A Response to Technology Adoption Review Consultation
14/02/2025

Key recommendations:

1. Devise a method of assessing technology adoption based on the following technologies: future telecoms, photonics, quantum and semiconductors.
2. Establish a hybrid pilot line to accelerate technology adoption by bringing together companies from across the supply chain to manufacture prototypes.
3. Commit to a long-term (10-year) investment.

Response Authors:

About CORNERSTONE Photonics Innovation Centre:

The CORNERSTONE Photonics Innovation Centre is the UK's leading technology hub for silicon photonics. We accelerate photonic innovation by bringing together tailored start-up support, engaging networking events, expert design consultancy, and flexible prototyping, backed by our open-source silicon photonics foundry.

We offer seven photonics technology platforms to accommodate a broad spectrum of applications, including telecoms, sensing, LiDAR, quantum, and more. Our unique approach allows us to assist in the development of early-stage R&D projects and build proof-of-concept prototypes, helping to drive silicon photonics innovation.

Citation:

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Response:

The current situation (questions)

1. Why does the UK rank lower than some OECD countries in technology adoption? What dynamics exist in the UK, but not in countries such as Germany or Estonia that might explain it?

In the World Intellectual Property Organisation (WIPO) 2024 report, the UK was ranked 5th for innovation and 31st for knowledge absorption. The WIPO report describes a clear methodology for assessing innovation and knowledge absorption.

However, the report does not describe a methodology or ranking for technology adoption, which is assessed in terms of the following indicators:

- Safe sanitation
- Connectivity (broadband and 5G)
- Robotics
- Electric vehicles
- Cancer radiotherapy

Rather than assessing technology adoption in terms of the above indicators, it would be more appropriate to consider the following technologies:

- Future telecoms
- Photonics

- Quantum
- Semiconductors

These technologies are closely related to each other, with three technologies cited in the Science and Technology Framework. According to the UK's National Technology Advisor, photonics is consistently ranked as a top ten priority for the UK. The above technologies play a pivotal role in five of the eight growth sectors from the Industrial Strategy:

1. Advanced manufacturing
2. Clean energy industries
3. Creative industries / digital technologies
4. Defence

Creative industries and digital technologies have been grouped together for the purpose of this analysis. The following table assesses the application of these technologies in each sector.

	Advanced manufacturing	**Clean energy industries**	**Creative/ digital technologies**	**Defence**
Future telecoms	MEDIUM Industrial IoT Edge compute and distributed systems	MEDIUM Smart grids Remote monitoring	HIGH Telemedicine Edge / cloud compute VR / AR, big data Gaming	HIGH Secure comms Battlefield reconnaissance Cyber security
Photonics	MEDIUM Laser cutting / welding Optical metrology	MEDIUM Solar LED lighting	HIGH VR / AR Optical comms High-efficient data centres	HIGH Laser weapons Optical comms Surveillance Guidance systems
Quantum	LOW Quantum computing	LOW Quantum computing	MEDIUM Secure comms Quantum computing	HIGH Secure comms Sensing and imaging PNT High performance compute
Semiconductors	HIGH Sensors Power electronics Semiconductor manufacturing	HIGH Solar Smart grids Energy storage EVs	HIGH AI / computing Digital health VR / AR Content streaming	HIGH RADAR and surveillance Military comms Electronic warfare

From this analysis, all four technologies have applications in defence, while photonics and semiconductors are applicable across all sectors.

2. What are the biggest barriers to technology adoption in your sector and/or across sectors? Does business size and geographic location affect how firms are impacted by these barriers?

Private companies are incentivised to adopt new technologies that improve productivity and/or provide a competitive advantage. The biggest barrier to adoption is risk: unknown RoI, uncertain deployment time, uncertain supply chains and unknown reliability. Companies of all sizes experience these risks.

Large companies tend to operate at the end of the supply chain, integrating components from smaller companies nearer the start of the supply chain. The geographic location of suppliers has minimal effect on risk, although some companies, such as defence primes, pay careful attention to the source of critical components in the supply chain, avoiding dependencies on 'non-friendly nations'.

Mitigating these risks requires the evaluation of a manufactured prototype, which involves bringing together multiple companies from across the supply chain. A prototype demonstrates not only the technology but also the ability of the supply chain to respond to demand. As no single company controls the supply chain, this requires a hybrid pilot line capable of integrating components from across the supply chain. This model benefits early adopters, such as defence, as well as supporting technology diffusion into the wider economy.

3. What is the evidence for technology adoption across different sizes of businesses?

Large companies often have substantial R&D budgets, funding a broad portfolio of projects. For example, Microsoft's 2024 R&D budget was $29b[1]. Such budgets can be used to directly fund R&D or to acquire early-stage start-ups developing key technologies. Despite significant investment budgets, larger companies tend to adopt technology slowly and incrementally. In contrast, start-ups and SMEs have limited R&D budgets, which they use to leverage support from agencies such as Innovate UK. These companies are more dynamic, exploring rapidly emerging technologies, but ultimately rely on large end-users to provide market pull. Bringing small and large companies together via a pilot line will accelerate technology adoption by forging new supply chains to manufacture prototypes for evaluation.

4. What are the differences in technology adoption rates in the nations and regions of UK and how can they be explained?

There is evidence that clusters improve technology adoption rates, as they encourage a virtuous cycle of innovation and investment. For example, over 30 photonic start-ups have spun out of the University of Southampton's Optoelectronic Research Centre (ORC). These companies have attracted significant investment, including the Microsoft acquisition of Lumenisity[2]. This investment fuels further research and innovation, creating a virtuous cycle.

5. Do technology adoption rates differ at a worker level, including by gender, ethnicity or other protected characteristics? If so, does this have wider effects on professions and sectors where a large proportion of that workforce comes from a lower technology adopting group?

Assessing the risk of technology adoption requires two main skill sets: technical skills and business skills. These skills are likely to be held by different teams within an organisation. Organisational structure and culture will determine the distribution of these skills within the business.

Existing measures (questions)

6. How effectively does the UK support the adoption of new technology? What could be improved in your sector and/or across sectors?

UKRI will invest £8.6b in research, development and innovation in 2024/25. The majority of UKRI's budget is invested at early stage 'discovery' research, with less than 10% invested in translational research, such as Innovation Knowledge Centres (IKCs) and Catapults. Current funding rules mean that IKCs and Catapults receive either OPEX without CAPEX or CAPEX without OPEX. These funding rules should be reviewed to create a sustainable business model that supports open access for industry.

[1] https://www.macrotrends.net/stocks/charts/MSFT/microsoft/research-development-expenses
[2] https://blogs.microsoft.com/blog/2022/12/09/microsoft-acquires-lumenisity-an-innovator-in-hollow-core-fiber-hcf-cable/

7. What current policies and/or initiatives support technology adoption in your sector and/or across sectors?
Have these policies been successful at supporting technology adoption and why? Examples from the following categories are of interest:

- **national government**
- **devolved, regional and local government**
- **industry bodies**
- **business-led, including individual companies**

Long term (10 year) programmes, such as the Advanced Propulsion Centre (APC) and the Aerospace Technology institute (ATI) have been effective at encouraging automotive and aerospace companies to adopt new technologies. These programmes encourage business-led adoption, they operate nationally and align with the advanced manufacturing sector. Similarly, the Defence And Security Accelerator (DASA) is effective at encouraging the adoption of dual use (defence and civilian) technologies across the UK.

8. The availability of skilled employees is a significant enabler of technology adoption. What are the main skills needs across the economy/in your sector required to drive technology adoption and where are the most significant gaps?
Where there are gaps, how can the UK effectively up/reskill domestic workers for roles that involve technology adoption? This could focus on any of the following groups:

- **leadership (management, C-suite)**
- **IT experts (e.g. requiring technical expertise with university or equivalent-level qualification)**
- **lower technical ability adoption skills (e.g. addressed via re- or upskilling programmes, typically shorter than for experts)**
- **all (e.g. safety, ethics and governance)**

Technology adoption requires knowledge of the technology and an understanding of business dynamics. There are significant gaps in rapidly evolving technologies, such as quantum, which requires highly specialist knowledge.

9. What international examples of technology adoption have been most successful, specifically from countries with economies similar to the UK and/or any novel or effective approaches from other countries?

Examples of ecosystems created to support technology adoption include:

- Dutch government created a €200m photonics ecosystem called Photon Delta
- Belgium government created a €7b semiconductor ecosystem called IMEC

The above cases demonstrate the success of sustained government support, with a long-term (10-year) commitment.

Future action to drive technology adoption (questions)

10. What are the top two transformational technologies for productivity in your sector and/or across sectors and why?

AI will be the most transformative technology for the foreseeable future, as it is a highly adaptable tool with multiple applications across all sectors. Within data centres, AI, future telecoms, photonics and semiconductors will have the greatest impact on productivity. Within the defence sector, AI will have the greatest impact on productivity, whereas photonics, quantum and semiconductors will have the greatest impact on performance.

11. Where is government uniquely placed to drive technology adoption?
Answers could focus on, but need not be restricted to, the following categories:

- **financial support packages**
- **growth hubs/local delivery**
- **awareness campaigns**
- **skills packages**
- **procurement**
- **convening stakeholder groups to unlock key challenge areas**

Government is uniquely placed to support open access pilot lines, accompanied by an appropriate skills programme. Additional support for stakeholder convening and coordination could be valuably used to develop and implement long term roadmaps.

12. Where is industry uniquely placed to drive technology adoption in your sector and/or across sectors? Where could industry go further to support the objectives of this review?

As an early adopter of future telecoms, photonics, quantum and semiconductors, the defence sector is uniquely placed to accelerate technology adoption. The defence industry requires a diverse range of technologies and associated supply chains, acting a lead customer to diffuse the technology into the wider economy. Many technologies required by defence have dual use applications, for example in data centres. Industry could go further by sharing technology roadmaps and defining pilot line facilities to support these roadmaps.

13. What opportunities are there for government and industry partnerships to drive technology adoption in your sector and/or across sectors?

Please see response to Q14.

14. What approach or policies should government consider to accelerate technology adoption across the economy and/or within sectors?

Consider the mission led approach advocated by Professor Mazzucato: Mariana Mazzucato : Mariana Mazzucato supported with appropriate pilot line infrastructure.