.

Secure – we will ensure technologies and data sharing systems are secure by design so they are **safe and predictable**. Using tools to protect the UK against threats to national security, we will create a secure environment for technology to flourish. We will safeguard personal privacy and property rights, including intellectual property.

Resilient – we will make sure technology is reliable and can be trusted by the public, that **UK innovation and critical systems are protected** and that we are promoting a stronger UK and a safer world by applying proportionate controls on sensitive technology.

Why do these principles matter to the UK?

These principles are derived from our national identity and are fundamental to the international systems we seek to shape and be part of. Promoting these principles globally is what drives our pursuit of strategic advantage. They underpin the strength of our S&T sector at home and drive innovation to tackle some of the world's greatest challenges. These principles will guide our international engagement, the partnerships we build and the actions we take on individual technologies.

1. G7 Roadmap for cooperation on Data Free Flow with Trust

What is our vision?

6. **The UK is ready to seize the S&T opportunity**. We are home to four of the world's top ten universities[2], ranked fourth in the Global Innovation Index, highest in Europe for tech unicorns and a world-leading fintech hub, representing roughly 11% of the global market share and attracting 11.6 billion dollars of investment in 2021. This represents a 217% increase in investment compared to 2020[3].

7. **Governments cannot act alone**. To achieve the ambition of this strategy, we will draw on industry, finance, academia and civil society to drive innovation, provide thought leadership and tackle global challenges. We will create stronger links between governments and the technology companies who now have global influence and will lead the way on developing emerging technologies.

8. **Regulation must provide protection and promote innovation**, agreed through coalition, not intimidation. In a world where technology development threatens to outpace the speed of regulation, we must be agile. We will strengthen our existing partnerships and build new alliances to influence international norms, rules, regulations and technical standards, based on our principles. We will engage internationally to reduce unnecessary barriers and harness technological innovation for the benefit of all.

9. **UK citizens and businesses will thrive**. We will include technology in our Free Trade Agreements, such as with Australia and Japan; driving exports of UK technology; and encouraging inward investment into UK businesses and venture capital funds, including from sovereign wealth funds. We will promote the UK as a global technology hub for Initial Public Offerings (IPOs) and work to attract global technology companies to list on UK public markets. Our tools to protect the UK against threats to national security, including the National Security and Investment (NSI) Act 2021, will ensure the UK is a secure and trusted place to do business.

2. 2022 QS World University Rankings

3. FinTech Investment Landscape 2021 – Innovate Finance – The Voice of Global FinTech

10. **Technology will support developing countries to become more prosperous and resilient**. Through British International Investment, the UK's development finance institution, we will invest in technology infrastructure. We will launch a new Technology Centre of Expertise to share the UK's world-leading expertise with partners in developing countries, supporting them to make informed choices on the development and use of technologies in line with our shared principles.

11. **We will protect our security interests**, and those of our partners. Strengthening the global security of key technologies will underpin the UK's critical national infrastructure, making our economy and infrastructure resilient to threats and shocks. As a responsible, democratic cyber power we will support inclusive and sustainable cyber transformation in developing countries. With our partners, we will build resilience into supply chains that allow innovation and growth without the threat of authoritarian sanction. We will work with partners to tackle malign influence or control sought through investment in our critical technologies.

Chapter 2. Our six strategic priorities

How will we deliver this strategy?

12. The International Technology Strategy is pivotal to delivering the international ambition set out in the UK's Science and Technology (S&T) Framework. Our approach also aligns with other key strategies, including the UK's National Cyber Strategy and approach to Critical National Infrastructure. The Integrated Review Refresh 2023 set out our objectives to generate UK strategic advantage through S&T, and build global resilience in the face of increasing competition and national security risks. The UK's review into the Future of Compute provides recommendations on a long-term plan for enhancing the UK's advanced computing capability. And the National Space Strategy set out the importance of the UK becoming a meaningful actor in space, through developing a competitive edge in priority S&T areas.

13. This strategy focuses on the five critical technologies set out in the S&T Framework, drawing together the actions and commitments within existing UK technology or sector specific strategies. **As technologies develop, and new challenges and debates around technologies emerge, this framework will guide our actions** and work with our existing and new international partners across government, businesses, academic institutions and civil society.

14. Our strategy is underpinned by a clear framework for delivery, describing how we will champion our principles on the international stage and achieve our ambitious vision by 2030. We have identified the key policy levers and highest-priority actions we will take in support of each strategic priority. We will develop a cross-government International Technology Strategy implementation plan, informed by engagement with priority nations, to deliver the ambition set out in this strategy.

Our approach and actions will be guided by six strategic priorities

Priority technologies and data: building strategic advantage in these areas to ensure the UK is world-leading and that they develop in line with our values.

International partnerships for global leadership: supporting our shared growth and addressing global challenges.

Values-based governance and regulation: promoting our principles and vision for a future technology order that benefits all by working with partners and through international fora to shape governance.

Technology investment and expertise for the developing world: building capacity to bridge the technology divide and support partners to make informed choices.

Technology to drive the UK economy: continuing to drive UK technology exports, and promote the UK as the best place for technology companies to raise capital and attract foreign direct investment.

Protecting our security interests: ensuring sensitive technology does not fall into hostile hands and that we retain critical technology capabilities in the UK.

2.1. Priority technologies and data

Which areas will we prioritise first?

15. **The UK cannot seek to be a world leader in all technologies**. We will focus our efforts on emerging technologies where the UK has significant existing strength or potential, or where technologies are most disruptive and vital to our security.

16. The Integrated Review 2023, and the UK S&T Framework identified **artificial intelligence (AI), quantum technologies, engineering biology, semiconductors and future telecoms** as priority areas of focus for UK S&T and **data** as a crucial enabler. The ITS framework demonstrates the type of focused action we will pursue and how they apply to technologies at different stages of maturity, from the early stage of quantum technologies, to the more mature applications of AI.

17. **Technologies do not exist in isolation of each other**. They form a complex, interconnected ecosystem where research and development breakthroughs or changes to regulation of one technology can impact the development or use of others. Some of the most impactful developments come from applications that combine different technologies in new ways. We will need to use and combine multiple technologies in creative and innovative ways to solve global challenges, tackling problems from different angles.

Privacy Enhancing Technologies

Privacy Enhancing Data Processing Technologies (PETs) are an emerging group of technologies that harness the power of data to address global challenges while reinforcing our democratic values in the face of authoritarian exploitation of technology. PETs for data processing are already being used to address societal challenges, such as tackling financial crime, facilitating research into COVID-19, and enabling greater understanding of the gender pay gap.

We are investing in this technology: in July 2022, the UK and US launched a joint prize challenge focused on advancing PETs. By bringing together top minds from both countries, the prize challenge will help mature and facilitate adoption of these promising technologies, with solutions profiled at the second Summit for Democracy in March 2023.

2.1.1. Artificial Intelligence (AI)

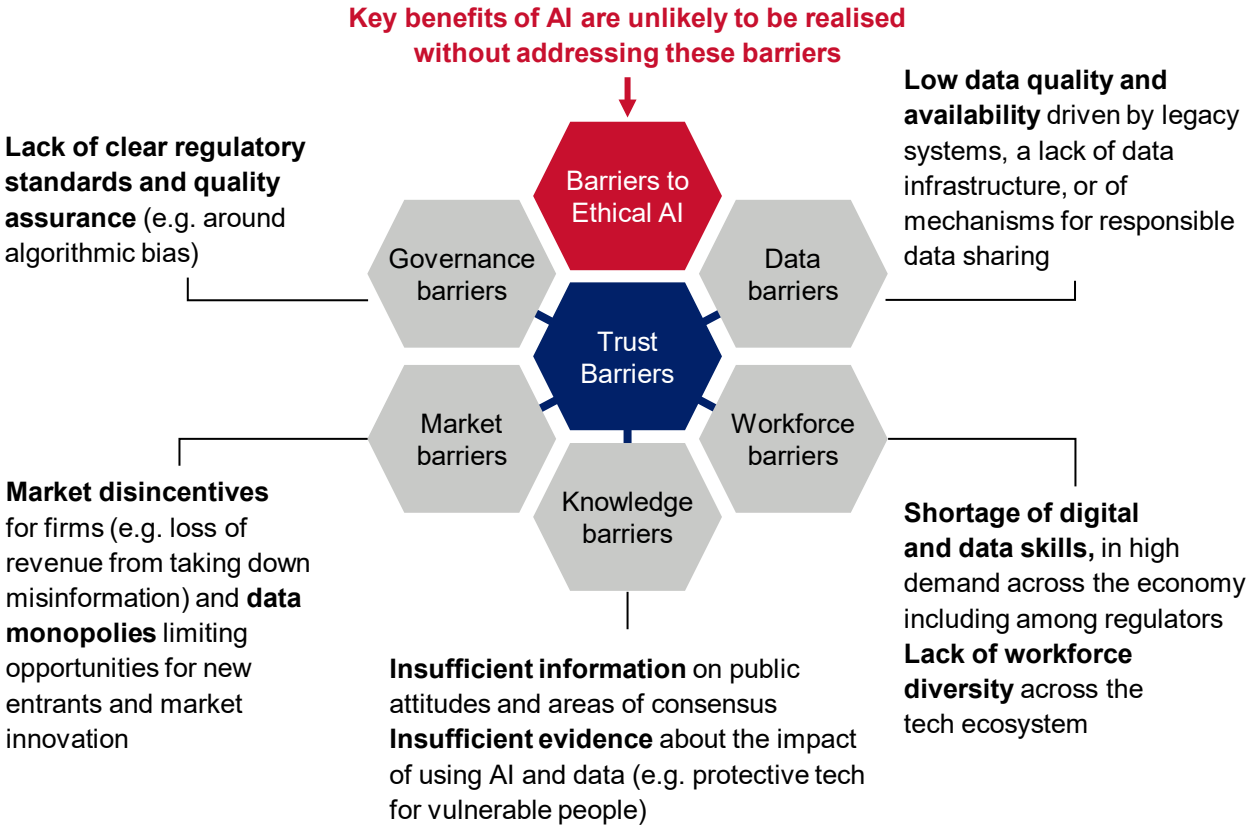
What are the main issues to consider in AI?

18. There is no general definition of AI that enjoys widespread consensus, though to further shape the discussion, the National AI Strategy describes AI as "machines that perform tasks normally requiring human intelligence, especially when the machines learn from data how to do those tasks." Key applications of AI include analysis, problem solving, perception and language interpretation. Much of the global population already encounters AI on a daily basis, for example through chatbots, navigation apps, and social media newsfeed personalisation. While current progress in AI development is rapid, the most transformative effects are still to come, and the pace of technological development and adoption is only likely to increase. As AI technologies become increasingly used and their applications broaden, they have the potential to bring huge new opportunities across government, business and public sectors, but also new and complex risks into everyday lives. Progress in AI therefore must balance the opportunities presented with important ethical, governance, and regulatory issues.

19. The UK has a thriving AI ecosystem and world-leading research and development (R&D). We are a hub for private sector and leading research institutes, ranking third in the world for AI publication citations per capita[4]. Internationally, we are a partner of choice, as reflected by the US-UK Declaration on Cooperation in AI R&D and AUKUS, the enhanced trilateral security partnership signed in 2021 between Australia, the US and the UK. We are a leader in global conversations through our foundational role in the Global Partnership on AI (GPAI) and by committing to the Organisation for Economic Co-operation and Development (OECD) AI Principles. Our ambition is to "supercharge" our domestic strength and global leadership in the future of AI, taking a proactive approach to AI safety and existential risks. The "adaptivity" of AI can make it difficult to explain the intent or logic of outcomes it generates, and the "autonomy" of AI can make it difficult to assign responsibility for outcomes. The UK's approach will use these core characteristics of AI to guide the scope of its emerging AI regulatory framework. We will pursue a common global cause on the emergence of general AI systems. They would bring profound challenges that go well beyond those we are encountering with today's AI technologies.

4. Stanford University, Artificial Intelligence Index Report 2021 (2021)

Figure A: Barriers to ethical AI[5]



How will we apply our principles to AI?

Open – we will promote a pro-innovation international governance and regulatory environment which supports **interoperability**, and fosters **liberty and democracy**. We will reject efforts to adopt and apply AI technologies to support authoritarianism.

5. Originally published in the Centre for Data Ethics and Innovation AI Barometer Report https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/894170/CDEI_AI_Barometer.pdf

Responsible – We will work to ensure international agreements embed our values so that progress in AI is achieved responsibly, according to democratic norms and the rule of law. We will work with our partners to establish international standards and governance frameworks that give clear, practicable guidance on key issues such as **algorithmic bias, diversity in the AI workforce, safety and personal privacy, and countering misuse of AI in relation to human rights**.

Secure – we will work with trusted partners to **safeguard intellectual property and expertise, to protect the UK ecosystem from hostile actors**, and to put in place measures to enhance cyber security through AI whilst **mitigating cybersecurity threats, including from AI itself**.

Resilient – we will **proactively assess the current and emerging risks of AI**, elevating the importance of these risks in global conversations and developing an early, coordinated response, with key allies, working closely with industry and academia. We will advocate for AI that is **robust, appropriately explainable, and trustworthy**.

Our top international priorities for AI

Promote the responsible development, use and adoption of AI, and shape the global AI governance in line with UK values and priorities. To do this we will:

- Deliver the National AI Strategy and ensure UK governance of AI technologies encourages responsible innovation, investment, and protects our security and our values.
- Deliver the UK's Defence AI Strategy which sets out the UK's approach to championing the safe and responsible development of AI internationally in support of defence objectives.
- Champion the role of interoperable non-regulatory governance tools, such as assurance techniques and technical standards, in enabling the development and deployment of responsible AI. This includes working with a broad set of multidisciplinary partners, including through the UK's AI Standards Hub to shape AI technical standards in standards development organisations.
- Play a leading role in prominent multilateral fora on AI topics, including the OECD, Council of Europe and the UN, and strengthen our engagement with multi stakeholder groups such as GPAI.
- Initiate an inclusive international dialogue on the current and future risks presented by AI, for example, general AI systems. We want to work with others to ensure that collectively we direct this dual-use[6] technology in a peaceful, human-aligned direction.

Why does this matter to the UK?

Over the next ten years, the impact of AI across the world will be profound, with both enormous benefits and risks. The UK is a global superpower in AI and is well placed to lead as a genuine research and innovation powerhouse, a hive of global talent and a progressive regulatory and business environment. But we must act now, with our partners, to ensure that the international standards and governance frameworks which will guide the uses of AI reflect our principles.

6. Dual-use items (including software and technology) are items which can be used for both civil and military purposes.

2.1.2. Quantum technologies

What are the main issues to consider in quantum technologies?

20. Quantum technologies (QT) use the principles of quantum mechanics to unlock new technological advances in areas such as sensing, imaging, communications, timing and computing. They have enormous potential to transform global security, economies and societies and underpin solutions to some of our biggest global challenges.

21. The best known application of QT is quantum computing (QC). QCs are at an early stage of development: realising the full potential of scalable, fault-tolerant computing could be ten or more years away. But when they come, QCs will create a step-change in computing power, able to solve problems that are impossible using classical machines. For instance, QCs have the potential to defeat cryptographic mechanisms that are used to secure much of today's communications.

22. The UK's ambition is to become a global centre of excellence for QT, shaping the global future of these technologies to harness responsibly the opportunities they can bring. We are home to many world-leading quantum start-ups, supported since 2014 by the National Quantum Technologies Programme. To drive further development, the UK is growing our international partnerships in quantum, such as through the UK-US Quantum Statement of Intent signed in 2021.

23. The UK has an opportunity to shape the development and future governance of QT from the outset. International conversations on technical standards are at an early stage within standards development organisations such as the Institute of Electrical and Electronics Engineers Standards Association, International Organization for Standardization and International Electrotechnical Commission. We will work closely with industry, academia, civil society and with international partners to ensure UK interests are represented at key standards and wider international bodies.

Figure B: Illustrative selection of potential use cases of quantum technologies

How will we apply our principles to quantum technologies?

Open – we will support innovation and the growth of the UK's quantum sector through **trusted international collaboration**, and engagement in key international fora to **develop pro-innovation governance** in line with our democratic values.

Responsible – we will advocate for the **early identification and consideration of the ethical principles** of quantum as the technology matures, including issues at the intersection with other fields such as medicine, recognising that the full range of potential uses and impacts are not yet known.

Secure – we will **mitigate security threats, including the cryptographic challenges posed by future quantum computing**. We will also provide guidance and support for industry and academia to promote secure innovation. We will work with likeminded nations to safeguard intellectual property.

Resilient – we will ensure the long-term strength of our quantum sector, working with likeminded nations to **safeguard expertise, protect the UK ecosystem from hostile actors and ensure resilient supply chains**.

Our top international priorities for quantum technologies

- Implement the National Quantum Strategy which build on the world-leading strengths of the National Quantum Technologies Programme.
- Collaborate and share expertise with international partners on the opportunities, challenges and key uses of quantum, especially where technologies could help to achieve major societal goals (e.g. net zero greenhouse gas emissions).
- Drive progress in quantum R&D by deepening collaboration with international partners and continuing to participate in leading multilateral research partnerships globally.
- Lead the global definition of the risks and opportunities of quantum, and work with international partners to develop shared principles for the responsible and secure development and deployment of quantum.

Why does this matter to the UK?

Quantum technologies are of the highest geopolitical importance. Those who develop functioning quantum technologies first will have access to capabilities that are impossible to replicate without a similar ability, bestowing huge economic and security advantages. The UK is well placed to emerge as a global leader in the quantum revolution, but we cannot lead alone. By collaborating with trusted international partners, we can ensure the UK and our allies can benefit from the opportunities which these technologies can bring and mitigate against risks.

2.1.3. Engineering Biology

What are the main issues to consider in engineering biology?

24. Engineering biology applies engineering principles to the design of biological systems. It builds on synthetic biology[7] to turn its biological discoveries into products. Engineering biology is likely to have a transformative impact, driving huge advances in the fields of health, agriculture, energy, environmental protection and materials science, and could be a key enabler in reducing carbon emissions.

25. Engineering biology's rapid advances raise important legal, regulatory, ethical and security considerations, posing a complex foreign policy challenge in balancing economic and social benefits with risks. The UK aims to support global markets for new engineering biology applications through international trade deals and by responding to these advances by leading development of international technical standards that facilitate commercialisation of these technologies. The UK has the skills to be a leader in the global debate on ethical standards and societal norms for the technology's use.

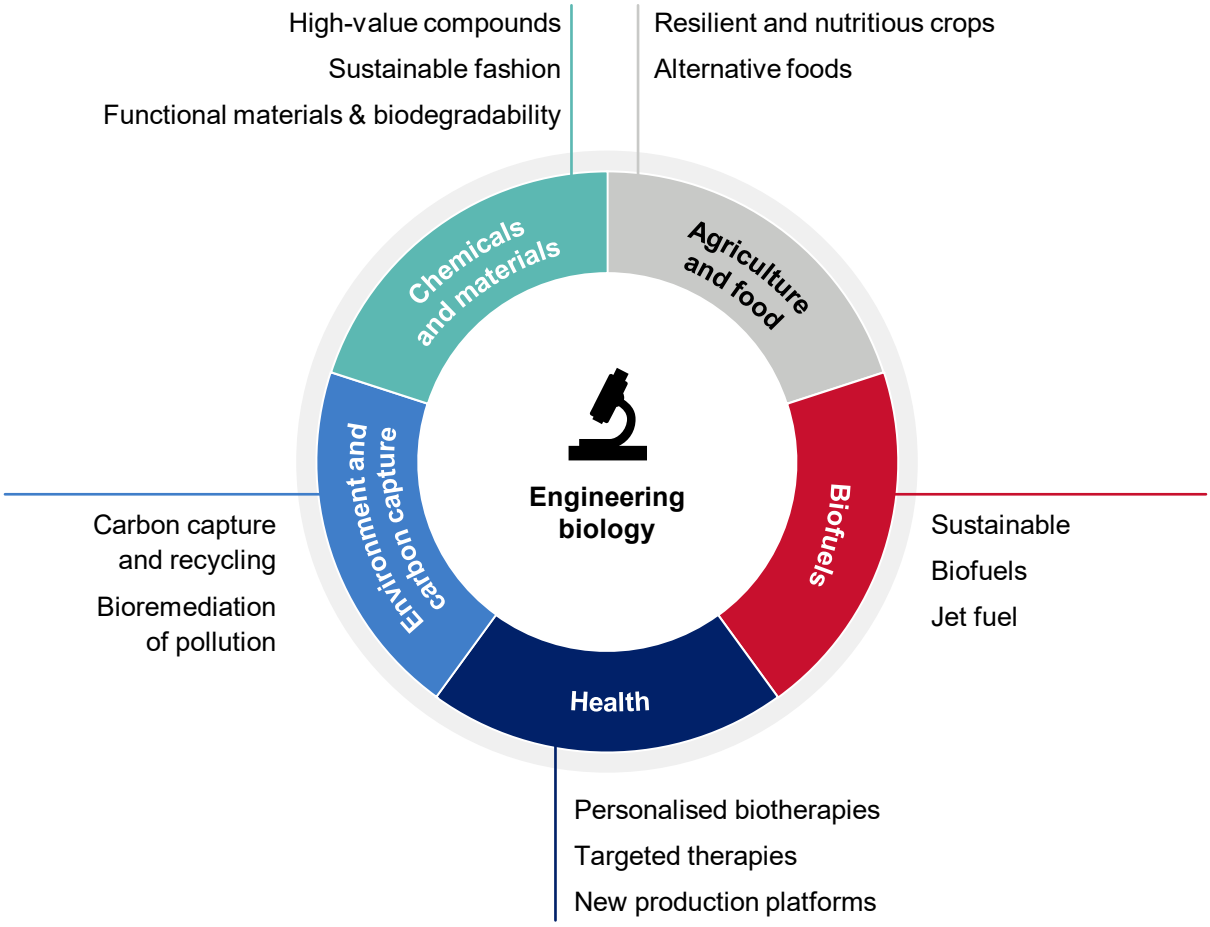
26. The UK has world-leading strengths in engineering biology and biotechnology, with a thriving and growing cohort of small and medium-sized enterprises (SMEs) aiming to commercialise innovations. We lead Europe in research publications, patents and private investment (£1.8 billion in the last five years), with government investing more than £500 million since 2010. UK successes include the start-ups Autolus, Oxford Nanopore and Ziylo, and pioneering innovations

7. Synthetic biology is the design and fabrication of biological components and systems that do not already exist in the natural world.

such as the biomanufacturing of fuels (C3 Biotechnologies) and engineered blood cells (Scarlet Therapeutics). We will ensure this brings economic benefits to the UK, including enabling our SMEs to establish overseas markets.

27. Aligned with the vision for the National Engineering Biology Programme, we will drive commercial and societal benefits, whilst protecting the UK from new kinds of security risks set out in the forthcoming refresh of the UK Biological Security Strategy.

Figure C: Illustrative selection of potential use cases of engineering biology



How will we apply our principles to engineering biology?

Open – we will support our domestic ecosystem by developing global standards, regulations and guiding principles which **enable responsible actors across the world to work together with trust in each other's values and intentions**. To advance the sector, we will bring innovations and ideas to global markets, collaborate with existing and new partners to promote joint R&D projects, exchange talent, and trade.

Responsible – we will work broadly to agree positions on **ethics and standards**. We will develop a shared understanding of the risks of engineering biology, including how applications could affect human rights.

Secure – we will maintain UK advantage by **safeguarding our intellectual property, the security of personal data and protecting the UK ecosystem from hostile actors**. We will work to agree positions on the global safety of engineering biology as new applications and opportunities emerge.

Resilient – we will **unlock key supply chains and leverage technologies to increase resilience** to tackle global challenges, particularly climate change and health.

Our top international priorities for engineering biology

- Identify and support opportunities for international collaboration to sustain the UK's leadership in scientific discovery and develop potential areas of application.
- Lead the global debate on ethics and responsible innovation in this field, including by playing an active role in multilateral fora, such as the OECD.
- Continue to develop our understanding of the risks of engineering biology, using the forthcoming refresh of the UK Biological Security Strategy as our framework for managing these risks. We will monitor other national approaches and investment into the sector.
- Drive international technical standards, sector-specific regulations and conventions for the safe and reliable uptake and commercialisation of engineering biology.

Why does this matter to the UK?

Advances in engineering biology have the potential to deliver significant advances across a range of areas including defence and security, the environment and the economy. The UK is in a strong position in this rapidly-developing sector, but needs to accelerate commercialisation. International collaboration can support our growing sector and increase economic growth. The current pace of development raises important legal, regulatory, ethical and security issues. The UK has the skills to play a leading role in helping to shape the global debate on ethical standards and societal norms in line with our principles.

2.1.4. Semiconductors

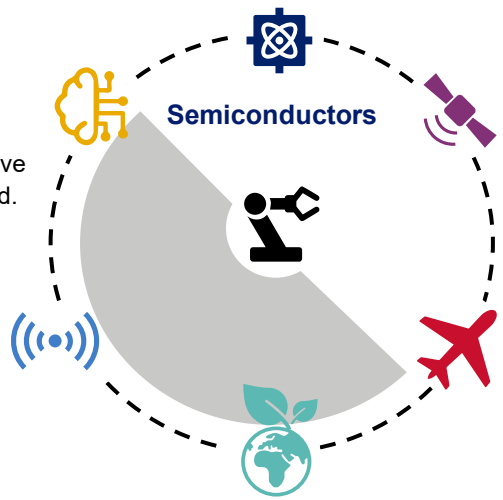
What are the main issues to consider in semiconductors?

28. **Semiconductors are critical for the functioning of the modern economy**. They are used to create the hardware which underpin electronic devices. Any prolonged disruption to their supply would have profound implications for the global economy. Semiconductors are vital to achieving UK strategic advantage in next-generation technological areas such as net zero, quantum, 6G and AI.

29. **The nature of the semiconductor supply chain makes it highly vulnerable to disruption**. The sector has a complex multi-stage production process, with different stages required to produce a chip occurring across the globe. The scale, complexity, costs, geographical diversity and pace of innovation within the sector mean that no government will be able to fully mitigate these risks alone, making international cooperation with key governments and companies crucial.

30. As the whole economy is becoming increasingly connected, a larger number of semiconductor devices – increasingly in consumer as well as sensitive applications – are now inextricably linked with protecting the UK's wider national security. Due to the increasing importance of semiconductors to wider technological progress and military applications, hostile states are looking to acquire semiconductor technologies to achieve their goals for defence and military advancement. International cooperation will be necessary to encourage the creation and adoption of cyber secure hardware across chips in use globally and joining up approaches to economic security between like-minded partners.

Figure D: Significance of semiconductors across sectors



Quantum Computing
Semiconductor materials offer a clear route to bring quantum computing to the real world, enabling quantum devices that can work at room temperature.

Artificial Intelligence
New semiconductor chips will be fundamental to the use of AI. For our use of deep learning to work and evolve, fast and effective semiconductor chips, with inventive new "architectures" will be needed.

Space
Normal computer chips can't work in extreme environments. Specialist compound semiconductors continue to operate with radiation or high temperatures, making them essential for future space technologies.

5G/6G
5G/6G can't work without cutting edge semiconductors – 5G/6G networks transmit large volumes of data at high speeds – powerful semiconductor chips are needed to process this information.

Defence and Security
Semiconductors and the computing they enable sit at the heart of all modern defence equipment, including aircraft, weapons systems and communications.

Net Zero
Semiconductor components are needed to handle the power that green technologies such as wind and solar create. New semiconductor designs can also reduce the energy consumption of our digital devices.

How will we apply our principles to semiconductors?

Open – we will support the **growth** of the UK's semiconductor sector through trusted international collaboration, and engagement in key international fora.

Responsible – we will ensure that international conversations related to semiconductors concentrate on **promoting enhanced cybersecurity standards** that mitigate threats to semiconductor devices, in both civilian and military sectors.

Secure – we will work with **trusted partners to safeguard intellectual property and protect the UK ecosystem from hostile actors**.

Resilient – we will work internationally to pursue a **coordinated approach that protects critical sectors**, such as healthcare, critical national infrastructure, and defence from semiconductor supply chain disruption that could cause risks to life or national security.

Our top international priorities for semiconductors

- Deliver the forthcoming UK Semiconductor Strategy to grow the UK's domestic semiconductor industry, in support of the UK's ambition to be a global S&T superpower.
- Work with international partners to improve resilience across dependent supply chains, including through developing a new approach which brings multiple partners together to address shared challenges in the sector.
- Expand and deepen collaboration with like-minded international partners in the semiconductor sector, drawing on respective strengths to increase skills cooperation, enhance industry and academia links, and develop R&D partnerships.

Why does this matter to the UK?

There are tens of semiconductors in every mobile phone, ventilator or boiler, and thousands in every car, power station or defence system. Their critical nature has led to semiconductors becoming a geopolitical battleground, with technological dominance in semiconductors key to the technologies of the future. Other governments are not standing still, with many announcing multi-billion dollar investments and using their industries to achieve wider national and foreign policy priorities. We need to act quickly to secure the UK's access to this vital underlying technology and build on the UK's existing influence internationally to ensure resilience is built into the sector, its supply chain and the products which depend on it.

2.1.5. Telecoms

What are the main issues to consider in telecoms?

31. **Telecoms networks underpin global economic growth and are part of our Critical National Infrastructure**. The global telecoms market is predicted to grow rapidly from £1 trillion in 2020 to £2.4 trillion by 2030[8] and the next generation of telecoms technologies, including 6G, will transform our way of life, as well as enabling other technologies such as Quantum and AI. The swift, reliable, and secure transmission and processing of digitised data will be integral to both the global and UK economy and to our national security. It is important that we take steps now to influence and shape the development of future telecoms[9] and support UK innovation.

32. **The increasing criticality of telecoms to our growth and prosperity brings new challenges**. The UK is committed to supporting the security and resilience of the UK's telecoms infrastructure, and has taken steps to increase the overall security requirements for equipment in the network. The Telecommunications (Security) Act 2021 establishes a strengthened telecoms security framework within the UK, alongside new national security powers for the Government to impose, monitor and enforce controls on public communications providers' use of high risk vendors' goods and services. These powers will allow the UK to manage risks posed to our telecoms networks, both now and in the future. A healthy, diverse and open supply chain is also critical to ensuring network resilience. The UK has also published a 5G Supply Chain Diversification Strategy to promote an open and diverse telecoms supply chain that is resilient to future trends and threats. The UK's telecoms networks face similar security and resilience challenges to networks in other countries, so it is vital that we continue to seek international solutions for this international challenge.

8. Based on growth projections from Ericsson Market Report (https://www.ericsson.com/assets/local/5g/the-5g-for-business-a-2030-compass-report-2019.pdf) and current estimates of the size of the global telecoms market.

9. Future telecommunication technology encompasses all evolutions of the infrastructure that carries digitised data. Future telecoms networks will be a hybrid of currently distinct communications technology that will converge over the next 10-15 years. We therefore consider the term future telecoms to cover 6th generation wireless (6G) – including management of radio frequencies, quantum communication/quantum internet, space-based communications, cloud communications, edge computing, and hardware advances such as next gen fibre optics.

How will we apply our principles to telecoms?

Open – we will continue to **broaden international support for the adoption of open and interoperable telecoms solutions** such as Open RAN (Radio Access Network), ensuring the global future telecoms market is open and competitive. We will engage with industry and multilaterally in the development of technical standards for 6G and beyond, and we will champion international cooperation to influence the development of the next generation of telecoms technologies.

Responsible – we will **drive delivery of the next generation of digital infrastructure**, boosting economic growth and productivity, supporting delivery of Net Zero. Tackling power efficiency challenges will remain a crucial focus of our R&D programmes.

Secure – we will work with our international partners to ensure that we have high security standards for current and future telecoms technologies, that the development of intellectual property is secure and international norms on its adoption are respected. We will push for **security by design** in the development of these technologies, including through our R&D programmes, and **ensure the security of our Critical National Infrastructure**.

Resilient – we will help ensure the **resilience of the UK's networks and supply chains** by working with allies to develop an open and competitive global market for future telecoms.

Our top international priorities for telecoms

- Demonstrate UK leadership on a global stage by driving the development of openness and interoperability in telecoms networks.
- Build on the UK-led joint statement on telecoms supplier diversity[10], issued alongside Australia, Canada and the US in December 2022, to promote and secure wider international endorsement for the UK's Open RAN Principles[11].
- Expand and deepen international collaboration with key partners on future telecoms.
- Harness international partnerships and collaborative R&D to develop global markets for export.
- Attract investment into the UK to contribute to the diversification of the UK's telecoms supply chain.
- Work with industry and international partners to ensure telecoms standards are set transparently and independently, promoting quality, innovation and security.
- Engage with key international partners to share our respective approaches regarding telecoms security and resilience.

Why does this matter to the UK?

Telecommunications is a key aspect of Critical National Infrastructure. As 5G is rolled out and future technologies are developed, we must secure UK access to the global market and ensure a diverse range of vendors to supply UK networks. Seizing this window of opportunity to increase connectivity in the next generation of telecoms technologies will boost the UK's market share, increase our influence internationally, protect the security and resilience of the telecoms infrastructure and ensure we reap the benefits of the sector's enormous growth and productivity opportunities.

10. https://www.gov.uk/government/publications/joint-statement-between-the-united-kingdom-australia-canada-and-the-united-states-of-america-on-telecommunications-supplier-diversity/joint-statement-on-telecommunications-supplier-diversity
11. https://www.gov.uk/government/publications/uk-open-ran-principles/open-ran-principles

2.1.6. Data

What are the main issues to consider in data?

33. Effective data sharing, access and use is a cornerstone of economic, scientific and technological leadership. The ability to transfer data across borders is critical for accessing overseas markets, and high standards of data protection are key to building public trust and confidence in how data is used. However, different perspectives and regulatory frameworks on global data governance are proliferating at speed around the world.

34. Data, and the rules governing its use, cannot be confined to country borders. The National Data Strategy sets out our vision to harness the power of responsible data use to boost productivity, create new businesses and jobs, improve public services, support a fairer society, and drive scientific discovery, positioning the UK as the forerunner of the next wave of innovation.

35. We have published our approach to international transfers of personal data and announced ten priority countries for data adequacy partnerships, or "data bridges". We have agreed ambitious data provisions in trade deals with Australia, the EU and the European Economic Area, Japan, New Zealand and Singapore. We have published, and will continue to develop, policies to increase data access and availability while ensuring we protect our national security interests. This innovative approach to data governance will enable us to build resilience, support innovation, retain global competitiveness and deliver our vision of data as a force for good.

How will we apply our principles to data?

Open – we will continue to champion Data Free Flow with Trust and pursue greater access and availability of data globally. We will seek to influence norms, regulations and standards, and promote an **accessible and interoperable global data ecosystem** that removes unjustified barriers to data sharing and access and enables global trade, innovation, fair digital competition and international cooperation.

Responsible – we will work with international partners to shape the global debate on data governance based on our ethical and societal values. This includes supporting greater interoperability of regulatory frameworks on data and making the case that **high data protection standards for individuals, data access and data flows** for trade, science, technology and the economy are all contributing to a better global ecosystem for everyone.

Secure – We will protect UK values, national security and law enforcement capabilities by working with like-minded countries to **develop shared global principles on trusted government access to date**, countering moves towards authoritarian visions of data governance. We will ensure data is used to empower citizens, not control them.

Resilient – we will work with allies to address evolving threats to data infrastructure, to ensure it is resilient and protect our citizens and businesses.

Our top international priorities for data

- Legislate to reform the UK's data protection regime, including building a new regulatory framework for international transfers of personal data which unlocks the benefits of data flows and reduces burdens on businesses and researchers that impede the responsible use of data. This will promote innovation and boost trade, while protecting citizens' rights.
- Progress our work on securing data bridges between the UK and priority countries and design alternative transfer mechanisms.
- Continue to work with like-minded partners to develop standards, mechanisms and initiatives to encourage responsible data sharing and availability, including through data anonymisation and Privacy Enhancing Technologies.
- Promote action across multilateral fora to remove unjustified data localisation measures and other barriers to the free flow of data, and seek commitments to this end in free trade agreements.
- Shape the global debate on interoperability of data regulatory frameworks to address international fragmentation, and support regulatory cooperation with priority countries.
- Pursue and develop, with like-minded countries, shared global principles on trusted government access.

Why does this matter to the UK?

Data is vital to the UK economy, and is a crucial enabler of technologies. In 2021 the UK exported £259 billion and imported £128 billion in data-enabled services (85% of total UK services exports and 73% of UK services imports respectively)[12]. Working with partners internationally will position the UK as the forerunner of the next wave of innovation. The proposition to our international partners is that data can be used to drive innovation, the economy, governmental cooperation and trade without compromising safety, security or privacy.

12. DSIT analysis, using UNCTAD's classification of digitally-delivered trade to calculate data-enabled trade. (Latest data published in 2022 relating to 2021)

2.2 International partnerships for global leadership

Why are our partnerships important?

36. **A strong and varied network of international partnerships is essential to shaping the responsible use of technology and realising the resulting economic and societal benefits**. To become a truly global science and technology (S&T) superpower, the UK cannot act alone. We need to work closely with other global S&T leaders, emerging digital and technology economies, industry and others across civil society and academia.

37. **Through technology partnerships, we will strengthen the entire S&T ecosystem and deepen our bilateral and multilateral relationships**. Collaborating on R&D with key partners will bring new perspectives and powerful innovation. Working together to embed international regulations, norms and standards in line with our values, we will promote democracy and counter digital authoritarianism. Capacity building, coordination and sharing will help build resilience in industries with supply chain issues, such as the semiconductor sector. Our collaborations will support us to attract and retain talent and secure higher levels of international investment. We will extend the benefits of the resulting UK innovation internationally, tackling global challenges, supporting efforts to close the digital divide, promoting shared values of open societies and embedding human rights principles into technology development.

38. We will secure access to materials required for technology development and further strengthen our trade relationships. We will join forces with like-minded partners to address shared security concerns and maximise the impact of technology for the defence of the UK and our allies. Together, through this wide-ranging collaboration we can build strategic advantage and ensure the free world shapes global norms, regulations and standards.

39. **We want technology to be an essential pillar of our bilateral relationships**. In 2022 we launched the UK-US Comprehensive Dialogue on Technology and Data, building on the commitment towards greater collaboration in Science and Technology in the New Atlantic Charter, signed in 2021. At the inaugural meeting of the Dialogue in 2023, the UK and US agreed priorities across data, critical and emerging technologies, and secure and resilient digital infrastructure. We have also agreed a world-first Innovation Chapter in our Free Trade Agreement with Australia, which strengthens our collaboration on innovation and trade, including regulatory approaches to AI and other key emerging technologies.

UK's bilateral partnership with Japan

Japan is an important strategic partner for the UK, central to a number of critical global technology supply chains, including semiconductors. We are collaborating across a wide spectrum of technology issues, to promote shared values and support mutual prosperity, economic security and defence interests.

In December 2022, the UK and Japan launched a broad and ambitious Digital Partnership, to deepen bilateral cooperation across digital and data issues.

We have a history of productive research and development and industry partnerships with Japan, combining both countries' respective strengths in cutting edge technologies. In 2021 we signed a £12 million research and technology deployment collaboration, which will support faster and safer delivery of nuclear plant decommissioning, and in February 2022 we signed a Letter of Arrangement to jointly conduct cooperative research on world-leading future fighter aircraft technologies.

UK's landmark Innovation Chapter in the UK-Australia Free Trade Agreement

The UK-Australia Free Trade Agreement, signed in December 2021, is the first bilateral trade agreement to include a dedicated chapter on innovation and trade, which creates a platform for cooperation on regulatory approaches, the commercialisation of new technologies, and supply chain resilience. It seeks to ensure new technologies are provided for with an appropriate trade policy response ensuring international markets are accessible as new technologies reach commercialisation.

How will we approach our partnerships?

40. **To maximise strategic advantage, we need an effective, coordinated and targeted approach to the partnerships we invest in**. We have a wide range of complementary foreign policy aims, including prosperity, security, development, defence, trade, counter-terrorism and human rights, which will drive how we prioritise those relationships. Our approach will build on the "own-collaborate-access" framework set out in the Integrated Review, ensuring our engagement across different technologies reflects the UK's expertise, access and the level of global impact we seek.

41. **Our partnerships will differ in scope and depth**. With some like-minded partners we are building deep strategic alliances across a range of technologies. Other relationships will be focused on specific goals or technologies of shared interest. We will prioritise, for example, regulatory projects and technology partnerships that can tackle pressing global challenges, offer huge economic or social value or where we want to ensure resilient supply chains, such as the new UK-Australia Cyber and Critical Tech Partnership, or our ASEAN Digital Innovation Partnership. Alongside strengthening our traditional relationships, we will continue to seek new partnerships which will foster cooperation and greater alignment with our values. The International Science and Partnerships Fund (ISPF), designed to enable global collaboration and foster prosperity, will support UK researchers and innovators to work with international partners on the major themes of our time, and to help them create new knowledge and technology for greater impact. And we will use Official Development Assistance to support partnerships with developing countries and their institutions, exchanging expertise and supporting locally led innovation to make progress towards the UN's Sustainable Development Goals.

42. **We will continue to engage in multilateral and international fora, building on the success of our 2021 G7 Presidency and the Future Tech Forum**. We will continue to work with partners in smaller groupings that contribute to wider global initiatives.

Future Tech Forum (FTF)

In 2021 the UK hosted the Future Tech Forum, bringing together representatives from partner countries, industry and other stakeholders for frank dialogue on how to harness the transformative power of data and new technology responsibly and safely. The FTF welcomed a wide variety of voices and perspectives to identify shared challenges, and build consensus around inclusive approaches to the development and regulation of technology.

The UK will continue to maintain this momentum in international digital and technology dialogues, securing the legacy of the FTF in the 2023 OECD-hosted Global Forum on Technology, which will enable like-minded governments to engage with industry, civil society and academia to shape the governance of technologies of the future. The UK has also, alongside Estonia and NGO Access Now, led a Technology for Democracy cohort as part of the US Summit for Democracy process, collaborating across the technology ecosystem to find ways that technology can support stronger democracies globally.

Our top priorities for international partnerships are to:

- Establish a prioritised set of technology-based partnerships with key partners around the world, building on existing links and defined by mutually beneficial objectives. We will build on the foundations of recent successful bilateral dialogues and partnerships, such as the US-UK Technology partnership, Cyber and Critical Technology partnership with Australia, and Digital Economy Agreement with Singapore.
- Enable UK researchers to participate in exchanges which deliver international links and establish new collaborations, continue to participate in multi-country research and innovation initiatives, including the Eureka Network, and explore new avenues for international collaboration.
- Deepen scientific collaboration between the UK and international R&D power, through the International Science Partnerships Fund (ISPF), launched in Japan in December 2022.
- Continue to develop innovative science partnership models, for instance between our Advanced Research and Invention Agency (ARIA), UKRI and other bodies with similar institutions in other countries.
- Pursue defence and security partnerships, such as AUKUS, a landmark defence and security partnership with Australia and the US that will collaborate on cyber capabilities, artificial intelligence, quantum technologies, submarines and undersea capabilities.
- Continue to support the implementation of NATO's Emerging and Disruptive Technology (EDT) Strategy. EDT is integral to the Alliance's current and future deterrence posture, collective defence and national resilience.
- Ensure the success of the Defence Innovation Accelerator for the North Atlantic (DIANA), which the UK jointly hosts with Estonia at Imperial College's White City Campus, to promote transatlantic cooperation on critical technologies.

Why does this matter to the UK?

Our bilateral and multilateral partnerships are critical to achieving our technology ambitions and securing the UK's place as an S&T superpower. They allow us to make faster technological advances, boost trade and innovation, protect our shared security interests, support UK scientists to work with the best and much more. Through our partnerships with traditional and non-traditional partners we will build support for shared principles and values, working together to ensure technologies promote freedom, not fear.

2.3 Values based governance and regulation

Why is the governance of technology important?

43. As technologies underpin ever more aspects of our lives, **the way we govern them will have huge implications for our prosperity, safety, security and society**. Our vision is that technologies strengthen our open societies, enable us and our international partners to address global challenges, drive forward innovation and growth, defend our democratic values and human rights, and are secure by design. But the same technologies that can promote our values can also be used to increase authoritarian influence. Using the freedoms afforded by Brexit, the UK is moving fast to establish world-leading rules for critical technologies and, where appropriate, regulations to increase certainty for innovators. In showcasing the UK's thought leadership and promoting the rationale for our approach, we will build consensus for interoperable frameworks that minimise the impacts of divergence for businesses and secure influence over shaping international regulations.

44. **Multilateral fora are critical platforms for achieving our vision**. Building consensus with partners on global governance of critical and emerging topics such as artificial intelligence, telecoms diversification and quantum computing will position us as a global leader and empower us to pursue our international digital and technology objectives through multilateral institutions. Partnering with like-minded and non-aligned nations will allow us to advance shared interests on research and development (R&D), technology development, standards and open societies.

Through these multilateral alliances, we will challenge the ambitions of authoritarian countries where they seek to use technologies and influence how they are governed for malign purposes. We will lead work to understand the risks and opportunities of emerging technologies, informing the right level of governance and regulation at the right point in their development.

How will we work through international fora?

45. **We will play an active role in the WTO, G7, G20, OECD, NATO, Council of Europe, Commonwealth and the UN, including utilising the UK seat on the Council of the International Telecommunication Union (ITU)**. We will continue to push for reform and agile approaches to the governance of new technologies that anticipate their exponential development. For example, we will build on our role as a founding member and inaugural Chair of the Agile Nations to drive international co-operation on innovative regulatory practice. We will increase our influence in newer bodies focussed on critical and emerging technologies, such as the Global Partnership on AI (GPAI), that shape the future uses of technologies. We will work through the OECD Global Forum on Technology to foster an international dialogue on topics at the forefront of the global technology policy debate.

46. We will foster **engaged, multi-stakeholder participation in the global digital technical standards ecosystem** as set out in our national strategies, including the Cyber Strategy and Digital Strategy, and we will improve cooperation and capacity in shaping those standards. States and companies are making use of technical standards to promote their own interests and we risk key technologies being shaped by those who do not share our values. We will focus on priority areas that matter most for upholding our democratic values, ensuring our cyber security, and advancing UK strategic interests through science and technology.

47. We will invest time in playing a **more active and coherent role across international fora**, and associated working groups, alongside allies including those in industry and academia. We will shape international governance to ensure it is agile, streamlined, diverse and inclusive and we will promote complementary action and seek interoperable frameworks. We will promote the competitive, safe, ethical, transparent and accountable design and use of technology, and the resolution of issues early in tech development and maturity.

Our top international priorities for governance and regulation are to work with partners to:

- Bring UK expertise and sector leadership to multilateral research partnerships on R&D, innovation, governance and trade, working with, among others, the G7 Digital and Science Tracks, the OECD and GPAI.
- Ensure the UN continues to support multi-stakeholder digital cooperation that promotes efforts to tackle digital divides and harness technology for inclusive, responsible and sustainable development.
- Strengthen international governance in specific high priority topics, for instance:
  - Global data governance: create an accessible, interoperable data ecosystem, building on the progress made with G7 members on Data Free Flow with Trust.
  - Dual-use technology: further develop international governance to cover a broader range of dual-use technologies and encourage participation of a wider range of countries to prevent the proliferation of dangerous applications, including through the Wassenaar Arrangement[13].
  - Research collaboration: ensure international research collaboration is as open as possible and as secure as necessary, building on the commitments in the G7 2021 Research Compact.
- Expand our international coalition of like-minded partners to achieve more engaged and diverse multi stakeholder participation in the global digital technical standards ecosystem, as set out in the National Cyber Strategy.
- Strengthen coordination and information sharing with international partners, including through the Digital Standards Points of Contact Group set up during the UK G7 presidency.
- Build on the UK's success in securing a seat on the Council of the ITU, working together with partners to deliver an ITU that works for all its members, increases worldwide connectivity, and bridges the digital divide. We will continue to help shape the global technical standards ecosystem in line with our principles and values.

13. The Wassenaar Arrangement is a politically binding export control regime which focuses on international and regional security and stability, through promoting transparency of the transfers of conventional arms and dual use goods.

Why does this matter to the UK?

Multilateral bodies are an essential part of our international approach to promote our principles. Through strong UK engagement in traditional multilateral bodies, and newer bodies set up to respond to the challenges and opportunities of technologies, we can share our expertise for global good and influence the way technology is developed, governed and used. We are committed to ensuring that we work with a range of partners, including industry and academia to jointly shape the rules of the future.

2.4 Technology investment and expertise for the developing world

How will technology influence development?

48. **Technology is essential for economic growth, competitiveness, and the ability to tackle critical challenges, such as poverty, climate change and health threats**. However, without appropriate standards to shape the development, governance and use of technologies, it can bring risks of harm, misuse and malign influence. Investments in increasing technological capacity should not put countries under debt distress or leave them reliant on authoritarian regimes who export models of technology that may undermine human rights or limit free speech and open economies.

49. **The UK will provide an alternative offer to developing and emerging countries, enabling them to make informed choices on the responsible use of data, digital and other critical technologies**. Through a blend of infrastructure investments, collaborations and research we will support technology development, and shape norms and standards that enhance security and support democratic principles.

50. **Strong partnerships bring mutual benefits**. We will provide access to reliable and secure technologies and support opportunities for digital and critical national infrastructure investments. Building equitable research partnerships will accelerate the development of technologies to address major global threats, generate new markets, and ensure more diverse supply chains for UK goods and services.

What will we do to support developing countries?

51. **We will deliver high quality and sustainable investments into technology infrastructure through British Infrastructure Investment (BII), the UK's development finance institution**. Our development programming and R&D portfolio will provide British Investment Partnerships with a pipeline of innovative technologies and pioneering tech-driven businesses that support economic growth, tackle global challenges, and empower women and girls.

52. **We will create a new Technology Centre of Expertise as part of British Investment Partnerships**. This will provide access to digital and technology expertise from the UK Government, private sector, civil society, and academia that supports countries to transform their economies in a sustainable and inclusive manner. The UK has highly sought-after and trusted expertise, including in digital, data and bio-technology, as well as in the relevant policy/regulatory frameworks and standards, and can provide an alternative partnership to that offered by authoritarian regimes: one which supports technology development and shapes an enabling environment that enhance security and support democratic principles.

53. **We will close the digital divide**. Through our Official Development Assistance programmes we will accelerate inclusive, responsible and sustainable digital transformation in partner countries. The FCDO-DSIT Digital Access Programme (DAP) promotes connectivity and digital skills in Brazil, Indonesia, Kenya, Nigeria and South Africa. Through its International Tech Hub Network, the DAP promotes start-ups and their ecosystems to stimulate digital innovation for local development problems. By using our position in multilateral organisations like the International Telecommunication Union (ITU), we will increase digital inclusion worldwide.

UK government investment in OneWeb

The UK Government is part of a consortium which invested $500 million to give the UK a strategic advantage in Low Earth Orbit (LEO) satellites. OneWeb's LEO satellite constellation will deliver high-speed, low latency internet internationally. Benefits from this technology will include internet services for underserved regions. The investment partnership between OneWeb and Saudi initiative NEOM will explore the use of satellite services in the Middle East and East Africa.

Our top priorities for sharing Technology investment and expertise are to:

- Create a new technology Centre of Expertise to provide access to a range of UK expertise that supports technological development and economic growth around the world.
- Deliver high quality and sustainable investments into technology infrastructure and innovative businesses through BII, the UK's development finance institution.
- Build collaborative, knowledge-sharing relationships with telecoms regulators and authorities in partner countries, to strengthen the business environment for expansion of connectivity in underserved markets, and to engage on policy and regulatory frameworks enabling digital transformation.
- Invest in and deliver mission-driven R&D and technology development to forge technology-focused research collaborations between the leading UK and global scientists. Support the discovery, testing and scaling of new technology solutions to global challenges, and generate evidence on the risks and opportunities from new and emerging technologies.
- Continue to invest in the cyber security and resilience of our international partners, prioritising support to Eastern Europe, Africa and the Indo-Pacific. The National Cyber Strategy sets out how we will focus on deterring and disrupting our cyber adversaries, protecting critical international supply chains and infrastructure and advancing the secure use of digital technologies.

Why does this matter to the UK?

Building strong, equitable partnerships with developing countries is essential to achieving our vision to 2030. The UK's offer of sustainable investment in technology infrastructure, development programming and R&D, including access to our world-leading expertise, will support our partners to innovate, drive inclusive growth and make informed choices on the development, use and governance of technology, drawing them closer to our principles.

2.5. Technology to drive the UK economy

What are the opportunities which technology can bring?

54. **Innovation boosts economic growth**. It creates jobs, increases productivity, stimulates investment, and catalyses trade. Maximising these opportunities for UK businesses requires continued international collaboration to break down trade and investment barriers and to showcase the UK as the destination of choice for global technology talent and capital.

55. **The actions outlined in this strategy will allow us to build from a position of strength**. The Department for Business and Trade (DBT) already supports UK companies to expand internationally, helping support the £23.3 billion of UK digital tech exports in 2019[14]. We will use our global influence to lead discussions on future technologies, championing our values and principles, while progressing domestic work to develop the technology sector in line with our vision. The International Technology Strategy will coordinate work across government to make the UK a more attractive place to invest and build technology companies.

How will we deliver this?

56. The UK technology sector recently surpassed a valuation of $1 trillion, the third highest in the world. 63% of the investment underpinning this comes from overseas. In the UK and across our overseas network, we will continue to work to **attract foreign direct investment (FDI) into the UK technology sector – directly into companies, and into the funds that support them**. In 2020-21 259 government-supported FDI technology projects created 14,164 new jobs in the UK. We also set up the Office for Investment (OfI) in 2020 to unlock significant strategic investments aligned to the government's priorities. Since the beginning of 2021 the OfI has helped secure over £21.75 billion worth of investment across sectors, directly creating 15,650 jobs and 4,500 more in UK supply chains.

57. We know how important venture capital is to the scaling and commercialisation of new ideas into world-beating companies. The UK already has the most vibrant venture capital ecosystem in Europe with the highest numbers of unicorns created and capital raised. We want to build on that advantage, by going further to bring the world's best venture capital funds to the UK, focussed on technology sectors. Through the Department for Business and Trade, **we will target world-leading**

14. https://technation.io/unlocking-global-tech-report/#summary

VCs to set up offices and funds in the UK. DBT will prioritise funds which bring genuine expertise investing in complex technologies, growing superstar companies, and are committed to retaining investments in the UK.

Asia Pacific Digital Trade Network

Launched in June 2020, the Asia Pacific Digital Trade Network (DTN) is a joint DSIT-DBT initiative to increase the UK's technology presence and capability in Asia Pacific. With presence in Australia, Japan, Indonesia, Singapore, South Korea and Thailand, the DTN's mission is to accelerate the growth of UK digital technology and digital trade through helping UK businesses find opportunities for new partnerships, increased trade and investment, and greater market access.

The DTN also helps overseas businesses connect with and understand the UK's technology ecosystem while promoting the UK as an investment and scaling-up destination for Asia Pacific technology companies and investors.

58. **We want to attract the best talent to work here, sharing their expertise with our home-grown talent**. We have established a new Global Talent Network with initial hubs being launched in India and the US. This network will promote the UK as a great place to work in key science and technology sectors, work with businesses and research institutions to identify talented individuals, and support those who choose to move to the UK. We will make it easy for talented people to come to the UK through visa programmes such as Global Talent Visas, Scale Up Visas, High Potential Individual Visas and Global Business Mobility Visas.

59. **We are using our trade deals to harness the potential of technology –** providing opportunities for companies across the economy to do business digitally around the world. As well as using our trade deals to reduce tariffs on technology, promote innovation and protect intellectual property we have included ambitious digital trade chapters in our Free Trade Agreements (FTAs) with the EU, Japan, Australia, and New Zealand, and have negotiated a ground-breaking Digital Economy Agreement with Singapore and a Digital Trade Agreement with Ukraine. These deals support our ambitions on technology through their provisions on open digital markets (including tariff-free digital trade), digital trading systems, consumer and business safeguards (including source code protections), free data flows and international cooperation. We will continue to use our trade deals to

support UK technology companies and to harness the potential of technology to boost all forms of trade. We will work with other countries to deliver modern global rules that support technology at the World Trade Organisation.

UK's landmark Digital Trade chapter with the EU in the Trade and Cooperation Agreement

The UK and EU's Trade and Cooperation Agreement (TCA), signed in December 2020, is the first EU trade agreement to include a dedicated chapter on digital trade, which promotes trade in digital services, facilitates modern forms of trade in goods and services, and provides a strong basis for future collaboration. Among other things, the TCA includes a permanent ban on customs duties on electronic transmissions, prohibits requirements to store or process data in a certain location, and contains commitments which support the use of electronic contracts, signatures, documents, and identification.

Our top international priorities to drive the UK economy using technology are to:

- Coordinate existing work across Government to scope opportunities and promote UK exports of leading UK technologies, attract foreign direct investment into UK technology growth companies and Venture Capital funds, and promote the UK as a global technology Initial Public Offering (IPO) hub.
- Work actively to attract leading tech companies globally, as well as in the UK, to list on UK public markets.
- Through the new Global Talent Network, attract talented science and technology professionals to work in the UK.
- Run the UK's second Global Investment Summit in October 2023, with a particular focus on high technology sectors.
- Continue to promote the UK technology ecosystem overseas, encouraging the best global companies to increase their number of high-skill and high-productivity jobs in the UK.
- Launch the GREAT Tech campaign in March 2023 to target the West Coast of the US. The campaign will improve investors' perceptions of the UK's technology ecosystem to attract more investment into the UK.
- Work closely on international intellectual property use to ensure that UK companies reap the greatest commercial advantage from their ideas and that UK intellectual property and expertise is protected and recognised internationally.
- Drive up competition in digital markets by addressing the far-reaching power of the biggest tech firms and open up opportunities for innovative start-ups to compete.
- Seek inclusion of a chapter on digital trade in new trade agreements as appropriate, and dedicated innovation chapters in agreements with strategic partners as set out in the UK Innovation Strategy.
- Seek opportunities to ensure global trade rules at the WTO keep pace with technology and to create ambitious and inclusive digital trade rules that are commercially meaningful for all, in line with the UK's broader objectives for digital trade.

Why does this matter to the UK?

We want the UK to be a global hub for technology and data. To achieve this we will draw on, and grow, our strong domestic base: attracting inward investment, promoting FDI and reducing barriers to trade. In an increasingly competitive world, we will work to attract top talent to the UK, enhancing the strength of our technology sector.

2.6. Protecting our security interests

How does the rapid pace of technology development impact our security?

60. **Technology brings enormous benefits. But the accelerating pace of development and our growing reliance on technology, including in our critical national infrastructure (CNI), increases the risk to security through growing and evolving threats**. Technology is an increasingly important tool of geopolitical power which nations and organisations are using to further their political interests, including through cyberattacks and disinformation. Our economic security is intertwined with national security. Intangible assets such as intellectual property often develop from collaboration across borders, bringing risks as well as opportunities. Technology has global interdependencies, through integrated global supply chains.

61. We will work with our allies to build the resilience of our CNI, businesses and citizens. We will ensure technology is secure by design, that underlying supply chains are resilient and diverse, and that data and intellectual property is protected. We will continue to adapt and innovate as technology changes and develops to advance our security, prosperity and values. Tools to protect the UK against threats, such as the National Security and Investment Act, enable us to continue championing open investment, while protecting national security.

How will we protect UK and global security?

62. As an outward-looking science and technology power, we will work to avoid countries slipping into technological protectionism which could hinder scientific and economic progress and slow our attempts to tackle global challenges. Our economic openness can also lead to vulnerabilities for UK national security, such as providing increased access to the UK's national security relevant technologies and related expertise. We will use our protective security toolkit to prevent actors with hostile intentions towards the UK building defence or technological capabilities which may present a national security threat. **We will pursue effective international collaboration that is as open as possible and as secure as necessary**. Collaborations which go beyond traditional partners can support diversification and increase the resilience of supply chains. We will shape and enhance global governance to provide sufficient protection for intellectual property and work with partners to open up international markets for UK exports.

63. **We will use a range of enhanced measures to tackle new threats**. We know that actors with interests contrary to our own are involved in attempted acquisitions of UK companies, or pursue arrangements to gain control of technology, presenting a risk to the UK's national security. The National Security and Investment (NSI) Act 2021 gives the government powers to scrutinise and, if necessary, intervene in acquisitions of control over entities and assets in or linked to the UK that may pose national security risks. It makes interactions with the government simpler and smoother, ensuring investment in the UK can continue with predictability and transparency while protecting national security. Our export control regime provides a framework to navigate complex national security considerations, and we will continue to refine this system to adapt as quickly as the dual-use technologies we develop.

64. We will **monitor the long-term evolution of emerging technologies**, assessing the emerging security risks and opportunities they may bring; from the possibility of generalised AI systems, to development of quantum communications and new biosecurity risks.

Cyber Power

The Integrated Review set our objectives to fortify the UK as a responsible cyber power, address challenges to our security online and build resilience to threats such as cyberattacks. A key pillar of the National Cyber Strategy is to take the lead in the technologies vital to cyber power, building our industrial capability and developing frameworks to secure future technologies. As digital technology becomes increasingly integrated into every aspect of our lives and emerging technologies create new opportunities for malicious actors, cyber security is a critical element of our approach.

The UK will prioritise a range of technologies and applications in support of cyber power, evolving the list in consultation with industry, academia and technical experts:

- 5G and 6G technology, and other emerging forms of data transmission.
- AI, including the need to secure AI systems and the potential for the use of AI to enhance cyber security in a wide array of applications such as network monitoring.
- Blockchain technology and its applications such as cryptocurrencies and decentralised finance.
- Semiconductors, microprocessor chips, microprocessor architecture, and their supply chain, design, and manufacturing process.
- Cryptographic authentication including for identity and access management and high assurance cryptographic products.
- Internet of Things and technologies used in consumer, enterprise, industrial and physical environments such as connected places.
- Quantum technologies, including quantum computing, quantum sensing and post-quantum cryptography.

Our top priorities to protect our security are to:

- Ensure UK security interests are addressed in the development of standards, norms and regulations, including ensuring technology is “secure by design” and safely interoperable, whilst supporting UK businesses and industries.
- Take measures to ensure the security and resilience of existing and future CNI, and protect the UK from hostile actors. The National Cyber Security Centre and National Protective Security Authority monitor evolving threats and offer guidance and support to help organisations improve their physical and cyber capabilities.
- Use the NSI Act to investigate and, if necessary, intervene to mitigate national security risks arising from foreign direct investment in emerging technologies and CNI sectors.
- Work to strengthen existing governance of cybercrime, either through existing treaties and bodies (e.g. Budapest Convention) or new initiatives.
- Respond to hostile actors attempting to exploit our innovations by increasing the cost of activity against the UK through, for example, co-ordinated diplomatic activity to call out malign behaviour and public attributions where this is deemed necessary.
- Continue to provide support to the research community, including through the Research Collaboration Advice Team and the Trusted Research programme, to ensure that university research is not being funded by, or being conducted in collaboration with, inappropriate entities with links to hostile states which may pose risks to the UK’s national security.
- Consult with business on how the export controls regime could be expanded to ensure that we can tackle national security risks arising from sensitive emerging technology transfers. We will also step up our work with international partners to increase the effectiveness of multilateral agreed controls.
- Work with partners to develop the global understanding of the long-term risks of emerging technologies, to agree on the future collective action needed.

- Work closely with likeminded international partners, both in industry and in governments, to shore up and diversify international supply chains and minimise ours and our allies' reliance on our adversaries, for instance through our 5G Supply Chain Diversification Strategy.
- Build capability on investment security in technology sectors, with economies that may be open to exploitation and/or expose the UK to vulnerabilities via integrated global supply chains and financing.
- Deliver the UK's upcoming Resilience Strategy which will strengthen the structures and capabilities which underpin the UK's resilience to all risks.
- Work to improve collective global resilience, including promoting a free, open, peaceful and secure cyberspace and protecting an accessible and interoperable global internet for future generations.

Why does this matter to the UK?

The protection of our people, territory, CNI, democratic institutions and way of life is our government's overriding priority. Technology is now critical to how we protect our interests, while its rapid pace of development brings new risks and potential threats. We will work with our partners to promote technology which is "secure by design", build collective resilience and support UK businesses and industry to collaborate safely.

How will we prepare HMG's overseas network to deliver this strategy?

65. Our diplomatic, trade, science and innovation, and development networks will be critical to delivering our strategic priorities and promoting our principles around the world. We will promote the best of British technology through our embassies and high commissions around the world. Our Digital Trade Network, Science and Innovation Network, Cyber Network, Tech Hubs, Trade Commissioners, Tech Envoys, and Conflict, Stability and Security Fund officers will work to drive forward our international technology agenda, and **we will use the full breadth of our overseas networks, identifying opportunities to support our priorities across the range of our partnerships and alliances**.

66. Based on the success of our Tech Envoy to the US, we will increase technology expertise across our global network, including appointing further senior Tech Envoys based in Europe and the Indo-Pacific. These roles will be crucial to the delivery of the International Technology Strategy overseas, engaging with priority stakeholders, helping deliver UK policy, and working in collaboration with our network of science and technology diplomats.

67. **We will build capability and capacity across the HMG's overseas networks, to ensure our diplomats have the necessary expertise, skills, and experience to engage confidently on technology**. Our networks will be clear on cross-government priorities and act as a simple and accessible front door to expertise across government. We will have specialised training for those working on technology issues, drawing on expertise from across government, academia and industry.

68. **We will deepen our links to the technology sector**, through the creation of a secondment programme which will create strong links between government and key international technology stakeholders. We will also review our recruitment policies and will bring in technology expertise as necessary at different levels to fill capability gaps.

69. We will monitor developments in technology, its application and its regulation. The Department for Science, Innovation and Technology will collaborate with other government departments on a horizon-scanning function for future international developments in technology, supported by insights from our overseas network. The Technology and Science Insights team, set up in 2021,

will provide honest assessments of the UK's strengths and dependencies in S&T, comparing the UK with other strategically important countries. The framework laid out in this strategy and the supporting implementation plan will enable us to respond quickly to future developments.

70. We will keep our actions under review: our priority technologies, the countries we are prioritising action with, and our strategic priorities themselves, to ensure that this strategy remains fit for purpose, however the international technology landscape evolves.

What are the key levers for delivery?

- **S&T diplomacy**
  We will invest in the FCDO's Global Science network, including the Science and Innovation Network and Research Hubs. We will expand the Tech Envoys network, and build capacity and capability on technology across FCDO.
- **Regulatory diplomacy**
  We will bring together government, standards bodies and industry to discuss and influence regulations, norms and standards, especially in rapidly developing areas. We will upskill our network of staff around the world to become even more effective in negotiating and delivering regulations, norms and standards that support the ambition of the ITS.
- **Cyber diplomacy**
  We will grow our international network of cyber (and technology) officers, cyber-security capacity building programmes and cross-government cyber and technology dialogues.
- **Trade diplomacy**
  The Digital Trade Network and the Department for Business and Trade's overseas network will promote the UK's technology sector, including supporting UK technology exports, attracting foreign direct investment into the UK and promoting the UK as the global technology IPO capital. We will establish new digital and emerging technology dialogues and deepen existing partnerships, forge partnerships on innovation and trade through Free Trade Agreements.
- **Defence diplomacy**
  We will increase government, academia and industry collaboration on defence and security technology, for instance through NATO's Defence Innovation Accelerator for the North Atlantic (DIANA).
- **Development diplomacy**
  We will use our Official Development Assistance partnerships and programmes, including the FCDO/DSIT Digital Access Programme, to deliver locally led technology innovations which bridge the digital divide, help solve global challenges such as climate change and health, empower women and girls, and support partners to make informed choices on responsible technology governance and use.

ISBN 978-1-5286-3539-4
E02764955