
TECHNOLOGY
ADOPTION
REVIEW
2025
GREAT
BRITAIN & NORTHERN IRELAND

CONTENTS

INTRODUCTION

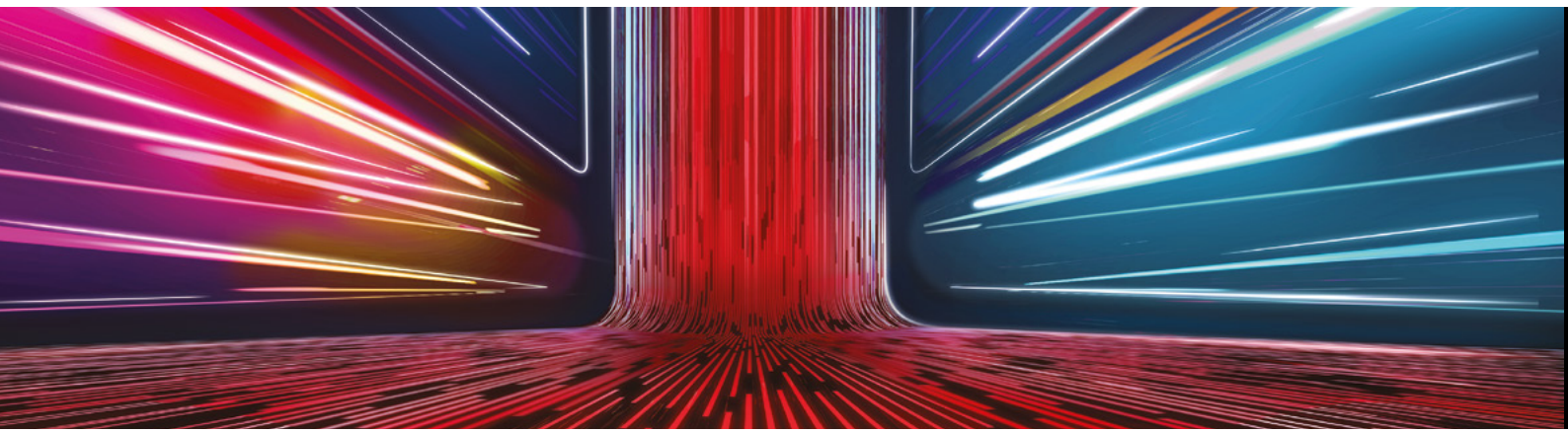
At the Autumn Budget 2024, the Chancellor announced that the government would be tasking the Government Chief Scientific Adviser, Professor Dame Angela McLean, with National Technology Adviser, Dr Dave Smith, to lead a review of barriers to the adoption of transformative technologies that could enhance innovation and productivity, with a focus on the growth-driving sectors identified in the Industrial Strategy green paper.[1]

The Technology Adoption Review ("the Review") has explored the barriers hindering the adoption of transformative digital technologies in the private sector. Through a detailed examination of technology adoption for large companies and SMEs within each priority sector, the Review has considered digital technologies available today that have the potential to drive growth and highlighted opportunities to further unlock the benefits these technologies present.

Greater adoption will ensure that the UK's modern Industrial Strategy embraces the opportunity presented by technology to drive innovation and growth in our highest potential firms and sectors. The Review considered the roles of both government and industry in improving private sector technology adoption.

The Review has been informed by a wide range of evidence including regional roundtables and a formal Call for Evidence that received over 200 responses.[2] The Review sought expert advice from leading academics on productivity, technology suppliers on their experience of deploying digital technology and business leaders making tough investment choices.
The Review would like to thank those who contributed towards its analysis and research.

This evidence has been used to inform a set of core cross-cutting actions that are relevant to all Industrial Strategy sectors and the wider economy. These are complemented by specific findings for each of the Industrial Strategy sectors, which have directly informed the approach to technology adoption set out in sector plans. This document summarises key findings.



KEY FINDINGS

Diagnosing the Problem

Technology adoption is essential for enhancing productivity and driving economic growth in the UK. By incorporating advanced technologies into their operations, the Review heard that businesses can reduce costs, improve output, and drive innovation, leading to higher wages and improved living standards. Historical trends indicate that technological innovations have significantly contributed to GDP growth, with emerging technologies, like AI, expected to drive substantial productivity gains in the coming years.[3,4]

Yet the UK lags behind other advanced economies in technology adoption and productivity. For example, analysis by the Resolution Foundation and Centre for Economic Performance found that 'digital intensity among UK enterprises is only slightly higher than the average' when compared to EU countries, - though 'larger firms do relatively better than their smaller counterparts'.[5]

While the UK ranked fifth overall in the Global Innovation Index 2024 and third for knowledge impact within that index, it only ranked twelfth in knowledge diffusion.[6] UK productivity is 14% lower than France and 22% lower than Germany.[7] Studies consistently demonstrate the UK's productivity gap, citing low and volatile investment, skills mismatches, and poor diffusion of technology and innovation.[8] Clearly, closing gaps in technology adoption will support significant growth in GDP.

Although progress in adopting digital technologies was made during the COVID-19 pandemic, larger firms were likely to have digitised further thereby widening existing disparities which persist among sectors and firms, particularly outside the Greater South East. [9,10]

The Review found that, while successful technology adoption in businesses depends on investment decisions in the private sector, government has a decisive role to play in addressing several barriers common to all the sectors.

Key barriers to technology adoption in the UK

The Review heard that barriers to technology adoption can vary by sector, firm size, and technology type. For instance, for firms in all sectors looking to adopt AI technologies, concerns about technology maturity and safety dominate. Manufacturing firms, however, often grapple with issues related to the cost of process changes, and access to talent, regardless of the technology being considered.[11] There are some overarching barriers that were reported by surveys and by stakeholders we have engaged with. They are outlined below.

Internal barriers to business:

Financial constraints: the cost of adopting new technologies was one of the most consistently cited barriers across the literature that the Review considered and in responses to the Call for Evidence. For example, one survey of businesses found that more than half of firms reported financial constraints as a barrier to digital adoption.[12] 'Cost' was the second most cited barrier to AI adoption in the ONS' latest Management Expectations Survey and by Massini et al.[13,14] Many responses to the Call for Evidence emphasised high upfront investment costs and limited access to capital and funding. In addition to high up-front costs, Busby et al. found that the dynamic implementation, maintenance and subscription costs of new technologies are also common barriers to adoption.[15]

Lack of workforce (e.g. STEM) and management skills: training is clearly an important route to technology adoption and productivity. Public spending on adult skills in the UK is down by a third since the early 2000s.[16] However, the Review found that the design of support programmes matters alongside funding levels. The Review learned about various private sector initiatives to rectify this gap for AI, such as Multiverse's AI training programmes, the Amazon Innovation Accelerator, and Google AI Works. The Review supports the Prime Minister's recently announced initiative that government and industry will work together to upskill 7.5 million workers with the skills to use AI in their roles by 2030.[17] The industry partners supporting this initiative are Accenture, Amazon, Barclays, BT, Google, Intuit, IBM, Microsoft, Sage, Salesforce and SAS.

Evidence suggests that the management skills gap is a significant barrier to adoption alongside the technological skills gap.[18] Industry described these skills as a blend of technical proficiency, leadership abilities, and business acumen. They involve strategic planning, project management, team leadership and operational planning, combined with a deep understanding of emerging technologies.

Valero et al. reported that around 40% of firms identified a lack of management skills as a barrier to AI adoption, with a similar share citing workforce skills as a barrier.[19] A quarter of firms in a PwC report reported the workforce skills gap as a significant barrier.[20] A lack of access to skills and talent was the joint-third most cited barrier in responses from businesses in Massini et al.'s report.[21]

Reorganisation costs and resistance to change from workers and managers: these were barriers cited by firms in Valero et al. as well as the Call for Evidence, with responses frequently identifying risk-averse mindsets and resistance to change in organisational processes as significant barriers.[22]

External barriers to business:

The lack of information on technology, its potential benefits, and risks: information constraints were the most frequently cited barrier to AI adoption by Valero et al.[23] Roundtable discussions hosted by the Review emphasised a lack of awareness of relevant use-cases and the difficulties in putting forward a business case with incomplete information about the potential future benefits of a technology. In the ONS' Management Expectations Survey, 'Identifying activities or business use cases' was the top barrier.[24] Massini et al. reported concerns that 'the technology was not mature' and concerns about 'safety and security' as top barriers.[25]

Policy and regulation uncertainty: regulatory climate was cited as a barrier by PwC, while more than a third of firms asked by Valero et al. reported policy and regulatory uncertainty as a barrier to digital technology adoption.[26,27] Regulatory and policy obstacles were cited in nearly 60% of responses to the Call for Evidence. As well as a lack of clarity about current regulations, some businesses delayed adoption because they assumed regulation of advanced technologies would change in the near-term.[28] Global businesses who export to, and operate in overseas markets with different rules, perceived the UK to have greater regulatory barriers to adoption, compared with domestic non-exporters.[29]

The lack of access to technology infrastructure: deficiencies in physical and digital infrastructure were cited by around 45% of responses to the Call for Evidence. 21% of firms asked by PwC reported inadequate technology infrastructure as a significant barrier.[30]

What industry said

In addition to widespread reinforcement for the six core factors above, further key insights emerged specifically from direct engagement with business across the eight sectors. These insights include:

- businesses see great value in local partnerships between the public sector, the private sector and universities, to drive technology adoption tailored to the needs of different sectors and geographies
- businesses trust advice and support primarily that comes from peers in their sector
- businesses want clarity and consistency from government, as the proliferation of different support programmes has become confusing and complex to navigate
- businesses see a key role for government to use its convening and co-ordinating powers to highlight effective use cases across industries
- businesses want to access technology expertise to use and integrate advanced technologies effectively
- some businesses highlighted the need for recognition at company executive level that technology adoption is no longer just an operational concern but a strategic priority

HOW CAN THE UK GOVERNMENT HELP TO ADDRESS THESE BARRIERS?

The Review has directly informed the development of the Industrial Strategy. Its findings support further government action, new initiatives, and suggestions for expansion in existing successful areas. Actions address both cross-cutting and sector-specific barriers. The three cross-cutting areas include:

- business support
- AI skills and awareness
- government strategy and coordination

Some of the findings, particularly with respect to addressing policy and regulatory uncertainty, endorse work that the government has done like establishing the Regulatory Innovation Office to address regulation for growth. Therefore, the Review does not discuss regulation in detail.

Government procurement processes have been used to drive innovation by ensuring that prime contractors can work with innovative supply chains. Similar approaches to government procurement can be used by working with prime suppliers to drive best practice for greater technology adoption through their supply chains, for example, for the curation of data or use of digital payment.

Digitisation and adoption of digital tools in government can influence adoption in private sector areas. This is particularly effective when government focuses on digitising processes where the public sector interacts with the private sector, for example, taxation or planning.

There are synergies with the SME Digital Adoption Taskforce's forthcoming report which considers the economy wide barriers small businesses face when adopting digital technologies.

Business support

In the UK, business support programmes focused on improving technology adoption and productivity in firms have tended to be short-lived, leading to a proliferation of different schemes that industry finds difficult to navigate. Some, however, were cited by industry as very positive interventions. For example, businesses reported that, in the Advanced Manufacturing sector, the six principles underpinning Made Smarter Adoption (expert advisor-led support, digital road mapping, match funded grants, tailored leadership programme, organisational and workforce development and digital internships) have been well developed. In future, stronger and more consistent evaluation of UK programmes would help build a more robust evidence base to scale effective interventions, as well as continued learning from successful programmes overseas.

A challenge for business support schemes is that they require experts working directly with companies and this is hard to scale rapidly. It is likely that the UK could mitigate this challenge by using technology to enhance these programmes. For example, an AI-driven 'Technology Consultant-as-a-service' or 'Technology Navigator app' could augment the initial provision of information provided in business support schemes and help businesses triage to cut through the confusing proliferation of existing schemes. It may even be that this is a service the private sector could provide.

Following analysis of successful business support schemes, government could look to develop further high impact technology adoption business support schemes while being cautious not to add to the current complex landscape. The Review has engaged with those that lead and engage with Made Smarter Adoption to suggest some actions that might improve the landscape. This includes:

- increasing Made Smarter Adoption capacity for the Advanced Manufacturing sector to increase its reach across England and strengthen its support for businesses, including SMEs, to adopt advanced technologies
- government working with the clean energy manufacturing industry to ensure it makes full use of an expanded Made Smarter Adoption programme to support its digitalisation, efficiency and resilience improvements
- reorganising and strengthening existing technology adoption support schemes for the Creative Industries sector by utilising best practice from Made Smarter Adoption to become 'Create Smarter', to streamline industry access and adoption efficacy
- industry ensuring the Life Sciences sector builds on the Life Sciences Innovative Manufacturing Fund by accessing the Made Smarter Adoption programme, recognising the importance of Advanced Manufacturing technologies to the future of our biopharmaceutical and medical technology companies, as well as to the long-term benefit of the NHS
- delivering a version of the Made Smarter Adoption programme that should tailor the technologies and expertise to help the Professional Business Services (PBS) Sector to take advantage of this successful intervention, enhancing digital transformation and operational efficiency

Government coordination and strategy

Government can play a greater role in coordinating technology adoption activity and partnering with industry across sectors. This work could be coordinated by the Department for Science, Innovation and Technology and the Department for Business and Trade with responsibilities sitting under an existing minister. There are several existing initiatives that support adoption and by better coordinating them it will help clarify the complex landscape of programmes so it is easier for industry to navigate. Government could also embrace transformational technologies itself and facilitate peer-to-peer knowledge transfer within industry.

The picture on technology adoption patterns in the UK remains incomplete due to the lack of consistent, frequent, and granular data. The gaps are particularly acute when considering adoption sector by sector. Given the speed with which trends are changing and their importance to the prosperity of the country, government can play a vital role in gathering and publishing data for policy makers and business. The Review has engaged with government leads to suggest the following actions, to improve coordination and learning.

They include:

- working across DfE, DBT and DSIT to build strong partnerships with the private sector, including supporting more peer-to-peer networks and improving skills and training, e.g. through application-based hybrid qualifications or micro-credentials for mid-career professionals
- working with industry to explore interventions to drive management skills for technology adoption, targeted specifically at senior leaders in industry
- coordinating cross-government work to ensure consistent evaluation of technology adoption approaches, participation in existing international studies, and greater prioritisation of high-quality, granular data through sectoral and longitudinal approaches
- accelerating policy development on the concept of a single company identity for interactions with government services

Artificial Intelligence

The world is in the age of AI, which alone could boost UK productivity by 1.5 % a year, worth up to £47 billion a year for the next decade, if we embrace it fully and safely.[31] AI was consistently raised by stakeholders across all sectors as the technology that could drive efficiency and growth in their businesses in the coming years. As Agentic AI matures, the impact will be even more transformative.

Government can build on the AI Opportunities Action Plan by prioritising efforts to raise industry awareness of AI and ensure businesses across the growth-driving sectors address AI skills shortages.[32]

The Review has engaged with government AI leads to suggest the following actions to inform the Industrial Strategy:

- supporting the creation of a network of AI adoption hubs to provide businesses with regional and sector-specific support to implement AI in their operations
- implementing an 'Industrial Strategy AI Adoption Fund' to facilitate the development of cutting-edge AI solutions in high-growth potential firms across the eight growth-driving sectors
- establishing an economy-wide AI adoption research and monitoring programme, and an annual AI adoption report aimed at business
- equipping workers with essential AI literacy and role specific skills to deploy AI, including working with technology providers to help train non-AI specialists
- supporting the AI assurance ecosystem to make the path to responsible AI governance and use clearer

SECTOR-SPECIFIC

The Review found that while some barriers to adoption ran across economy, there were also unique barriers to each of the Industrial Strategy sectors. These sector-specific issues, as well as the nature of how sectors operate, mean that a range of sector-specific findings emerged. A key aim must be to ensure that every sector recognises the need for technology adoption.

Advanced Manufacturing

While the Advanced Manufacturing industries are highly innovative, the Review found that the sector is still slow on proven technology adoption. Only 7% of UK manufacturers surveyed for a report in 2024 were regarded as being very knowledgeable about AI applications and 8% of the total had successfully introduced AI and machine learning into their businesses.[33] The UK also lags other G7 nations in robotics adoption, with 74% of UK SMEs in the sector operating without robots.[34] In areas such as robotics, these barriers are creating a gulf between large and small companies.

The Review heard that there are technology-specific adoption barriers in the sector, such as a lack of specialist skills, cyber security concerns (particularly in using AI and robotics), and integration challenges with legacy technologies in factories. Cross-cutting barriers also slow down supply of these technologies, including fear of the perceived impact on jobs and a lack of sustained access to finance. Discussions identified information barriers with respect to companies understanding use cases and applications of technology as a critical barrier preventing them from investing in the opportunities of technology.

As well as the expansion of Made Smarter Adoption, the Review has engaged with government Advanced Manufacturing leads to suggest the taking forward of user-driven demonstration programmes to enhance technology confidence and utilisation across businesses. This could be achieved for example by establishing new adoption hubs for Robotics and Autonomous Systems (RAS) learning from the successful model of the Robotarium to provide advisory services and connect businesses with suppliers. This would de-risk and increase adoption, showcase real-world applications, and connect businesses with expertise – strengthening the sector's competitiveness.

Clean Energy Industries

Since 2019, the sector has attracted £23 billion in private investments demonstrating innovation and growth.[35] This diverse ownership and size landscape fosters a broad range of technology adoption pathways. However, it was cited at roundtables that significant technology adoption barriers exist including access to finance and tailored support (for manufacturers); regulatory complexity and infrastructure constraints (for developers); and cost, convenience, and information gaps (for consumers).

The Review has engaged with government Clean Energy Industries leads to support the sector to use AI to streamline planning processes and optimise energy use, building upon existing programmes across government and Ofgem. This will also support the UK Government's Clean Energy 2030 targets.

The Review has therefore suggested the following actions are taken forward in the Industrial Strategy:

- focusing Ofgem's Grid Adoption Fund towards greater cross-network collaboration, skills enhancement and regulatory alignment to bring forward grid capacity boosting technologies
- enabling use of AI technologies to streamline local planning of Clean Energy sector projects to reduce the time for application development and assessment
- enabling the use of AI, digital and advanced technologies to accelerate consenting of clean energy, driving rapid scale-up of generation capacity
- using AI and other energy data enabled innovations, to unlock the power of building EPCs and smart meters for businesses to make it easier for businesses and consumers to optimise energy use and adopt low carbon technology

Creative Industries

One of the most dynamic sectors for technology adoption, the Creative Industries, contributed £124 billion in Gross Value Add (GVA) to the UK economy in 2023.[36] They are leading the way in technological disruption and could unlock unprecedented growth over the next decade through 'createch', which incorporates technologies like AI, virtual production, and immersive media to boost creativity and productivity.[37] The sector consists largely of SMEs and freelancers, with 98.8% of firms employing fewer than 250 people.[38]

However, the Review heard that smaller companies face challenges in funding upfront technology investments and accessing equipment for experimentation due to limited resources and expertise, leading to financial risk aversion that hampers technology adoption. Additionally, the plethora of support programmes available has created confusion regarding technology adoption pathways.

The government can support the sector in showcasing UK innovations for greater investment and provide clear signals to the Creative Industries on what is available to them to support adoption. As well as a 'Create Smarter' approach to schemes, the Review has engaged with government Creative Industries leads to suggest the following as part of the Industrial Strategy:

- establishing business to business createch demonstration hubs where creative technology companies can showcase innovations to attract investment and facilitate cross-sector adoption
- developing a facilities directory and strategic roadmap for the sub sectors in the Creative Industries to access technology adoption support. This centralised online directory will help locate technology facilities, infrastructure, and associated funding/support programmes

Defence

The UK Defence sector, dominated by major contractors is supported by thousands of SMEs that face several barriers to technology adoption. A lack of incentive to promote new technological requirements, combined with limited capital among smaller firms, hampers investment in technology.[39]

While government is the primary customer for the Defence sector and hence has more potential to increase technology adoption, in 2023, only 4% of Ministry of Defence (MOD) spending reached SMEs directly.[40]

Key barriers include UK data sovereignty requirements, which mandate that sensitive defence data be stored locally for national security reasons, preventing access to cost-effective UK cloud solutions. This drives up costs for defence firms, forcing them to develop expensive private solutions with inadequate infrastructure capabilities. Additionally, stringent standards and regulations in the Defence sector require technology suppliers to allocate resources to meet various compliance demands, and historical divergence from common architectures in the US and NATO restricts scaling opportunities.

The government can promote technology adoption through procurement provisions, encourage large contractors to expand technology adoption in their supply chains and increase the number of secure digital testing spaces. The Review has engaged with government Defence leads to suggest the following actions for the Industrial Strategy:

- promoting technology adoption in defence government procurement by exploring opportunities to update existing procurement provisions to flow down technology adoption
- establishing a voluntary Defence Technology Adoption Charter to encourage large contractors to promote technology adoption within their supply chains
- working with the sector to increase the number of secure digital testing spaces to accelerate adoption and explore ways to modernise the test and evaluation ecosystem over time, so that the sector can benefit from simplified processes, reduced costs and regulatory clarity

Financial Services

UK Financial Services sector firms are leaders in AI adoption. 75% of firms recently surveyed by the Bank of England and Financial Conduct Authority reported already using AI. [41] The Review found that the UK has provided a supportive environment for businesses in financial services to adopt new technologies but must continue to take action to ensure the UK remains a world-leading financial centre. Over the next decade, every part of the Financial Services sector will become increasingly digital. However, feedback from industry has highlighted that regulators have an important role to play in facilitating the timely adoption of innovative new technologies.

The government can ensure there is more proactive regulator-industry engagement on use cases, work with the Financial Services Skills Commission to grow skills and the Next Generation Programme to increase collaboration. It should also look to use this sector to demonstrate best practice on Digital ID compliance.

The Review has engaged with government Financial Services leads to suggest the following actions for the Industrial Strategy:

- financial regulators building on existing mechanisms, such as the FCA AI Lab, to engage industry on emerging use cases for different technologies and coordinating closely with the Regulatory Innovation Office (RIO) to facilitate change in this sector
- government working with the Financial Services Skills Commission to ensure the sector has the skills it needs for the future
- supporting collaboration between universities and industry, for example via the established Innovate UK and ESRC Next Generation Professional and Financial Services Programme, and providing the sector with high-quality opportunities for business networking, matchmaking events
- providing new guidance on how Digital IDs can be used in compliance with Anti-Money Laundering regulations to encourage widespread adoption and reduce the costs of fraud.

Life Sciences

Regulatory barriers, unclear NHS signals, and high manufacturing costs can restrict innovation in this sector. The Review found that the adoption of advanced technologies in the sector tends to be driven by changes in regulations, market pressures, and the NHS's priorities.[42] The pharmaceutical industry is making progress in AI adoption, but there is still potential for the sector to be more productive and globally competitive through the adoption of digital and hardware technologies into medical device, diagnostics and digital health businesses.[43]

Findings focus on barriers such as the need to work within a rigorous regulatory regime, high barriers to accessing high-quality data, and high up-front costs for transitioning to new manufacturing methods. The need for better data access was cited by many as an issue- it prevented faster innovation and reduced the ability of firms to collaborate with others.

The government can ensure there is more proactive regulator-industry engagement on adoption of new technologies, expand Secure Data Environments for data access to drive productivity and optimise technology utilisation. The Review has engaged with government Life Sciences leads to suggest the following actions for the Industrial Strategy:

- ensuring that the MHRA is resourced to expand capacity in the innovation service. This will give more companies access to support to adopt technology that has the potential to have an influence on process and product compliance of medicines and medical technologies produced and used in the UK
- working with industry to ensure that the recently announced Health Data Research Service answers industry's call to make the UK's health data easier to access for academia and industry. Government should also ensure that data generated through public funding remains accessible to both industrial and academic researchers and is not 'orphaned' when funded projects come to an end

Professional Business Services

The Review heard that the PBS sector stands at an inflection point, with AI and digital innovation enhancing customer interaction but disrupting established systems and processes. However, industry have told the Review that digital adoption among PBS SMEs has declined, hampering productivity gains and potentially widening the gap between larger firms and the sector's majority. The Solicitor's Regulation Authority (SRA) reports that 75% of the largest law firms are using AI – a figure that has doubled in three years.[44] Similarly, 68% of large accountancy and consulting firms use AI, compared to just 15% of small firms.[45]

As well as a PBS version of Made Smarter Adoption, the government can look to improve accessibility of public datasets for use by the sector. The Review has engaged with government PBS leads to suggest making more public datasets available, benefitting from the developments in the National Data Library programme. Many businesses rely on data from public entities for legal and financial transactions and will need to work with regulators and professional bodies to set appropriate standards for greater data use.

Digital and Technologies

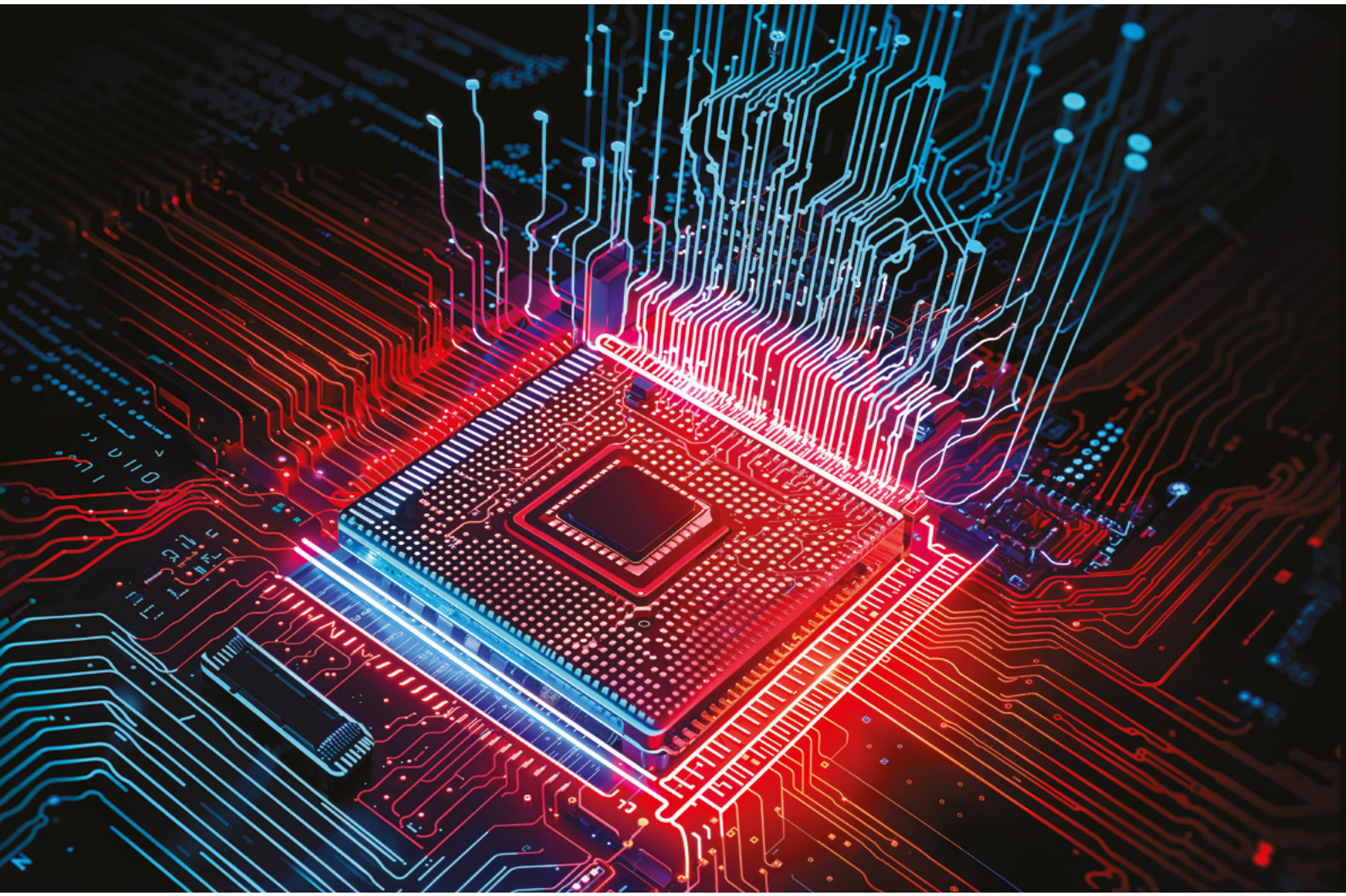
If actions from this Review are realised through the Industrial Strategy, it offers a major opportunity for the Digital and Technologies sector to grow and meet the increased domestic demand. From 2010 to 2022, the sector's GVA increased by 81%, contributing £153.5 billion to the economy, or 6.5% of total GVA.[46] Further growth could be driven by higher adoption rates in the growth driving sectors.

The Digital and Technologies sector is comprised of companies of all sizes covering numerous technology sub-sectors such as AI, advanced connectivity technologies (ACT), cyber security, engineering biology, quantum technologies and semiconductors. As well as supplying new technologies for adoption in other sectors, companies in the digital and technologies sector can also benefit from the adoption and convergence of digital technologies, such as AI, to drive operational efficiencies and unlock new capabilities.

Positioned at the core of future technology adoption, the sector can boost productivity and growth by enhancing efficiency, creating new revenue streams, and scaling production. The government should leverage the sector's strength to make technology adoption central to its ambition to make the UK one of the top three places in the world to create, invest in and scale-up a fast-growing technology business. As the Digital and Technologies sector supplies many of the technical solutions other sectors adopt, we suggest that this sector reflects on our findings and recommendations identify opportunities for their products and services to meet the needs of the other growth driving sectors in the UK.

CONCLUSION

By working together to learn from the advice of this Review, the interventions that are set out in the Industrial Strategy will help support better adoption of technology across the UK's economy. The government must also ensure that it applies this learning to the adoption of future disruptive technologies too. Clearly this Review does not mark the end of work in this space, but the start.



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