UK INSTITUTE FOR TECHNICAL SKILLS & STRATEGY

Frontier Industries Skills Coalition

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Executive Summary

The UK Institute for Technical Skills & Strategy (UK ITSS) established the Frontier Industries Skills Coalition (FISC) following publication of The Technical Skills Landscape in the Digital and Technologies Sector Report (henceforth the "Technical Skills Landscape report"). The report identified persistent technical skills shortages across Advanced Connectivity Technologies (ACTs), Artificial Intelligence (AI), cyber security, engineering biology, quantum technologies, and semiconductors, alongside cross-cutting challenges relating to career pathways, education, and industry alignment, regional provision, workforce development, and the quality of available evidence.

The FISC workshop brought together stakeholders from research, innovation, education, industry and government to test this evidence, identify where collective action could add most value and explore potential practical responses. The workshop was informed by stakeholder survey across the technical skills ecosystem.

The key findings were:

- **Strengthen the evidence base.** Participants highlighted the need for more consistent data on technical occupations, skills shortages, education and training pathways, workforce demographics, employment outcomes and regional demand. Better coordination and linkage of existing evidence could support more targeted workforce planning.
- **Improve education, training and workforce development.** Stronger links between employers and education providers were identified as important, alongside apprenticeships, further education, alternative technical pathways, and continuous upskilling and reskilling for the existing workforce.
- **Respond to regional and sector differences.** Participants highlighted the need for national workforce intelligence that can also support locally relevant decision making. Regional horizon scanning was proposed as one way of identifying where skills are required and where existing provision may be insufficient.
- **Increase coordination across the skills ecosystem.** Greater employer engagement, improved awareness of technical careers and stronger collaboration across government, industry, education, research and regional organisations were identified as important areas for further development.

These findings provide the foundation for the next phase of FISC. In early 2027, UK ITSS will bring together a FISC Strategic Partnership Group from across the frontier industries ecosystem to refine the emerging priorities and co-develop a shared agenda for technical skills in frontier industries.

A glossary of terms is included in Appendix 1.

1 Background

The Frontier Industries Skills Coalition (FISC) was established by the UK Institute for Technical Skills & Strategy (UK ITSS) to bring together stakeholders from government, industry, education, and research and innovation to strengthen the UK's response to technical skills challenges across the Digital and Technologies sector, in support of the UK's Modern Industrial Strategy. FISC takes an inclusive view of the technical skills ecosystem. Its scope extends across industry, research and innovation, education and training, government, funders, professional and sector bodies, and regional organisations. The FISC therefore provides a mechanism for bringing these perspectives together and identifying where collective action can strengthen technical capability across the frontier industries.

This report summarises the evidence that informed the establishment of FISC, the findings from the stakeholder survey, and the key themes and proposals emerging from the inaugural workshop. These findings will provide the foundation for the next phase of the Coalition and the co-development of a shared agenda for technical skills in frontier industries. The shared agenda will build on the priorities emerging from the workshop and provide a common direction for areas where collective action can add value.

In early 2027, UK ITSS will convene the FISC Strategic Partnership Group, a smaller cross-sector group of senior stakeholders drawn from the wider Coalition, to support this co-development process. The group will help refine the emerging priorities, consider their scope and feasibility, and shape the areas of work that FISC should take forward.

1.1 The Technical Skills Landscape in the Digital and Technologies Sector

The Technical Skills Landscape report was commissioned by the UK ITSS in the context of the UK's Modern Industrial Strategy, published in June 2025. The strategy identified eight priority growth sectors with significant potential to support future economic growth, including the Digital and Technologies sector, encompassing six frontier industries:

- Advanced connectivity technologies (ACTs)
- Artificial intelligence (AI)
- Cyber security
- Engineering biology
- Quantum technologies
- Semiconductors

Frontier industries are critical to the UK's future growth and competitiveness, but their success depends on access to a highly skilled technical workforce. To strengthen the evidence base on the technical talent supporting these sectors, UK ITSS commissioned Frontier Economics to assess the current landscape and future demand for technical professionals. The analysis found that, without a significant expansion in the supply of technical talent, the cumulative shortfall across the six frontier industries could reach around 120,000 professionals by 2035. Reflecting this challenge, skills and access to technical talent emerged as central themes within the Industrial Strategy, with skills shortages and weaknesses in skills development identified as potential barriers to growth.

The research examined the economic contribution, workforce demographics, current technical skills landscape, and future demand for technical professionals across the six industries. It also considered the role of universities, research institutes, and policymakers in addressing identified gaps. The study combined a rapid evidence assessment of around 80 relevant academic, government, and industry sources with qualitative engagement involving technical professionals, industry leaders, universities, research institutes, and industry bodies. Findings were triangulated and tested with policymakers through workshops before the recommendations (Table 1) were finalised.

The Technical Skills Landscape report identified widespread and persistent technical skills shortages across all six frontier industries, alongside several challenges shared across sectors. These included limited visibility and accessibility of technical career routes, barriers to entering and progressing within technical roles, regional imbalances in skills provision, gaps between education and training and the practical skills required by employers, and rapidly changing skills needs. The analysis also highlighted the importance of developing alternative technical pathways alongside higher education and significant gaps in the available evidence on workforce diversity.

Table 1 Recommendations from The Technical Skills Landscape in the Digital and Technologies Sector report

Topic	#	Recommendation
Economic Contribution	EC1	Standardise, where possible, the approach to data collection, modelling assumptions, taxonomies, and timeframes across studies.
	EC2	Gather data to provide detailed breakdowns of the number of technical roles and their type in each industry.
	EC3	Provide a regional breakdown of economic statistics (revenue, number of firms, GVA, number of employees).
Demographics of the workforce	D1	Develop a consistent dataset providing comparable demographic data across technical roles in frontier industries over time.
	D2	Steps should be taken to further explore the causes of gender imbalances and possible solutions.
Current skills landscape	CS1	Detailed and consistent information quantifying technical skills shortages and vacancies should be collected to enable policy responses to be effectively targeted.
	CS2	A robust, data-driven mapping of current and emerging technical skills should be completed.
	CS3	A systematic analysis of retirement risks, succession planning, and supply of prospective technical professionals should be conducted for each frontier industry.
	CS4	Steps should be taken to improve the pipeline of skills and awareness of technical routes early, before children start to specialise.
	CS5	The working conditions of technical professionals should be improved.

	CS6	Ensure there is a level playing field in funding and support across regions.
	CS7	Align educational pathways more closely with industry skill needs.
Future shortages of technical professionals	FS1	Periodic horizon-scanning should be undertaken to assess and quantify where technical skills shortages are likely to worsen or ease over time.
	FS2	Producing updated technical professional shortfall forecasts using more robust industry-specific data is advised.
	FS3	Steps should be taken to ensure technical professionals are continuously trained in line with the emerging skill needs in each frontier industry.
The role of universities and research institutes	RU1	University curricula should be better aligned with industry needs.
	RU2	Alternative pathways for technical professionals should be investigated alongside higher education options.

1.2 The Frontier Industries Skills Coalition

The Technical Skills Landscape report provided the evidence base for the establishment of FISC. The Coalition was created to bring together stakeholders from across the technical skills ecosystem including research & innovation, education, industry, and government. FISC provides a mechanism for considering where greater coordination and collective action could strengthen technical capability across the frontier industries, particularly where challenges extend beyond the responsibility or capacity of individual organisations. Its focus is on areas where progress requires collaboration across organisations and sectors, while building on existing activity and avoiding unnecessary duplication.

Ahead of the workshop, UK ITSS invited stakeholders across the technical skills ecosystem to contribute and explore the most significant skills challenges, priorities arising from the Technical Skills Landscape report, existing approaches that FISC should build on and areas where collaboration could add value. The workshop then provided an opportunity to test and refine this evidence, identify the issues where collective action could make the greatest contribution, and explore potential practical responses. The next phase will build on this work through the FISC Strategic Partnership Group that will help refine the priorities emerging from the inaugural workshop and shape the future direction of FISC.

2 Stakeholder Survey

UK ITSS invited key stakeholders from across the technical skills ecosystem to share their perspectives on the challenges facing the UK's frontier industries. Stakeholders explored the most significant technical skills challenges, priorities arising from the Technical Skills Landscape report, existing approaches that FISC should build on, gaps in current provision, and areas where collaboration could add value. Stakeholders from across universities and research organisations, government and public bodies, funders, professional and sector bodies, and organisations working across the technical skills landscape were invited to respond to the survey. Interests spanned all six frontier industries, with many respondents working across more than one area.

Several recurring themes emerged. Respondents highlighted the need for stronger alignment between education and industry, clearer technical career pathways, continuous workforce development, and improved workforce intelligence. Funding, access to specialist infrastructure and organisational capacity were also raised, alongside the need to better connect existing initiatives and organisations working on technical skills.

When asked which recommendations from the Technical Skills Landscape report (Table 1) were most important for their sector, respondents placed greatest emphasis on education and workforce development. As shown in Figure 1, the top 3 priorities identified were:

- CS7, aligning educational pathways more closely with industry skills needs
- CS4, improving the early skills pipeline and awareness of technical routes
- FS3, ensuring continuous training in response to emerging skills needs

Alternative pathways alongside higher education, gender imbalance, and closer alignment between university curricula and industry needs were also frequently selected.

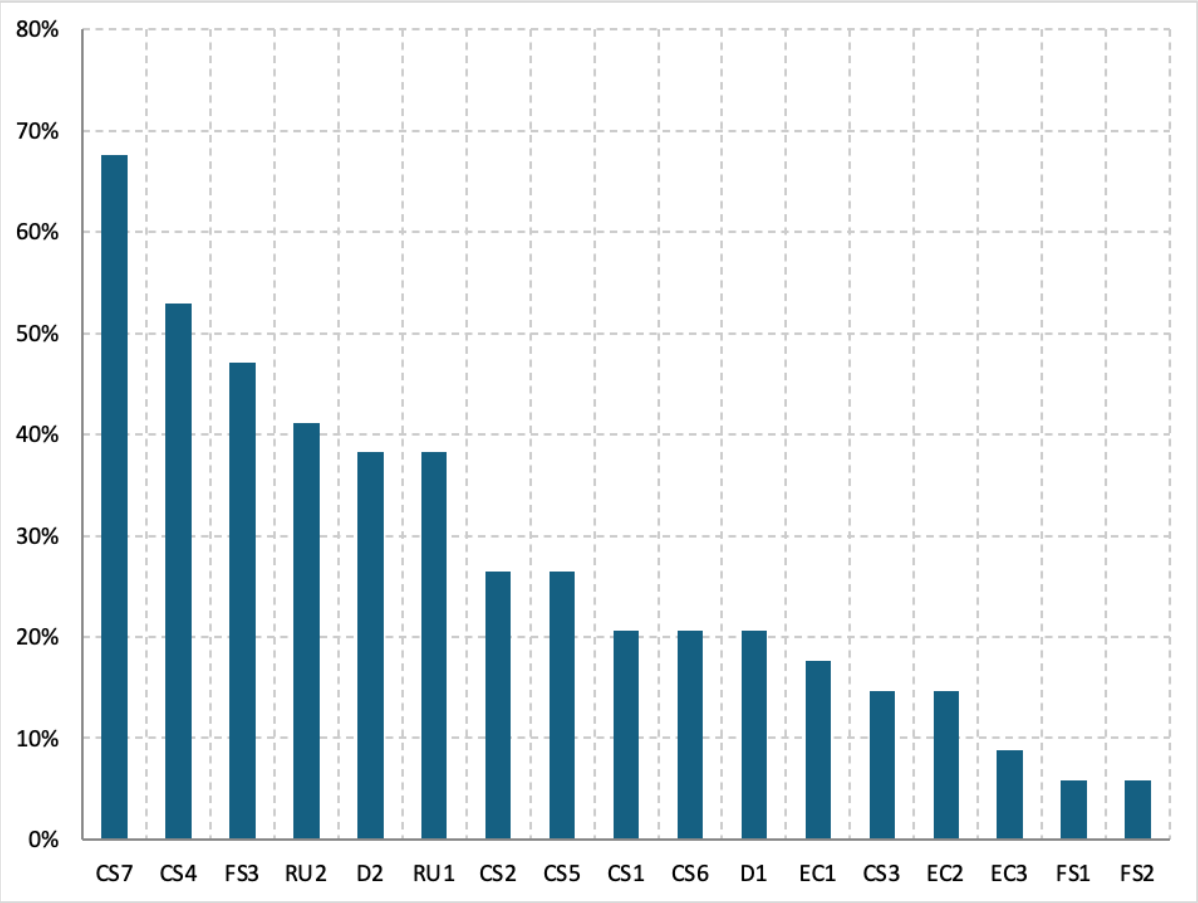

Figure 1 Recommendations identified by survey respondents as most important for their sector. Respondents could select more than one recommendation. Recommendation codes correspond to those used in the Technical Skills Landscape in the Digital and Technologies Sector report.

Stakeholders also highlighted significant activity already underway across the technical skills ecosystem, including apprenticeships and work experience, professional development, technical career frameworks, mentoring, shared facilities and sector-specific skills initiatives. Respondents emphasised opportunities to improve visibility of successful approaches, share good practice and strengthen connections between organisations.

Areas where collaboration could add value included improving the connection between employer demand and training provision, strengthening workforce intelligence and horizon scanning, expanding practical learning and employer engagement, supporting workforce development and mobility, improving awareness of technical careers, and ensuring that regional priorities and the needs of SMEs are reflected in future activity. These findings provided the basis for the issues explored in greater depth through the FISC workshop.

3 FISC workshop

3.1 Workshop purpose, objective, outputs, and outcomes

Purpose – to bring together stakeholders from across research, innovation, education, industry, and government to build a shared understanding of the technical skills challenges facing frontier industries and identify where collective action can have the greatest impact.

Objectives – to test and refine the evidence base, prioritise the challenges requiring collaborative action, explore potential practical actions, and gather the insights needed to support the co-development of the next phase of FISC.

Outputs – a shared set of priority challenges, potential practical actions, evidence gaps, and stakeholder insights that will inform the co-development of a shared agenda for technical skills in frontier industries.

Outcomes – greater alignment across the frontier industries skills ecosystem, stronger collaboration between stakeholders, and a clearer shared direction for future practical action through the FISC.

Participants were to use four tests to help identify where the FISC could add value:

1. **Do we consider this as a system-level challenge?** Does the challenge extend beyond an individual organisation or sector?
2. **Why do we need collaboration?** Does meaningful progress require organisations from different parts of the skills ecosystem to work together?
3. **Will addressing the challenge improve UK technical capability?** Would action make a meaningful contribution to the UK's ability to develop and sustain technical capability?
4. **Does it address the future as well as the present?** Are we building capability for the next decade, rather than simply responding to today's vacancies?

These questions were intended to help focus discussion on areas where FISC could make a distinctive contribution and where coordinated action could achieve more than organisations working independently.

3.2 Understanding the challenge and what the evidence tells us

Participants tested the findings from the Technical Skills Landscape report and the stakeholder survey against their own experiences. The discussion broadly supported the existing evidence while identifying several areas that required greater emphasis. Key points raised by participants included:

- **A broader range of education and training pathways.** Participants highlighted the importance of further education, apprenticeships and lifelong learning alongside higher education. Greater attention was also placed on supporting people to develop new skills throughout their careers.
- **The economic opportunity associated with technical capability.** Participants highlighted the need to better understand the economic and strategic consequences of

skills shortages, including impacts on productivity, competitiveness, investment and the growth of frontier industries.

- **Greater focus on the existing workforce and transferable skills.** Participants emphasised the importance of durable skills that support people to move between sectors, occupations and technologies. This included greater consideration of upskilling, reskilling and workforce redeployment.
- **The relationship between national and regional skills needs.** Participants highlighted the importance of recognising regional strengths and ensuring that national approaches can be applied in ways that reflect local capability and demand. The discussion also cautioned against unnecessary duplication of specialist provision across regions.

These points were carried forward into the next session, where participants considered which challenges were most significant and where collective action through FISC could add the greatest value.

3.3 Where can collective action make the biggest difference?

Discussion focused on identifying the areas where collaboration through FISC could add most value. Participants worked in groups to assess the recommendations from the Technical Skills Landscape report against two criteria. The first considered the potential impact of addressing the issue across the frontier industries, while the second considered the level of collective action required to make progress.

Figure 2 shows the average position assigned to each recommendation across the workshop groups. Recommendations positioned towards the upper right of the matrix were considered to combine relatively high impact with a greater need for collaboration across organisations and sectors. The exercise highlighted eight recommendations within the high impact and high collective action area of the matrix. These covered all five recommendation themes from the Technical Skills Landscape report.

Within **economic contribution**, EC1 focused on improving consistency in data collection, modelling assumptions, taxonomies and timeframes.

Within **demographics of the workforce**, D2 focused on understanding the causes of gender imbalance and identifying potential solutions.

CS1, CS4, and CS7 from the **current skills landscape** were also prioritised, covering more consistent information on skills shortages, earlier awareness of technical routes, and closer alignment between education and industry needs.

Within **future shortages of technical professionals**, FS3 focused on continuous training to ensure that technical professionals can respond to emerging skills requirements

Finally, RU1 and RU2 from within the **role of universities and research institutes** highlighted the importance of stronger alignment between university curricula and industry needs and the development of alternative pathways alongside higher education.

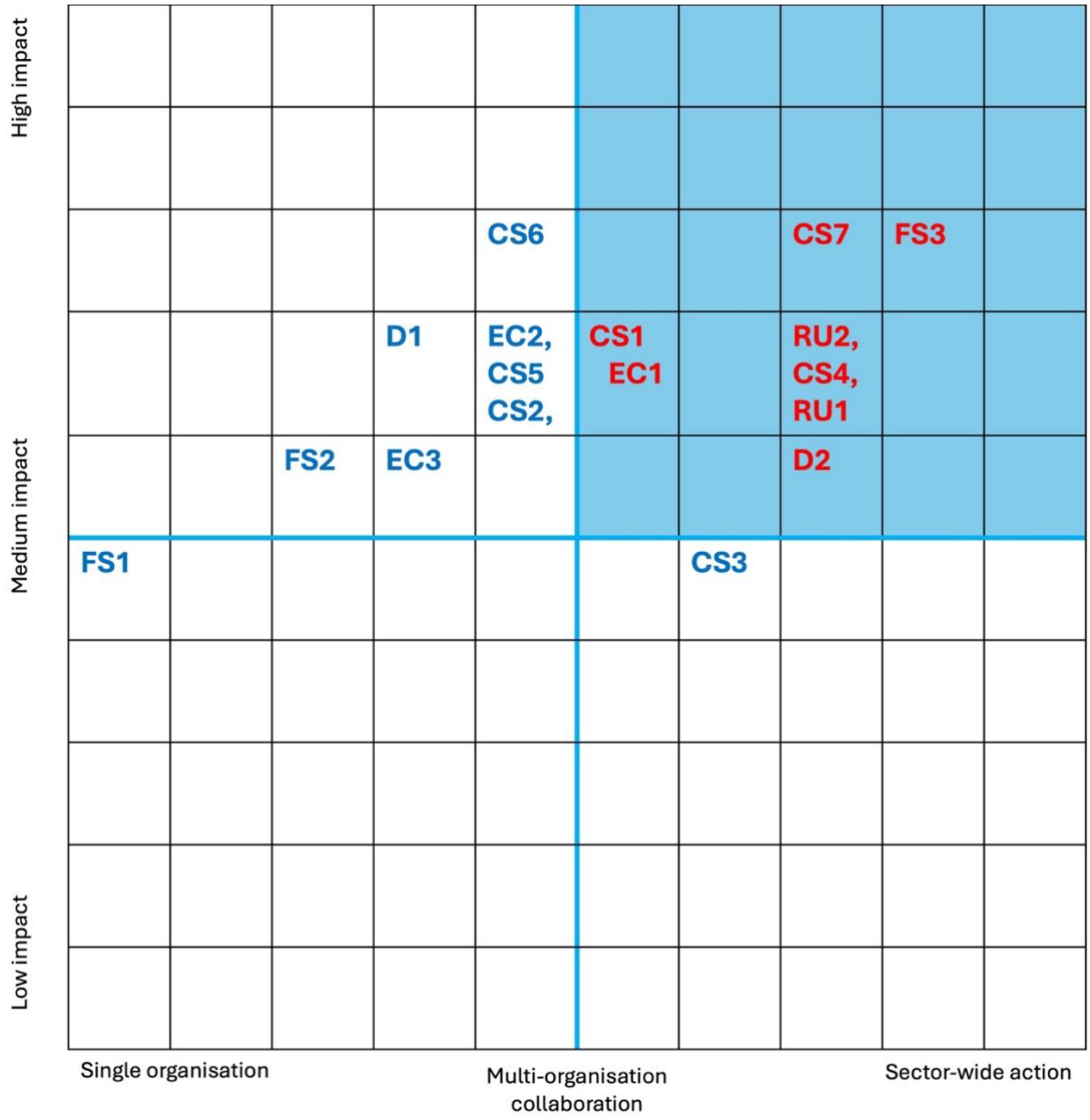

Figure 2 Prioritisation of Recommendations by impact and collective action. Each recommendation is plotted according to the mean position assigned by workshop participants. Recommendation codes correspond to those used in the Technical Skills Landscape in the Digital and Technologies Sector report (see table 1).

The pattern across the matrix suggests that participants placed particular emphasis on challenges that cut across different parts of the skills system and require coordination between multiple organisations. Workforce evidence, education and training pathways, continuous workforce development and participation were all positioned towards the collaborative end of the matrix. Participants also highlighted relationships between these areas. Better workforce intelligence was seen as important for understanding demand and informing education and training provision, while continuous skills development was linked to wider issues around retention, progression and working conditions. Regional variation was also raised during discussion, with participants emphasising the need for national intelligence that can support locally relevant planning and investment.

3.4 Designing practical actions

The final session focused on developing practical responses to the priorities identified earlier in the workshop. Each group explored a selected challenge, considering the problem, the change required, possible actions, the organisations that would need to be involved and the questions that remained unresolved. The discussions focused on four connected areas for further development. Four connected potential actions were identified in the discussions, together with the organisations and groups considered important to their delivery, are summarised in the Figure below.

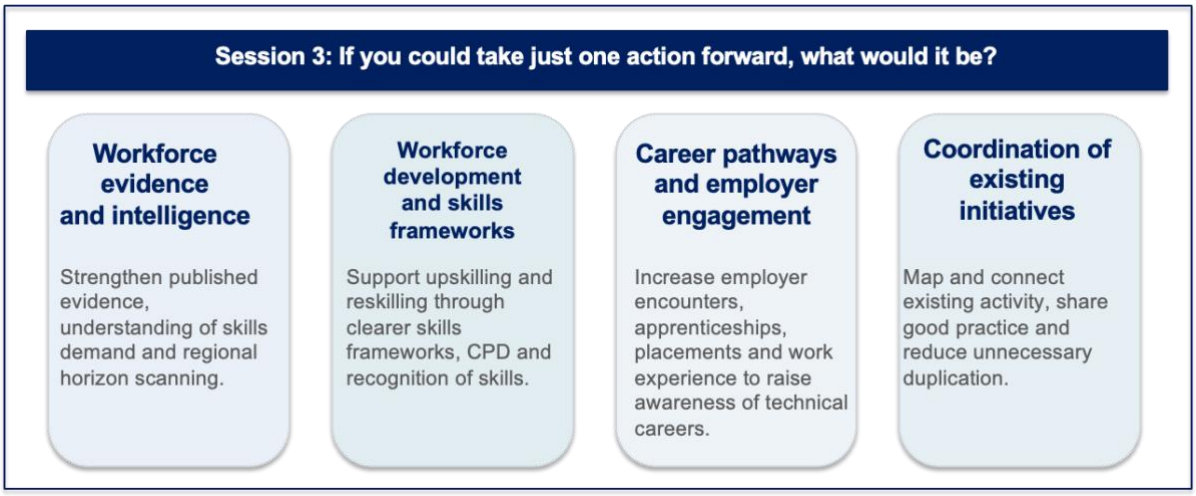

Figure 3 Priority actions identified by participants in response to the question, "If you could take just one action forward, what would it be?"

Improving the evidence base remained a strong theme. Participants highlighted gaps in information on technical occupations, education and training pathways, workforce demographics, employment outcomes and earnings, alongside limited coordination between existing data sources. Proposals included developing more consistent definitions of frontier industry occupations and pathways, linking existing datasets more effectively and publishing evidence that could support workforce planning and career decision making.

Workforce development formed a second area of focus. Participants identified rapidly changing skills requirements, limited access to appropriate training, cost, time and employer incentives as barriers to upskilling and reskilling. Potential actions included shorter and more flexible training, greater use of the Lifelong Learning Entitlement and Growth and Skills Levy, improved communication of existing provision and stronger incentives for employers to invest in staff development. Skills passports were also proposed as a way of recording skills and supporting progression and mobility across technical careers. Participants highlighted the potential value of a shared framework that could help employers, education providers and individuals understand skills and training pathways more consistently.

Regional workforce intelligence was identified as another area for further development. Participants highlighted the need for a clearer understanding of where technical skills are required, where relevant employers are located and how skills gaps vary across the UK. Regional horizon scanning using a shared methodology was proposed as a way of producing more targeted evidence for employers, education providers and policymakers and supporting locally relevant skills interventions.

The final area focused on **increasing awareness of frontier industry careers through greater employer engagement**. Participants identified limited understanding of technical pathways and career opportunities among young people. Apprenticeships, placements, work experience and other employer encounters were proposed as practical ways to increase exposure to frontier industries. Participants also highlighted the importance of supporting SMEs to participate and of sharing approaches that have already demonstrated value.

Across these areas, participants identified a wide range of organisations with a role in delivery, including government, industry, SMEs, higher and further education, research institutes, regional bodies, professional and sector organisations, funders, and training providers.

Several questions remain around ownership, governance, funding, employer incentives, and coordination. These questions will require further consideration during the next phase with the FISC Strategic Partnership Group as they will work towards co-developing a shared agenda for technical skills in frontier industries.

4 Next steps

The survey and inaugural workshop provide the foundation for the next phase of FISC. In early 2027, UK ITSS will bring together the FISC Strategic Partnership Group from across the frontier industries ecosystem to co-develop a shared agenda for technical skills in frontier industries, building on the priorities and potential actions identified through the workshop. This group will help refine these priorities, consider where collective action can add greatest value, and explore the scope, feasibility, and ownership of potential areas of work. This will also include identifying opportunities to build on and connect existing activity, considering how progress could be followed, and identifying where wider engagement or further evidence is needed.

The wider FISC Community of Interest will continue to be engaged as this work develops, providing opportunities for stakeholders to contribute to and remain informed about the next phase of the work.

Appendix 1: Glossary of terms

Terms	Definition
Technical professional	"...typically use their technical expertise and knowledge and their practical, analytical and management skills to make a range of vital contributions to research and innovation, including (but not limited to): Delivering the goals of a research and innovation project; Maintaining and developing the environment, standards, resources, materials and facilities needed to deliver research and innovation; Teaching others in the design, use and analysis of research techniques and methodologies; Managing budgets, procurement and teams directly associated with research projects, equipment, instruments and research resources."
Frontier technologies	Priority technology areas identified in the Digital and Technologies Sector Plan: Advanced Connectivity Technologies (ACTs), Artificial Intelligence (AI), cyber security, engineering biology, quantum technologies, and semiconductors
Advanced Connectivity Technologies (ACT)	Core ACT companies primarily or exclusively provide ACT-related solutions to the market. - Hybrid companies are telecommunications companies with some involvement in, or reference to, ACT as part of a broader business.
Artificial Intelligence (AI)	- Dedicated AI companies are those for which all or most activity is assumed to be AI-related. - Diversified AI companies are those where only a portion of employees is estimated to be engaged in AI activity.
Cyber security	- Dedicated cyber security companies are those for which all or most revenue or employment can be attributed to the provision of cyber security products or services. - Diversified cyber security companies are those for which only part of revenue or employment is attributable to the provision of cyber security products or services.
Engineering biology	- Application engineering biology companies use engineering biology to develop products and services across sectors such as healthcare, agriculture, and food. - Supply chain engineering biology companies operate within the enabling engineering biology supply chain.
Quantum technologies	Companies and innovators that develop and sell products and services based on quantum phenomena, or whose principal applications are in quantum technologies.
Semiconductors	- Dedicated semiconductor companies specialise in the design, development, and manufacture of semiconductors. - Diversified semiconductor companies operate across multiple industries, including semiconductors as one area of activity.