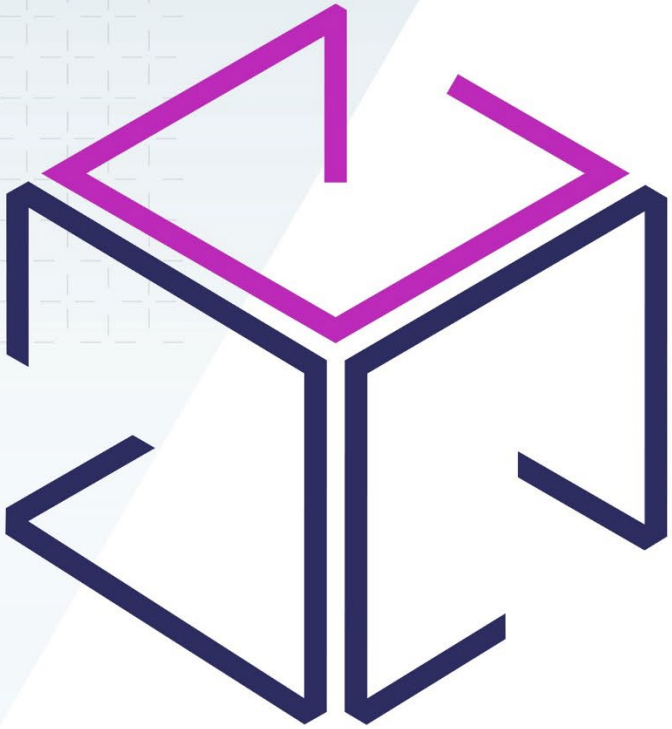
Workforce Foresighting Hub



Adopting Systems Engineering for Secure, Resilient, and Energy-Efficient RF and Microwave Systems to Address Skills Gaps and Enhance Open RAN Integration

Workforce Foresighting Hub findings report in collaboration with Compound Semiconductor Applications (CSA) Catapult.

Date: May 2025

Acknowledgements

The Workforce Foresighting process integrates data from the following international data sets:

IfATE – Institute for Apprenticeships and Technical Education, England

ESCO – European Skills, Competencies, Qualifications & Occupations, EU

ONet – Occupational Networks Online, USA

In accordance with licence and publishing requirements of these organisations for the use of their data sets, the Workforce Foresighting Hub team states that –

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The method and process used in the Workforce Foresighting process is under development and there may be errors and omissions in the data provided.

This report was produced following workshops undertaken December 2024 – April 2025 using the data set and tools available at that time.

Contents

Foreword

The UK has long held a leading position in the development of RF and microwave technologies, underpinned by world-class research and strong educational foundations. Our universities and technical institutions have played a vital role in training generations of engineers and technicians who support sectors critical to the UK economy and national security - including telecommunications, defence, aerospace, satellite systems, and emerging areas like fusion energy.

As we move toward a more connected and secure future, the demand for high-frequency expertise is only growing, yet we face the challenge of an ageing workforce. RF and microwave professionals are central to the rollout of 5G and future 6G networks. In 2022, the UK telecoms sector contributed £33.8 billion to the economy - evidence of both its impact and the opportunities ahead. In defence, where the industry generated over £28 billion in turnover in 2023, RF technologies underpin essential systems such as radar, secure communications and electronic warfare. Furthermore, these sectors are underpinned by technologies such as compound semiconductors, which provide the high frequency RF and microwave active devices used in all these systems, and the UK compound semiconductor market was estimated to be $11bn in 2024.

The UK has held a strong international position in manufacturing, design, research and development in RF and microwave technologies, but has seen a decline in the number of qualified engineers and technicians since the early part of this century, which impacts current business and limits future growth and security in this sector. This report highlights the urgent need to strengthen the talent pipeline and ensure the UK maintains its global leadership in high-frequency technologies. It offers a clear view of the training, education and strategic investment required to support the industries that depend on these skills - and to secure the UK's position in an increasingly technology-driven world.

Professor Sir Christopher M. Snowden FRS, FREng, CEng, FIET, FIEEE, FCGI
Chair of the ERA Foundation

Executive Summary

Executive Summary

This report outlines findings from the Workforce Foresighting cycle focussing on " **Adopting Systems Engineering for Secure, Resilient, and Energy-Efficient RF and Microwave Systems to Address Skills Gaps and Enhance Open RAN Integration** ". The study is sponsored by Filtronic and conducted by the Compound Semiconductor Applications (CSA) Catapult in collaboration with the Workforce Foresighting Hub, an Innovate UK initiative.

Workforce foresighting is a systemic approach to planning ahead and anticipating future skills and capability needs associated with new technologies and government transformation targets. It involves identifying and understanding the skills required for tomorrow's jobs, ensuring our education and training systems are prepared so that our workforce is ready to adopt new technologies and support future industrial growth.

This report sets out the findings of the Workforce Foresighting study and suggests the next recommended actions required by various stakeholders to ensure a workforce is created that is prepared to effectively implement these new technologies in the sector.

Workforce Foresighting Topic

The UK faces significant challenges in building secure, resilient, and energy-efficient RF and microwave systems, particularly but not solely in the context of Open RAN integration. The key challenges include:

Skills Gaps in RF, Microwave, and Semiconductor Technologies

- There is a critical shortage of skilled personnel across all levels - apprentices, technicians, graduate engineers, and postgraduate researchers.
- A high reliance on overseas recruitment suggests an insufficient domestic talent pool, especially in RF, wireless, and photonics roles.
- An ageing workforce will only compound the shortages, the loss of experienced engineering staff may severely impact UK industry's ability to deliver RF & microwave systems.
- The gender imbalance in the industry is stark, with UCAS recording only 435 accepted female applicants to electronic and electrical engineering degrees in 2023, (13% of the total accepted applicant figure).

Technological and Industrial Bottlenecks

- There is a need for a sovereign, compound semiconductor foundry capable of supplying on-wafer circuits, called MMICs, to support the RF & microwave industries.
- Open RAN aims to shift from proprietary systems to a more modular, vendor-agnostic approach, requiring extensive redesign of systems, components, and supply chains.
- The deployment of automated technology to support increased delivery requires advancements in semiconductor handling processes and packaging. Performance automation, cybersecurity, and real-time interoperability testing are crucial to maintaining the efficiency of future telecommunications.

Investment and Economic Challenges

- The UK government has allocated £452 million through DSIT's "Future Network Programmes" (2025), including £200 million for the 5G Testbeds and Trials Programme.
- Despite these investments, it is thought that there is a predicted £25 billion funding gap for full advanced 5G rollout by 2030.

- The global telecom test and measurement market, valued at $8.1 billion in 2023, is forecasted to grow at 8.3% CAGR, with the UK market expected to reach $670 million by 2032.

Technology Solutions Considered
Several technology solutions were evaluated for enhancing future telecommunications and semiconductor integration:

1. **RF and Microwave Technologies (Chosen Technology)**
    - These are fundamental to wireless communication, providing high data rates, improved network capacity, and low latency.
    - They support modular network designs that improve resilience and efficiency in, for example, Open RAN systems.

2. **Photonics**
    - Enables ultra-fast data transmission and reduces bottlenecks in data centres and telecom infrastructure.
    - Essential for 6G and high-capacity networks but requires significant adaptation for current Open RAN needs.

3. **Quantum Technologies**
    - Quantum communications offer ultra-secure data transfer and clock synchronisation, which is crucial for cybersecurity in future radio communications.
    - Quantum technology is still in the early stages of industrial application and requires further R&D before large-scale deployment.

Chosen Technology for the Cycle
RF and Microwave Systems was the chosen technology for this cycle for followings reasons:
- RF and microwave technologies are already at mid-TRL (4-7) with industrial and market applications.
- They provide immediate benefits for Open RAN and all future telecommunications systems by ensuring interoperability, security, and energy efficiency.
- The UK's Compound Semiconductor Centre, CSA Catapult and Octric Semiconductor investment are positioned to support these advancements.

Scope of Implementation
- Design and Manufacture: Adoption of compound semiconductor materials for RF and microwave applications.
- Installation and Deployment: Integration into Open RAN for improved network efficiency.
- Testing and Security: Continuous performance monitoring, interoperability assurance, and cybersecurity enhancements.

Forecast and Industry Impact

1. **Market Growth**
    - The telecom test and measurement market in the UK will grow to $670 million by 2032, driven by RF and microwave innovations.
    - The global investment in 5G infrastructure is projected to surpass $1 trillion by 2030, benefiting RF and microwave technology providers.
2. **Workforce Development**
    - Addressing the skills gap requires immediate long-term investment in STEM education. Not only financial investment, but investment of time and resource to address curriculum. Expansion of apprenticeship programs, clear career route progression, additional funding to encourage better uptake of degree programmes and development of CPD to ensure relevant reskilling of current workforce, but also to ensure we can bring new entrants into the sector from aligned industries with ease.
    - Encouraging diversity and retention strategies will strengthen the long-term talent pipeline.
3. **Strategic Positioning**
    - The UK government's £100 million Future Telecoms Mission and initiatives like the £22 million SBRI Future Telecommunications Challenge will accelerate RF and microwave technology adoption.
    - UK Government's acquisition of Octric Semiconductors in North East of England in September 2024 secures a sovereign capability to manufacture compound semiconductors for defence and future technologies, such as artificial intelligence, quantum and telecommunications such as 6G.
    - By enhancing sovereign, Open RAN capabilities, the UK can reduce dependence on foreign telecom vendors and foster domestic innovation.

Participants and stakeholders

Industry Participants	Skills Participants	Technology Participants
Microwave Inspection Technologies Ltd	Cardiff University	CSA Catapult
Filtronic	University of Sheffield	Focus Microwaves
Viper RF	University of Bristol	CML Micro Design Services
Ericsson	University of Manchester	Keysight Technologies
Octric Semiconductors UK	South Devon College	Anchored In Ltd
	University of Bradford	Space Solar
		Electronics and Photonics Innovation Centre
		Dr Daniel Verdin

In parallel with this exercise opinions were sought from engineering leaders in the UK defence primes to ensure, where possible, some synergy in skills requirements.

The Findings and Insights

The most significant observation is the misalignment between current education and training provision and the future occupational profiles (FOPs) required to support the secure, resilient, and energy-efficient RF and Microwave systems within Open RAN integration. This is particularly pressing given the high demand for, RF & Microwave Design Engineers, RF Cybersecurity Specialists, Quantum RF Engineers and technician roles including assembly, test and validation, none of which are well-supported by existing IfATE standards.

The introduction of advanced RF and Microwave technologies will reconfigure organisational capabilities across the telecommunications supply chain, leading to:

- A **shift towards Design and Logistics functions**, reflecting the emphasis on innovative system architectures, prototyping, and supply chain integration.
- Increased **requirements for data management, regulatory compliance**, and **system-level thinking**, especially within enterprise functions.
- Greater dependency on **AI and automation** across system monitoring and support, demanding proficiencies in predictive maintenance and real-time interoperability.

Summary of the priority FOPs generated:

- RF Systems Architect
- RF & Microwave Design Engineer
- RF Integration & Packaging Engineer
- RF Cybersecurity Specialist
- Antenna & Propagation Engineer
- Quantum RF Engineer
- RF Test & Validation Technician

These roles emphasise advanced design and integration of RF systems, cyber-physical security, AI-driven diagnostics and system tuning and compliance with emerging global standards and regulations.

Some universities (e.g., Bristol, Imperial, Cardiff) offer modules that align well with key FOPs like RF & Microwave Design Engineer and Quantum RF Engineer.

Certain apprenticeship standards show “some” suitability for roles like RF Cybersecurity Specialist and RF Integration & Packaging Engineer.

However, there is low suitability is seen across a wide range of current roles including:

- Cybersecurity Governance Specialists
- Data Architects
- Business Development Managers
- IT Systems Architects

Many Technician-level and Senior Engineer FOPs have no high-fit standards, highlighting a lack of foundational and advanced education alignment.

View the full data for this cycle here *Data Capture Overview Foresighting*

The Next Steps

Following this cycle CSA Catapult will convene a working group to Cause Action. This will include IfATE and equivalent bodies across the devolved nations, Innovate UK (IUK), employers, industry representatives, and education providers.

The Future Occupational Profiles will be further validated through iterative workshops and employer feedback loops.

CSA Catapult will identify a 'champion' for development of selected skills for the sector such as a sector body or lead employer to drive skills development and adoption. Together an action plan will be established to address short-term and mid-term actions such as:

- Short-term: Identify CPD needs and adapt current provision.
- Mid-term: Co-develop new standards and integrated qualifications.

In collaboration with the Workforce Foresighting Hub, CSA Catapult will evaluate the opportunity for further foresighting studies in the Semiconductor domain and explore foresighting in adjacent domains like AI-driven network orchestration, supply chain security, and quantum communications. They will also look to create a CDT specifically for RF & microwave technologies.

Without immediate and coordinated action, the UK risks falling behind in deploying secure and resilient telecommunications infrastructure. The skills gap identified is not just a training issue - it's a potential national capability bottleneck. The sector's progress, resilience, and sovereignty depend on bridging this gap immediately.

Due to the cross-cutting nature of the skillset required for this sector, we are also at risk of seeing a similar pattern in aligned sectors – such as defence – highlighting the critical need for attention to be given to workforce development and retention. This will involve more than simply creating new course content – but will require an aligned campaign of 'awareness raising' to ensure that we are delivering a clear message about the volume of skilled jobs available in the UK. The strength and depth of RF and Microwave roles remains largely hidden amongst young people – as with the wider semiconductor industries, despite them offering a robust opportunity for future jobseekers.

1. Introduction

1.1 Background to Workforce Foresighting

The report “Manufacturing the Future Workforce” (Collier et al., 2020) recommended the Skills Value Chain as an approach to avoid shortfalls in workforce capabilities relating to future innovations (see Figure 1). This is the genesis of the workforce foresighting programme, which is sponsored by Innovate UK and delivered through the Innovate UK Catapult Network.

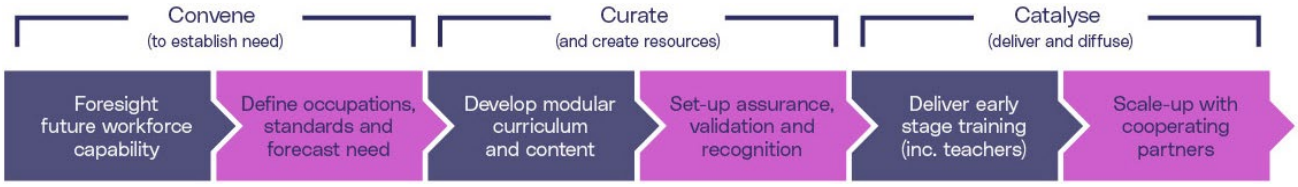


Figure 1: The Skills Value Chain

The first step of the skills value chain is to “Foresight future workforce capability”: This calls for technology, industry, education, and training partners to convene using government as a focal point, to “foresight and articulate future skills needs, standards and qualifications associated with emerging technologies” (Collier et al., 2020).

1.2 Workforce Foresighting - Process Overview

The core of workforce foresighting is convening three groups of relevant specialists to conduct structured, Delphi-style, facilitated workshops to capture and discuss the set of organisational capabilities that will be required to respond to and exploit technology innovation.

Organisational capabilities are captured using a bespoke classification that has been developed by the Workforce Foresighting Hub. The classification uses a structured common language to enable cross sector and cross centre collaboration and integration of data. Additionally, the classification enables data from a number of other national and international open-source workforce datasets to be integrated through the same common language. The data is held in a cloud based “data-cube” that is dynamically growing as each workforce foresighting cycle adds to the shared data relating to future workforce capabilities.

Using cutting edge AI and Large Language Model data tools, the data-cube is used to undertake detailed analysis to ‘map’ future workforce capability requirements against the current education and training provision to identify where existing provision can be used and where new provision, CPD or qualifications are required.

As an agile development project, the Workforce Foresighting Hub team are constantly evolving and improving the detailed workshop process and workshop approach, but always consists of the following stages:

Considering – Clarifying the Challenge to be met (the ‘what’ and the ‘when’) and collating solutions (the ‘how’) as foresighting topic suggestions align with strategic priorities

Identifying – Gain clarity and consensus about the solutions to be put forward – make the case for foresighting

Preparing – The convening of specialists and scheduling of workshops

Carrying out – Run foresighting workshops with experts, collate and analyse data

Communicating – Insights, findings and recommendations gathered from all research in report

Causing action – The driving of action based on the recommendations (promoting progress down the rest of the skills value chain) built on the findings and recommendations of foresighting.

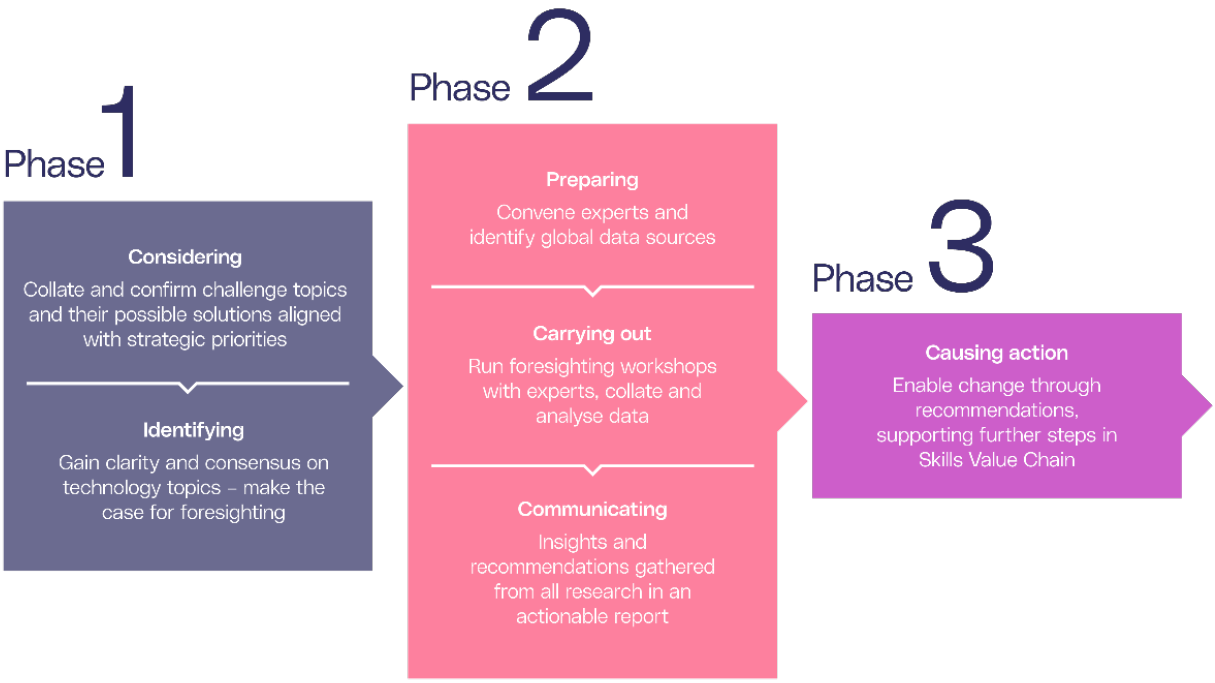


Figure 2 - The workforce foresighting process

1.3 Foresighting vs Forecasting

Although this study is focussed on workforce foresighting (capabilities required) it is important to keep in mind parallel findings from forecasting (required capacities and numbers). Forecasting, alongside foresighting, provides vital input to the sector, feeding into recruitment and development targets for employers, and consideration of economic class sizes and recruitment targets for educators. However, it is beyond the scope of the foresighting study to carry out independent forecasting, and as such readers should refer to referenced studies for detail on forecasting.

1.4 Introducing the Visualisation Tool

The Workforce Foresighting Hub's Visualisation Tool is a powerful, innovative system, which will enable the reader to explore and analyse foresighting data to determine the capabilities required for future roles. Links throughout this report make it easy to identify existing standards which meet the needs of these future roles and pinpoint where new standards are necessary to develop a skilled workforce equipped to adopt new technologies.

The data is generated by the foresighting cycles, integrating the expertise of technologists/domain specialists, employers and educators. The data informs the development of future curriculums and course content as determined by the action plan. Using AI tools validated by human oversight, and by linking to external data sources, the tool identifies differences at the level of occupation/role as well as detailed changes required to help update/refresh knowledge, skills and behaviours thus delivering insights for learners, providers, creators and assurers of skills.

Detailed instructions on how to use the Visualisation Tool can be found in the appendix.

Link to ***Data Capture Overview***

2. Aligning the Challenge and Solutions with national priorities

2.1 Positioning and context of national challenge

The UK government has outlined ambitious targets for the telecommunications sector, particularly in advancing Open RAN adoption and strengthening future telecoms networks. As part of its commitment to 5G diversification strategy, the UK aims to:

- Reduce reliance on a limited number of telecom vendors.
- Enhance network security and resilience.
- Foster innovation and competition within the supply chain.
- Strengthen semiconductor and RF technology capabilities to support next-generation telecom networks.

The UK telecoms industry contributes significantly to the economy, with a market value exceeding £30 billion and employing over 200,000 professionals. Key players include network operators, infrastructure providers, and semiconductor firms.

Despite strong R&D investments, the UK faces global competition from the US, China, and the EU, requiring strategic investment in skills, security, and innovation to remain competitive.

- Open RAN Transition: Moving from proprietary to open, interoperable systems.
- Semiconductor Advancements: GaN-based RF solutions for energy efficiency.
- AI & Automation: AI-driven network optimisation and predictive maintenance.
- Security and Resilience: Zero Trust architecture integration.
- Sustainable Networks: Energy efficient telecom initiatives to reduce carbon footprints.

Various reports have highlighted the challenges and opportunities in the sector.

- UK Government's **5G Diversification Strategy** (2020).
- Telecoms Supply Chain Review (DCMS, 2021).
- National Security and Investment Act (2022).
- Reports from **Ofcom, Innovate UK, and Catapult Centres.**

2.2 Potential and prioritised technology solutions to the challenge

Various technology solutions were evaluated that sought to address the challenge and these are detailed below.

Technology Solution	Description	Relevance to Challenge	Impacted Supply Chain
Open RAN Automation	AI-driven orchestration for vendor interoperability	Enables seamless multi-vendor integration	Software, network operators, system integrators
Secure RF & Microwave Systems	Hardware security for Open RAN components	Enhances network resilience	Semiconductor, telecom infrastructure
GaN-based Power Amplifiers	High-efficiency RF front-end solutions	Reduces energy consumption	Semiconductor, equipment manufacturers
Virtualised RAN (vRAN)	Software-based RAN implementation	Reduces dependency on proprietary hardware	Network operators, cloud providers

Each technology was assessed based on security, energy efficiency, deployment complexity, and supply chain impact. Open RAN automation and secure RF systems emerged as high-priority due to their critical role in ensuring interoperability and resilience.

The UK supply chain for telecom components remains highly reliant on international suppliers, particularly in semiconductors and advanced RF components. Investments in domestic manufacturing and R&D partnerships will be essential to mitigate supply chain risks.

The timing of each solution was considered:

- ***2027-2030**: Scaling national adoption, strengthening supply chains.*
- ***Beyond 2030**: Full integration of Open RAN with 6G-ready infrastructure.*

2.3 Workforce Foresighting for Chosen Prioritised Technology Solutions

Adopting Systems Engineering for Secure, Resilient, and Energy-Efficient RF and Microwave Systems to Address Skills Gaps and Enhance Open RAN Integration was the chosen technology for this cycle for followings reasons:

- RF and microwave technologies are already at mid-TRL (4-7) with industrial and market applications.
- They provide immediate benefits for Open RAN and all future telecommunications systems by ensuring interoperability, security, and energy efficiency.
- The UK's Compound Semiconductor Centre, CSA Catapult and Octric Semiconductor investment are positioned to support these advancements.

2.4 Current and predicted scale of technology deployment in UK

Factor	Adopting Systems Engineering for Secure, Resilient, and Energy-Efficient RF and Microwave Systems to Address Skills Gaps
Horizon	5-10 years (2025-2035)
Impact	High (driving UK telecom security, resilience, and competition)
Scale	Nationwide implementation across telecom operators and vendors
Supply Chain	Semiconductor Manufacturers / Module / Chip Fabless Design manufacturers / Software Developers/ System Integrators / Equipment Providers / Network Providers

2.5 Key Stakeholders

To undertake this workforce foresighting exercise the Compound Semiconductor Applications Catapult assembled key stakeholders identified by the appointed Leads. Industrial stakeholders whose businesses will rely on a future supply of well-trained technicians and engineers include fabless companies such as Viper RF, Filtronics and CML. Octric Semiconductor UK represented the wafer foundry industry, Ericsson the deployment and maintenance of telecommunication networks. The university and further education colleges were represented by Universities of Cardiff, Sheffield, Bristol, Bradford and Manchester, and South Devon College.

3. Findings and Results

3.1 Methodology and Findings

Summary information is provided with a narrative based on the underlying data which is also provided using bespoke visualisations to enable greater insight and access to detail. The report is aligned to the needs of those responsible for workforce planning – employers, educators, and skills providers.

Step One – How will the Supply chain change - Organisational Changes

Exploration of organisational changes provides insights into how organisations will need to adapt their current capabilities to implement the solutions that respond to the challenge addressed by the foresighting project.

Typically, organisational changes will also require the adoption of new capabilities and a change in the distribution of these capabilities across supply chain partners. The change in capabilities within an organisation as well as their supply chain partners will determine the changes knowledge and skill changes required by the role groups within the workforce of each Supply Chain partner.

Step Two – How will the Workforce change - Occupational Changes

A set of 'Future Occupational Profiles' (FOPs) is produced by the foresight process that demonstrates how current occupations may need to change in the future. FOPs are generated using a combination of attributes from the underlying capability classification and from data collected in the workshops.

The FOP generation algorithm works to group capabilities into logical sets reflecting role levels, function, proficiency and capability similarity. As part of the foresight process the generated FOPs are reviewed, revised and distilled by the Employer group. The agreed set of FOPs are then compared with selected current education provision; the default reference is the set of Institute for Apprenticeships and Technical Education (IfATE) apprenticeship standards to assess which current training and education provision could be used in the future.

For this cycle we also pulled provisions from higher education and NOS standards (see below):

- Cardiff - MSc/MRes Wireless and Microwave Communication Engineering (combination of modules)
- Bristol - BEng Electrical and Electronic Engineering (combination of modules)
- Sheffield - BEng/MEng Electrical and Electronic Engineering (combination of modules)
- UCL - BEng Electronic and Electrical Engineering (combination of modules)
- Cambridge - BA/ MEng in Engineering (combination of modules)
- Surrey - BEng/MEng Electrical and Electronic Engineering (combination of modules)
- Manchester - BEng Electrical and Electronic Engineering (combination of modules)
- Imperial - Electrical and Electronic Engineering / Electronic and Information Engineering MEng and BEng (combination or modules)
- Southampton - BEng/MEng Electrical and Electronic Engineering (combination of modules)
- Edinburgh - BEng/ MEng Electronics and Electrical Engineering (combination of modules)
- Leeds - BEng/ MEng Electronic and Electrical Engineering (combination of modules)

- Warwick - BEng/MEng Electronic Engineering (combination of modules)
- Strathclyde - BEng/ MEng Electronic and Electrical Engineering (combination of modules)
- Queen Mary - BEng/MEng in Electrical and Electronic Engineering (combination of modules)

NOS standards:

- SEMSEC301 – Prepare and Start the Semiconductor Manufacturing Process
- SEMSEC302 – Control and Maintain the Semiconductor Manufacturing Process
- SEMSEC303 – Close the Semiconductor Manufacturing Process
- SEMSEC304 – Prepare and Start the Semiconductor Manufacturing Technical Support Function
- SEMSEC305 – Carry Out the Semiconductor Manufacturing Technical Support Function
- SEMSEC306 – Complete the Semiconductor Manufacturing Technical Support Function

Two bespoke metrics - match and surplus - are used to evaluate the alignment of current provision with the set of FOPs proposed. Summaries are presented of the key findings related to each Supply Chain partner.

Findings are aimed at both Employers, and Education and Training Providers, and identify matches and gaps in future training needs compared with current provision to guide further detailed investigation.

Step Three – How the current Education provision meets the future need - Highlighted Changes to Future Provision

The report identifies suggested changes to education and training provision – principally apprenticeship standards that will deliver the knowledge, skills and behaviours required by future occupations. In some cases, this will include the development of short courses and continued professional development (CPD) to upskill the current workforce to meet future needs. Additionally, foresighting outputs can be used to develop programmes, qualifications, and apprenticeship standards for new entrants to the workforce joining via apprenticeship, taught qualification, or other training programme.

The insight and data in this part of the report are primarily aimed at educators training providers, apprenticeship standards bodies and awarding organisations. Combined with insight arising from the Supply Chain capability changes, the provision insight offers an effective way for employers to identify training opportunities that align to their future needs.

3.2 Step One – How will the Supply Chain change - Organisational Changes Insight

Organisation functions

The Workforce Foresighting process uses an information architecture built on five functional areas which are common to any business:

Design	The function of an organisation that focuses on activities relating to product, service or solution design.
Implement	The function of an organisation that focuses on activities relating to producing / making / providing its products or services.
Logistics	The function of an organisation that focuses on activities relating to procurement, delivery, materials, or services necessary for operations – service / manufacturing, etc.
Support	The function of an organisation that focuses on activities relating to users, in-service support, repair / maintenance, recycling, end of life disposal.
Enterprise	Core functions of an organisation - e.g., strategic planning, leadership and management, human resources, digital backbone and data systems, integration of relevant statutory / regulatory requirements and compliance.

The functional structure is developed to levels of detail that enable the foresight process to reference external data sets including ONET (US) Occupational Information Network [1], ESCO – European Skills, Competences, Qualifications and Occupations[2], IfATE (UK) Institute for Apprenticeships and Technical Education[3] .

The five root functions comprise around 40 domains which are broken down to around 140 functional areas. The architecture is used to position ~ 25,000 capability statements which are the building blocks used in the workforce foresight process. Each capability statement has several attributes - some are static and reflect the position of the capability statement in the architecture, whilst others are dynamic and are assigned values through a cycle and set of workshops.

The data architecture is implemented in a bespoke ‘data-cube’ which underpins the foresight process, workshops, and enables extensive use of LLM and AI tools. Additionally, a key feature of the data-cube is that the data from each foresight topic cycle is added into the data set and can then be used, where relevant, in future cycles. This ensures that the capabilities of the system are dynamic and up to date.

[1] *ONET - Occupational Information Network - https://www.onetcenter.org/*
[2] *ESCO - European Skills, Competences, Qualifications and Occupations - https://esco.ec.europa.eu/en*
[3] *IfATE – Institute for Apprenticeships and Technical Education - https://www.instituteforapprenticeships.org/*

Identifying the Future Supply Chain Capabilities

The following charts and graphs summarise the changes in the set of capabilities that will be required by the supply chain (Supply Chain involved in production) in the future. The pie-charts reflect the distribution of capabilities across the five functions of the capability classification. The future state data is captured in three technology focused workshops. The current state data is derived from information collected on apprenticeship standards used across current supply chain partners. sector. This latter information is not as detailed as that produced by the workshops but is indicative and used to provide a point of comparison.

These initial pie charts summarise the changes that will be required by the whole supply chain, across the five capability functions. There is a significant increase in Design & Logistics with an overall relative decrease in Implementation, Support and Enterprise.

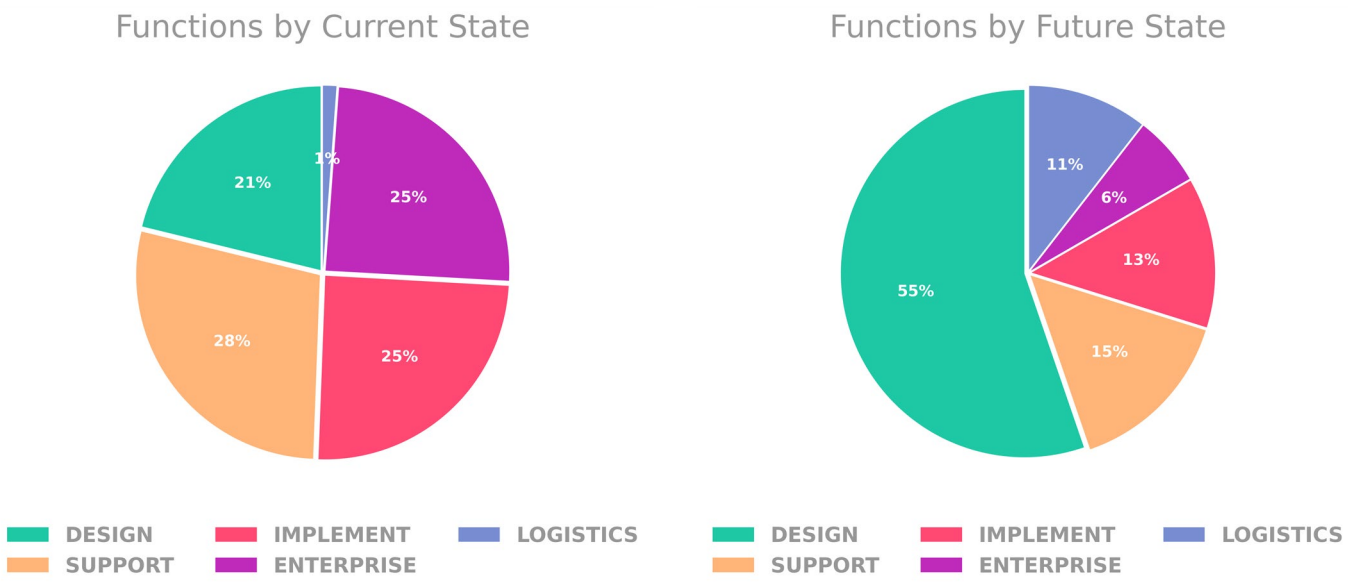


Figure 3: Current and Future – Whole Supply Chain - Capability Function Distribution %

Whilst the information on current and future Supply Chain capabilities is useful to indicate relative changes, factors such as volume of activity will also determine which functions may have greater future significance.

The graphs below show the distribution of capabilities assigned at domain level within the five main functions for this cycle. These graphs provide insight into the relative importance of each domain for the screen sector in the future.

Design Domains

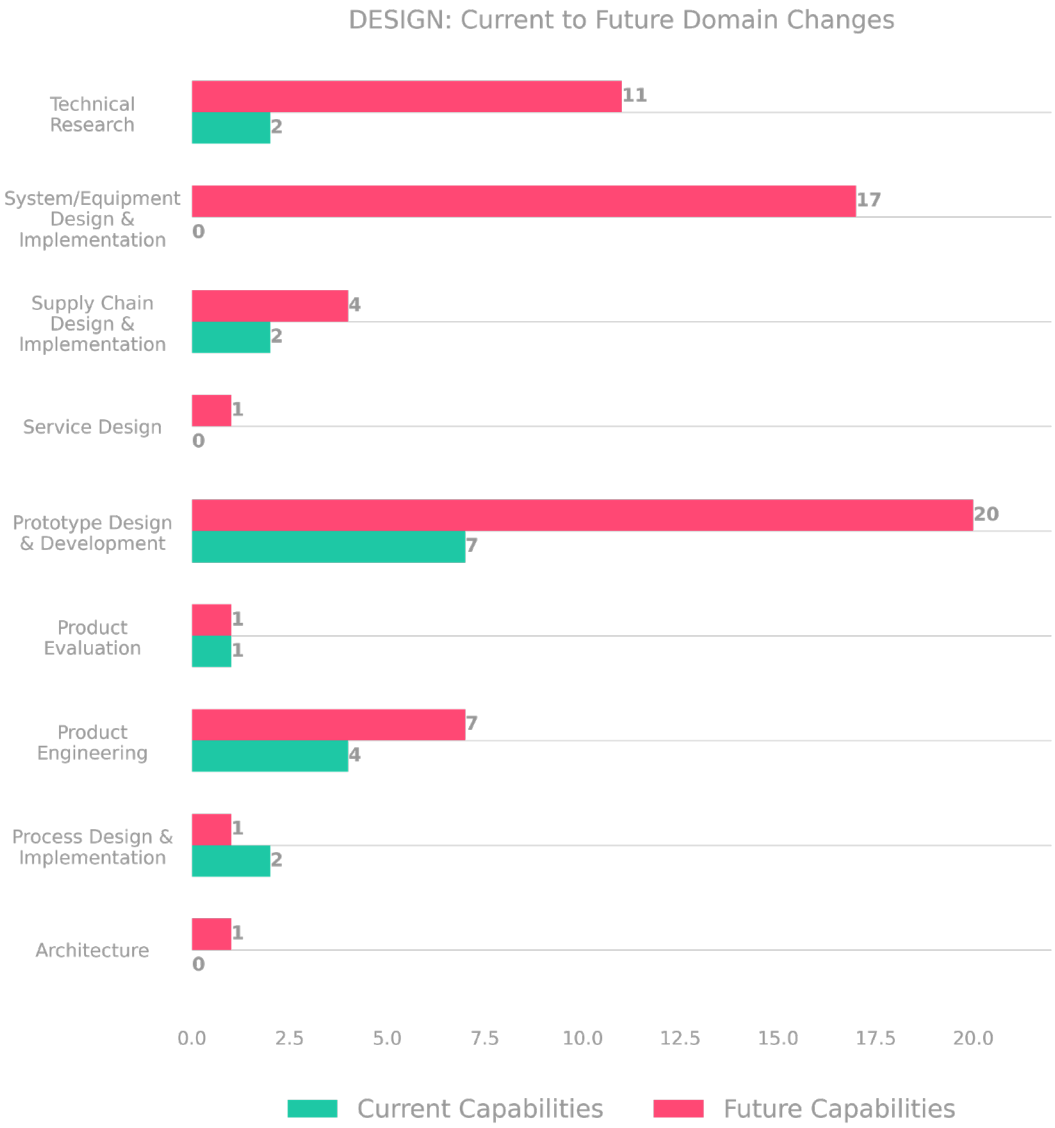


Figure 4: Design Future Domain Spread of Capabilities

The design function has the **highest number organisational capabilities with 63 out of a total of 114 capabilities for this cycle**. The highest score is in prototype design and development with a high requirement for the design of systems and applications, rather than physical prototypes.

The current / future comparison for Design reflects the foresighted transition to an increase in new products, engineering, and evaluation ahead of the development and implementation phase.

Enterprise Domains:

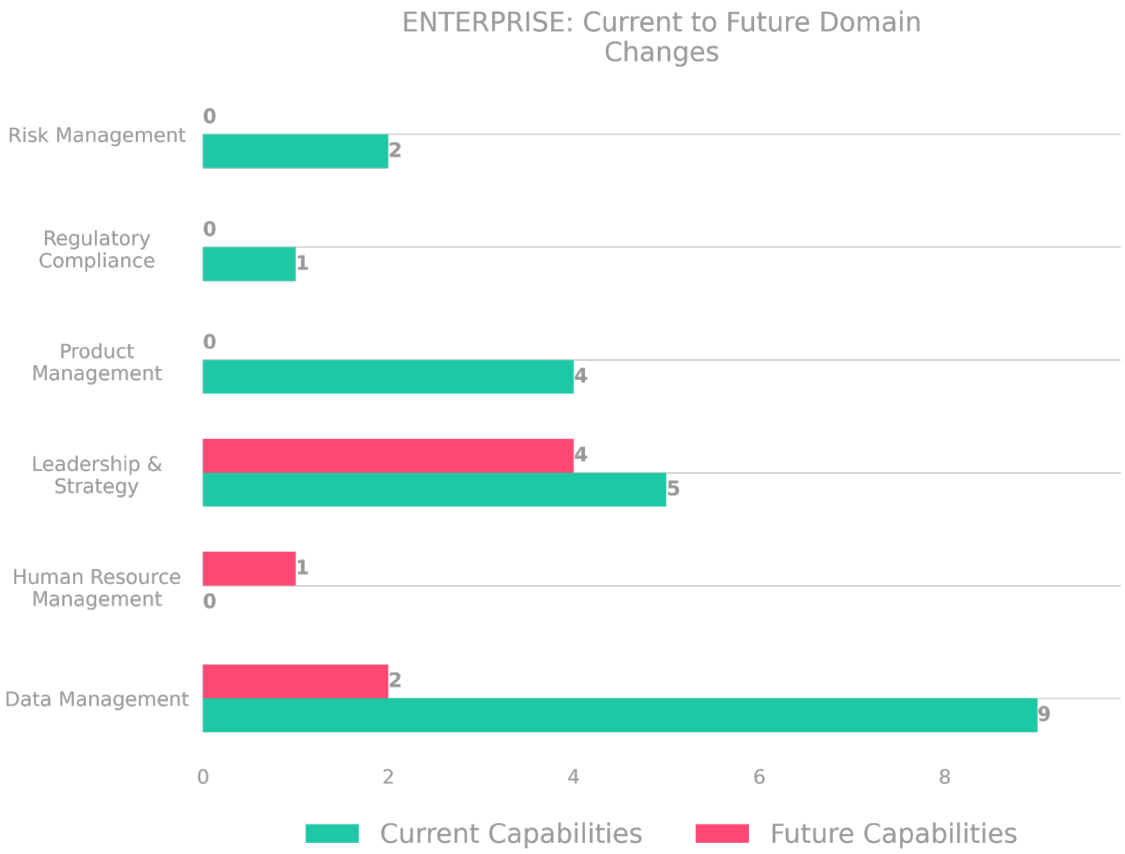


Figure 5: Enterprise Future Domain Spread of Capabilities

The **enterprise function has 7 capabilities out of 114**. Most capabilities sit in the **Leadership and Strategy domain and include** capabilities on identifying new business partnerships for this emerging technology; identifying business threats and opportunities; and evaluating environment impact.

The current / future comparisons in the Enterprise area show the increased need associated with a maturing and competitive regulated market and the need to increase human resources.

Implementation Domains

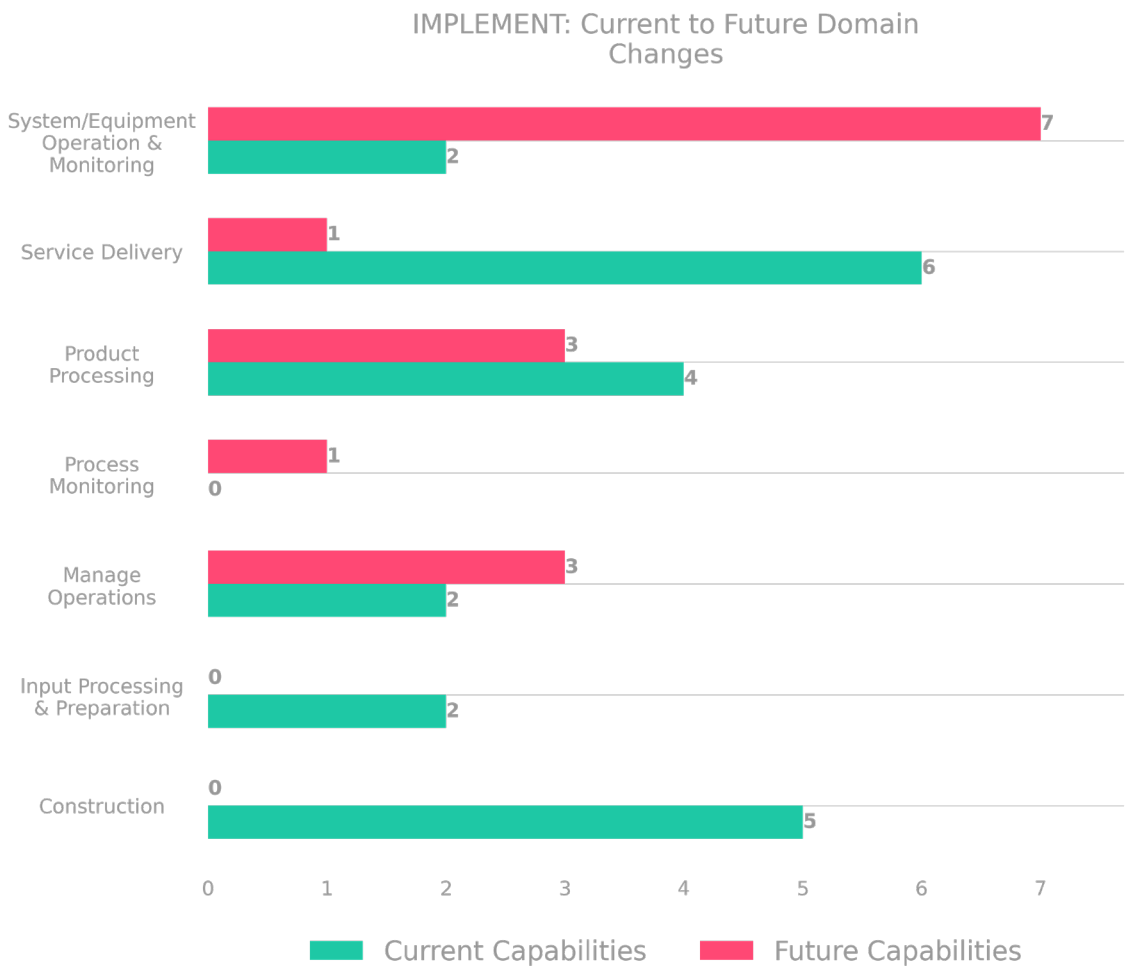


Figure 6: Implementation Future Domains Spread of Capabilities

Of the 114 cycle capabilities for the cycle, **15 sit in the 'implement' function with most operating in the** system and equipment monitoring and manage operations.

The current / future comparison of implementation functions reflects the changes associated with greater adoption and product sales volume.

Logistics Domain

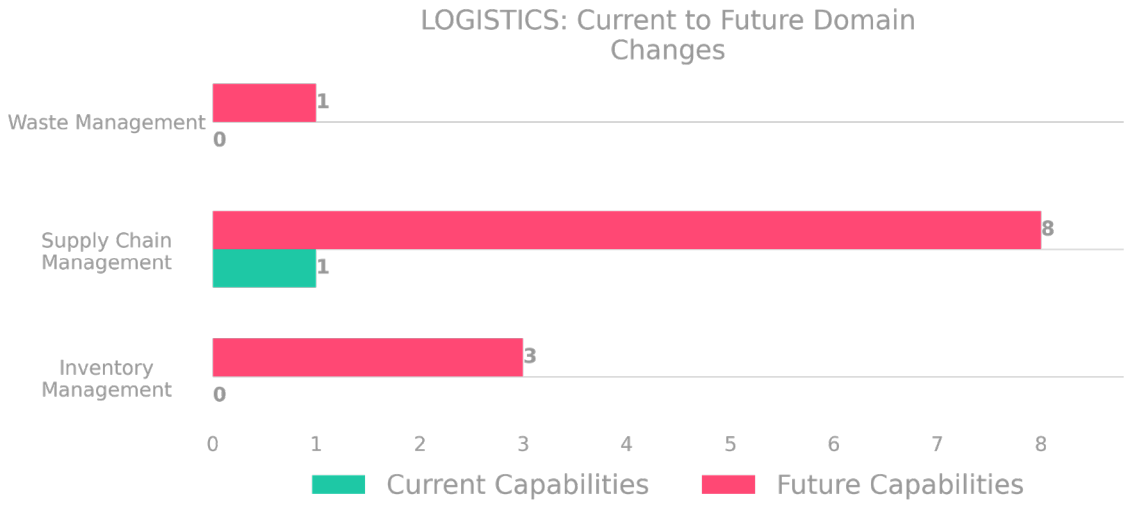


Figure 7: Logistics Future Domains- Future Spread of Capabilities

Only 12 capabilities out of 114 sit in the logistics function, with the bulk of the capabilities being under supply chain management.

The current and future comparison for logistics is as expected for organisations gearing up to work at a higher scale of production.

Support Domains

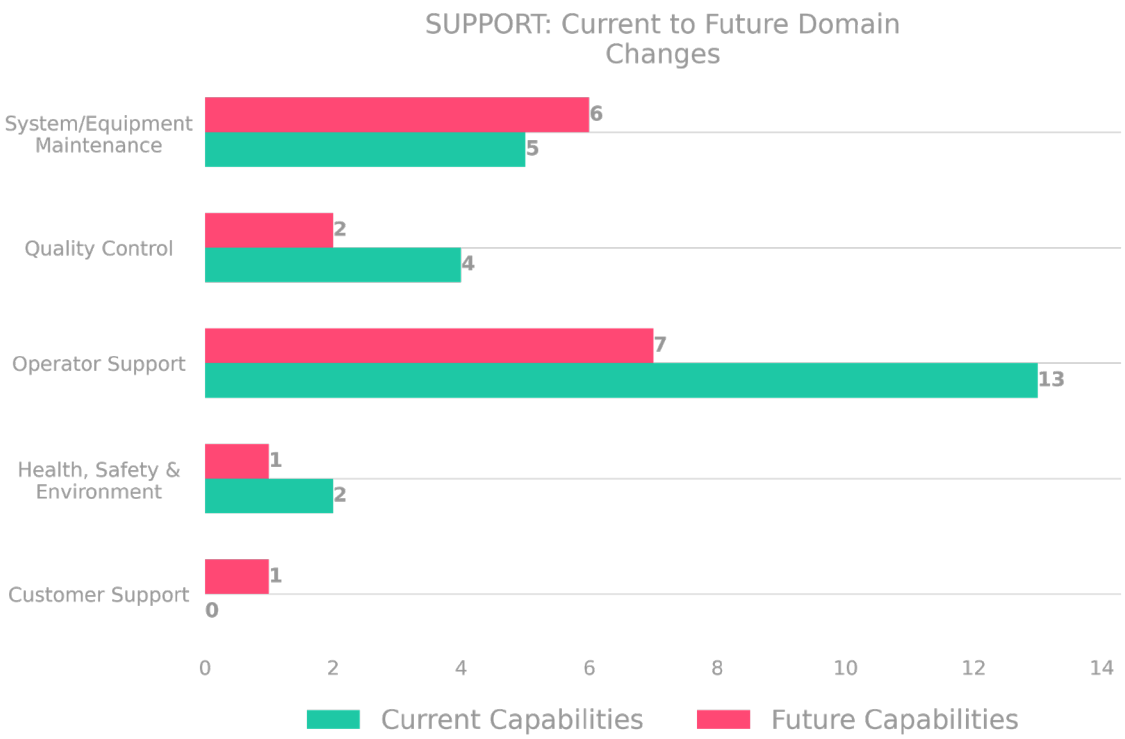


Figure 8: Support Future Domains - Future Spread of Capabilities

The 'support' function has **17 capabilities of the 114 for the cycle**, with the Operator Support domain being the highest. This included capabilities in areas such as designing and configuring support systems and operating support systems

The current and future support comparison reflects the current prominent levels of Health and Safety – the reduction in proportions may be due to omissions during the data gathering and analysis.

Visualisation Instructions

Visualisation Data Link	What is it and what can it be used for?
Organisational Capabilities	The page provides details of the capabilities required by each supply chain partner and the supply chain as whole. The information is presented using the Capability Classification Framework , Design / Implement / Logistics / Support / Enterprise and can be interrogated and then exported to suit specific user requirements and interest. The information provided also identifies capabilities supported by existing provision, and also where there may be gaps that require new development to support to equip the future workforce.

3.3 Step Two – How will the Workforce change - Occupational Change Insight

Insight into occupational change uses the understanding of how capabilities will change across business functions (section 3.2) to inform proposals for how occupations and their associated skills sets for each supply chain partner may need be revised to reflect change for each role level within that partner.

Supply Chain partner organisation types

The workforce foresighting process recognises that different partners in a Supply Chain will require appropriate capabilities, and these are determined and agreed in the initial workshops.

In this cycle, the following Supply Chain partners were identified and then used during participant workshops and data analysis to determine the organisational needs:

1. Semiconductor Manufacturers
2. Module / Chip Fabless Design Manufacturers
3. Software Developers
4. System Integrators
5. Providers (equipment)
6. Network Providers

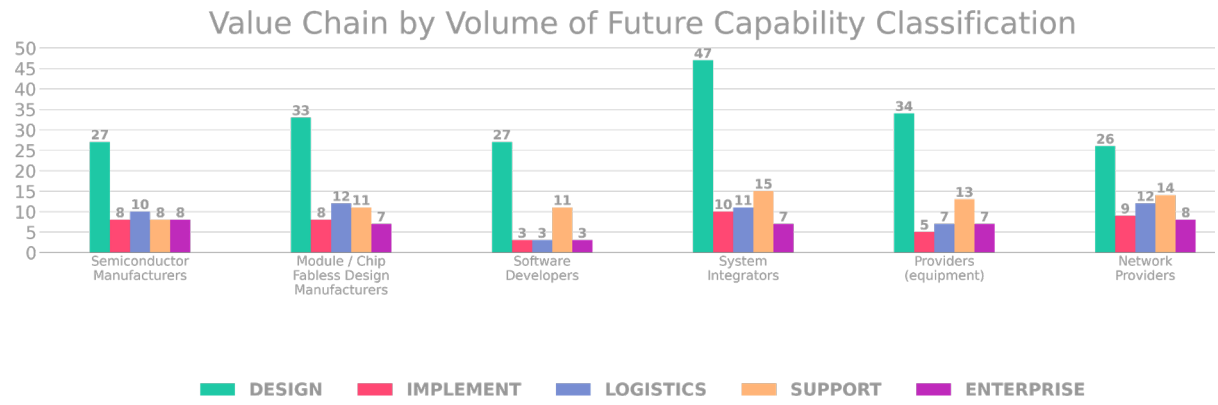


Figure 9: Distribution of Functions across each Supply Chain Partner

The graph illustrates the distribution of capabilities by function across the Supply Chain Partners. These capability sets are used to form the set of Future Occupational Profiles within each role level.

Visualisation Instructions

Detailed instructions can be found in the appendix.

Visualisation Data Link	What is it and what can it be used for?
Supply Chain Capabilities	This page provides an overview of the identified capabilities at a Supply Chain Partner level. By selecting/deselecting each Supply Chain Partner you can review the capabilities identified as required in that area of the Supply Chain.

	This can be used to generate organisational capability profiles for each area of the Supply Chain to help prioritise and focus the acquisition of new capabilities that will be required in the future. It can also be used to generate combined organisational profiles, where an organisation may be involved in more than one area of the Supply Chain.

Role Levels

The foresighting process uses the concept of Role Levels to represent future occupations. Utilising this approach acknowledges that the workforce is not homogeneous, there will be varying levels of proficiency required across a workforce and qualifications and training may be aligned/require different types of vocational or academic qualifications. Additionally, the role level approach seeks to avoid presuming that the future workforce will be operating at a different level to the current state.

Role Levels determined through workshops:

1. Technician
2. Engineer
3. Senior Engineer

Proficiencies

Each of these role levels will require proficiency that reflects their role and the needs of each Supply Chain Partner. The foresight process uses a three-point scale to capture and differentiate the proficiencies required. This information is used both in the generation of the Future Occupational Profiles, and to assist the definition of training needs identified. Within the workforce foresight process proficiency is defined as:

> **Awareness (A)** - Has a foundational knowledge of tools, technology, techniques relevant to sector, industry, or organisation. Sufficient comprehension to know where to seek further information/details as necessary for a particular issue.
>
> **Practitioner (P)** - Has the ability to apply and use independently a tool, system, or process. Understands the implications, consequences, and impact for their role/function. A Practitioner knows what key actions are required and in what context.
>
> **Expert (E)** - Has detailed knowledge of process, system, tool, or technology. Can support others and identify improvements required for a process, system, or tool. An Expert can implement improvements personally or direct and guide others.

During the workshops participants applied their insight to assign proficiency for each role group to each capability. Individual responses were aggregated by the system to arrive at a consensus.

A summary of the distribution of required proficiency for the role levels in the cycle are:

	Technician	Engineer	Senior Engineer
Awareness	19	58	26
Practitioner	25	135	50
Expert	16	57	62

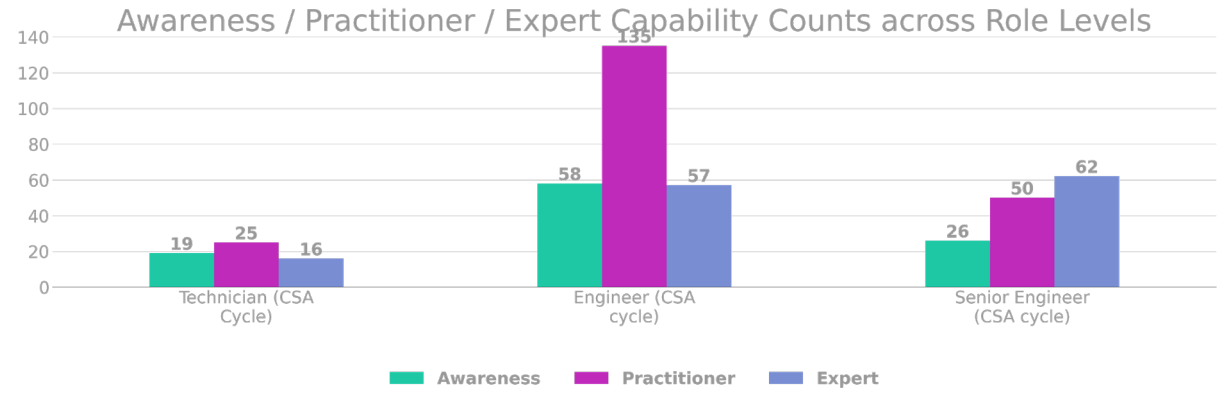


Figure 10: Proficiency details by Role Level

Future Occupational Profiles

FOPs are used to describe and suggest occupations, or roles, that may be required in the future and provide a framework to indicate capabilities and related duties. They can be used to review the impact on current roles and the adaptation that may be required in the future.

Educators can review current apprenticeship standards against the requirements of the FOPs and interpret which need to be changed to fill the gaps between the current and future state.

Employers can consider existing apprenticeship standards and make a judgement on adapting an existing apprenticeship standard to upskill their workforce to meet the requirements of a particular FOP.

FOPs and indicative skills need

Combining proficiency with the identified FOPs, the following graphs indicate the priority needs across the supply chain for each Role Group to deliver future capabilities.

Technician Role Level FOPs:

In this cycle the Technician role level was defined as occupations and roles requiring Level 2 qualifications or apprenticeships.

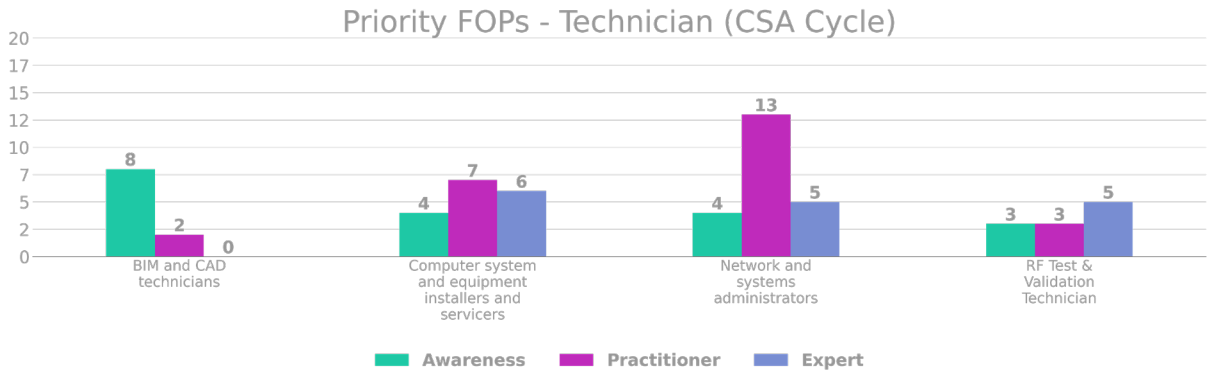


Figure 11: Priority FOPs - Technician Role Level

Engineer Role Level FOPs:

In this cycle the Engineer role level was defined as occupations and roles requiring Level 3 qualifications or apprenticeships.

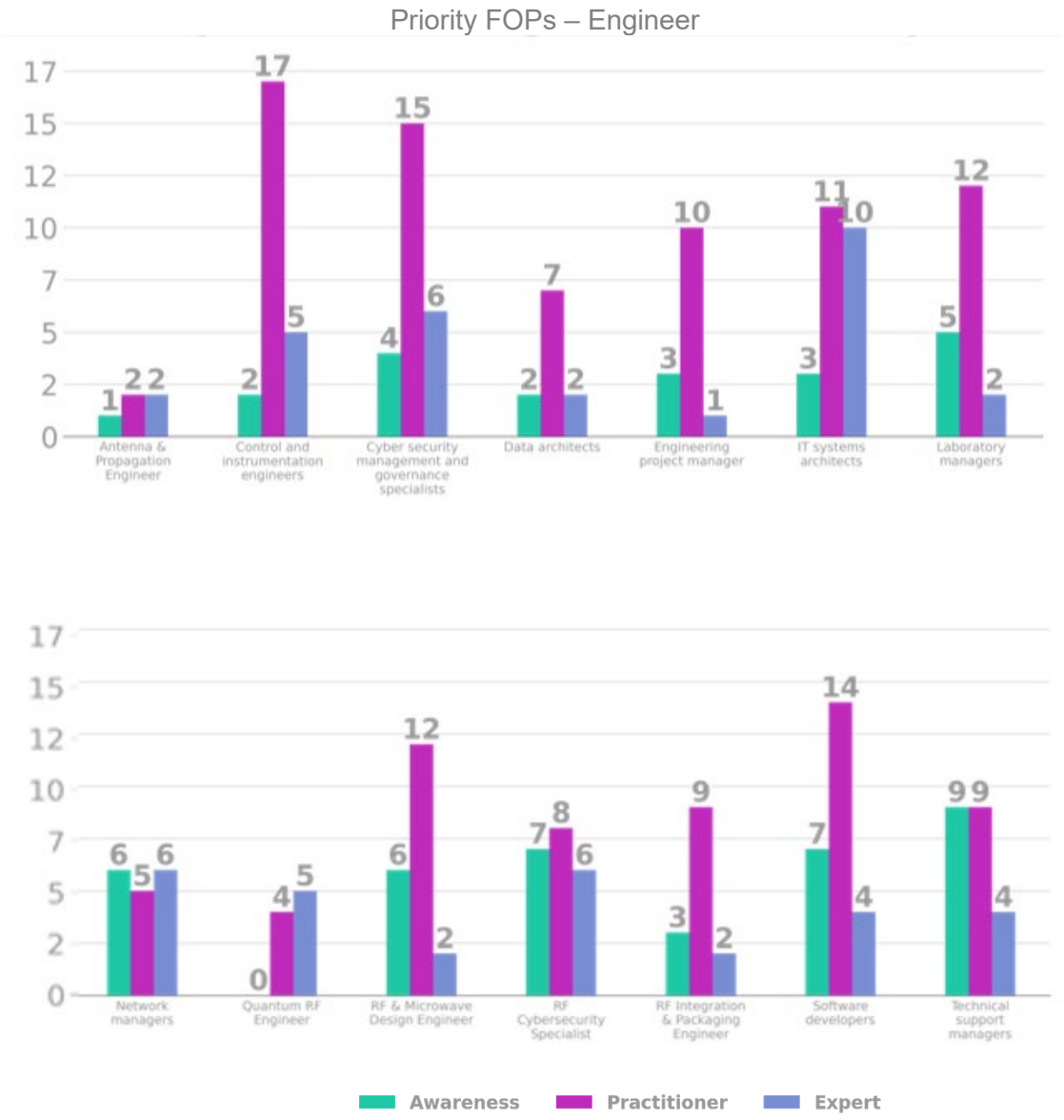


Figure 12: Priority FOPs - Engineer Role Level

Senior Engineer Role Level FOPs:

In this cycle the Senior Engineer role level was defined as occupations and roles requiring Level 4 qualifications or apprenticeships.

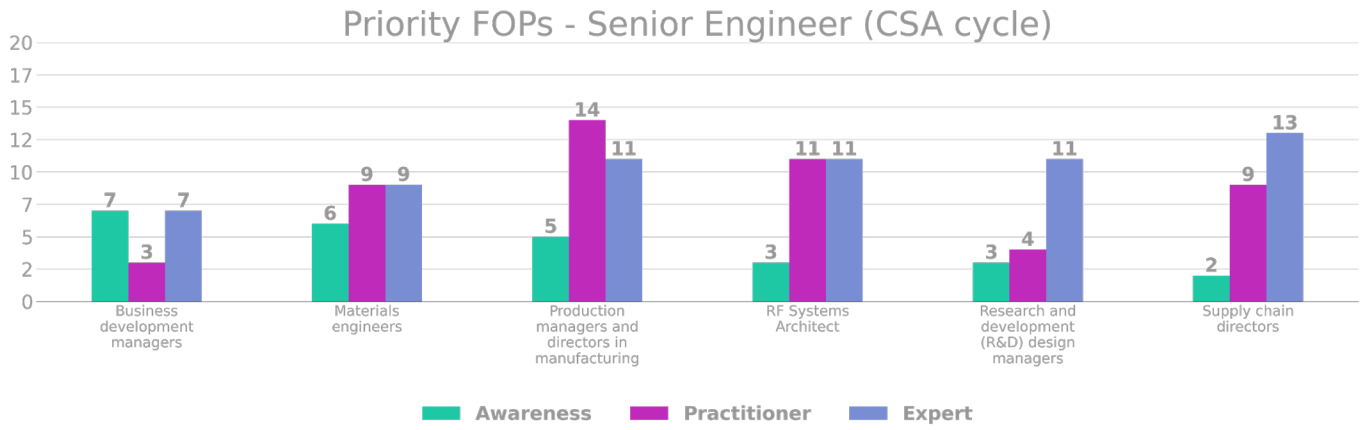


Figure 13: Priority FOPs - Senior Engineer Role Level

Visualisation Instructions

Detailed instructions can be found in the appendix.

Visualisation Data Link	What is it and what can it be used for?
FOP Matrix	This page provides a detailed breakdown of future occupational profiles that could be required in the future workforce. These were generated using a combination of attributes collected through the workshops and an algorithm. These suggested profiles were then reviewed and ratified by small groups of employers who were able to add/remove capabilities and uprate/downrate proficiency levels required. You can view all the FOPs in a role level by selecting one (or more) of these from the drop down. This will then allow you to select the FOPs aligned to that role level. The populated table allows you review and compare different FOPs within or across role levels. You can view the capabilities in each FOP and the assigned proficiency levels.

3.4 Step Three – How the current Education provision meets the future need - Highlighted Changes for Future Provision

The Future Occupational Profiles (FOPs) outlined below have been identified as critical roles within the evolving workforce. The convener has identified 7 priority Future Occupational Profiles (FOPs) as these capabilities will be fundamental to:

- driving industry transformation
- facilitating the adoption of next-generation network technologies
- ensuring resilient and efficient connectivity across diverse environments

While there is some alignment with existing education and training programs, key emerging competencies in this domain remain insufficiently addressed by current offerings across apprenticeship standards.

This gap presents a strategic opportunity for innovation, necessitating the development of new education and training provisions tailored to the evolving demands of integrated network ecosystems.

A comprehensive analysis of how current education and training initiatives align with the FOPs identified in this workforce foresighting cycle is available within the data visualisation tool: FOP vs Provision link.

Cycle selected Priority Future Occupational Profiles (FOPs):

1. RF Systems Architect
2. RF & Microwave Design Engineer
3. RF Integration & Packaging Engineer
4. RF Cybersecurity Specialist
5. Antenna & Propagation Engineer
6. Quantum RF Engineer
7. RF Test & Validation Technician

Below is a comparison of each priority FOP against highest scoring existing education provision. The tables highlight the highest-scoring standard for each and identify capabilities that are not currently addressed by the selected standard. These unmet capabilities could inform the development of future education and training provision, either by adapting existing programmes or through the creation of short continuing professional development (CPD) courses aimed at upskilling the current workforce.

RF Systems Architect

FOP vs Provision	64.0% Sheffield - BEng/MEng Electrical and Electronic Engineering (combination of modules)
Capability ID	**Unmatched FOP Capabilities**
226929	Interpret international standards to ensure compliance with regulatory requirements.
227040	Plan or schedule engineering research or development projects involving RF and microwave technology.
182277	Select optimal Through Life Engineering Service (TES) solutions to maximise asset capability, reliability, availability and sustainability at minimum capital and operational cost
226956	Manage legal risks and contract-related damages to protect the organisation's interests.
227033	Integrate product support specifications into product requirements
226972	Develop and maintain strategic long-term relationships between industries and universities to enhance collaborative research and innovation.
214114	Develop system architecture models to improve integration capacity and resilience in the Microwave and RF supply chain.
209139	Understand and interpret equipment specifications and requirements

RF Cybersecurity Specialist

FOP vs Provision	**66.7% Bristol - BEng Electrical and Electronic Engineering (combination of modules)**
Capability ID	**Unmatched FOP Capabilities**
210425	Monitor cybersecurity vulnerabilities and threats for organisational security.
213857	Identify new security challenges and coordinate new solutions
227026	Define and maintain software engineering plans to collaborate effectively with multidisciplinary teams and stakeholders.
99740	Monitor emerging trends regarding industry regulations to determine potential impacts on organisational processes.
227035	Conduct testing on equipment under hostile electromagnetic conditions to assess its resilience and performance.
183275	Ensure the security, including cyber security of all information disseminated and stored

RF Integration & Packaging Engineer

FOP vs Provision	**92.9% Sheffield - BEng/MEng Electrical and Electronic Engineering (combination of modules)**
Capability ID	**Unmatched FOP Capabilities**
227040	Plan or schedule engineering research or development projects involving RF and microwave technology.

Antenna & Propagation Engineer

FOP vs Provision	80.0% Bristol - BEng Electrical and Electronic Engineering (combination of modules)
Capability ID	**Unmatched FOP Capabilities**
222967	Conduct site surveys and document findings

Quantum RF Engineer

FOP vs Provision	88.9% fit with Bristol - BEng Electrical and Electronic Engineering (combination of modules)
Capability ID	**Unmatched FOP Capabilities**
182277	Select optimal Through Life Engineering Service (TES) solutions to maximise asset capability, reliability, availability and sustainability at minimum capital and operational cost

RF Test & Validation Technician

FOP vs Provision	63.6 – Power Industry substation fitter
Capability ID	**Unmatched FOP Capabilities**
214110	Conducts environmental and electromagnetic compatibility (EMC) testing.
213854	Assemble energy-efficient optical communications systems to enhance performance and sustainability.
227035	Conduct testing on equipment under hostile electromagnetic conditions to assess its resilience and performance.

The table below lists the statements defined through this foresighting cycle, with an overview of the number of FOPs which require these capabilities. This data highlights the anticipated demand for specific capabilities within the future workforce and overlap in skills across future job roles, providing valuable insights for the development of future education and training programmes.

Further details on the FOPs that these capabilities correspond to can be found within the visualisation tool.

FOP Distribution link

Capability ID within Visualisation tool	Organisational Function	Capability Statement	Highest capability count across 24 FOPs
226929	DESIGN	Interpret international standards to ensure compliance with regulatory requirements.	13
99740	ENTERPRISE	Monitor emerging trends regarding industry regulations to determine potential impacts on organisational processes.	11
227011	LOGISTICS	Collaborate with cross-functional teams, including manufacturing, project management, and finance, to ensure successful integration of appropriate products.	10
51920	DESIGN	Develop system engineering, software engineering, system integration, or distributed system architectures.	9
227040	DESIGN	Plan or schedule engineering research or development projects involving RF and microwave technology.	8
30600	DESIGN	Conduct research that tests or analyses the feasibility, design, operation, or performance of equipment, components, or systems.	8

226949	SUPPORT	Develop and maintain broad technical knowledge across various domains to support interdisciplinary projects.	8
227016	DESIGN	Design advanced software and hardware integration systems to ensure compatibility and enhance performance.	7
182753	DESIGN	Use scientific methodology to apply understanding and knowledge in order to deliver Electronic Systems projects that meet customer requirements	7
209139	IMPLEMENT	Understand and interpret equipment specifications and requirements	7
214101	SUPPORT	Integrate AI/ML algorithms for automated system tuning, predictive maintenance, and network management.	7
4930	ENTERPRISE	Analyse and report computer network security breaches or attempted breaches.	7

Link to full data set - Visualisation Instructions

Visualisation Data Link	What is it and what can it be used for?
FOP Detail	This page allows you to review a specific Occupational Profile, including the capabilities contained within it and the Knowledge, Skills & Behaviour (KSB) tags associated with the capability. You can select an individual Role Level and linked FOP in the two available dropdowns. The table in the lower section of the page will then be populated with all relevant capabilities. The search control above the table allows you to filter content of any of the columns of data. A key piece of functionality in this table is the presence of the KSB tags associated with the capabilities.
Future KSBs Summary	This page provides a view of the complete set of capabilities within the cycle along with all of the associated KSB tags which are linked to them. It is, essentially, the superset of all details displayed on the FOP_detail page. This is used to: • To review the identified Knowledge, Skill and Behaviour tags for a given capability, to support development of future education and learning material. • To review the requirements from a capability level, rather than a role level/occupational profile grouping.
Capabilities Matched to Current Provision	This page allows you to review and compare individual capabilities against 'Duty' statements in an Apprenticeship / Occupational Standard. You can select individual capabilities to review their specific matches. These matches are shown in the bottom panel, including the Standard, the Level and the Duty Statement this is matched to. You can filter in several ways to focus your review: • By the Capability Classification Framework (left-hand panel). • By capabilities that **are** served by the reference mapping framework – the default is Institute for Apprenticeships and Technical Education (IfATE) provision.

	• By capabilities that **are not** served by the reference mapping framework, e.g., IfATE provision – these are capabilities required in the future that may require new/bespoke training and CPD materials to be developed to upskill/re-skill the workforce. This page can be used to identify where existing provision may exist across the broad spectrum of Apprenticeship standards, and not just within a narrow range of sector-specific Standards. The data also allows you to identify where provision may already exist to support specific capabilities.
Fit & Surplus Factors	This page allows you to review the 'Fit' and 'Surplus' of Prototype Future Occupational Profiles (FOP) against existing training provision e.g. Institute for Apprenticeships and Technical Education (IfATE). It is possible for the 'Fit' and 'Surplus' comparison to total over 100%, as they are two separate calculations based on a two-way comparison.
Fit & Surplus Matrix	This page is a visual representation of the 'Fit and Surplus Factor' insight. You can visually review 'Fit' and 'Surplus' of Prototype Future Occupational Profiles (FOP) against existing training provision e.g. Institute for Apprenticeships and Technical Education (IfATE). This can help you identify which provision may align strongest, or which may require adaptation, to provide the suitable provision fit for each future role. It will help you focus in on which provision to focus your attention for analysis.
FOP Capability Matches	This page allows you to view the matches between Capabilities and Institute for Apprenticeships and Technical Education (IfATE) Duty Statements. Clicking the arrow next to a number in the 'Matches' column will open a popup with more detail for each Capability. Each capability also includes Knowledge, Skill and Behaviour Tags, to support with scaffolding future education provision. You can review individual Prototype Future Occupational Profiles (FOPs) or review all FOPs under a Role Level, to give a more holistic view of Capabilities and Matches Where a future capability has been matched to existing provision (currently, by default, IfATE apprenticeship standards) it is possible to interrogate the data and identify specific statements in standards that align to enable identification of existing training materials and activities that could be used or adapted to meet future requirements. This can be used to review the capability requirements for Role Levels and FOPs, from Job / Occupation level through to Knowledge, Skill and Behaviour level

4. Conclusion and Next Steps

4.1 Summary of Key Insights

This foresighting cycle has demonstrated the need to develop a workforce equipped to design, deploy, and secure advanced RF and microwave components and systems, particularly in the context of Open RAN integration. An outcome of this study is the identification of high-priority Future Occupational Profiles (FOPs), many of which are currently underserved by existing education and training provision.

Key takeaways include:

- **Persistent skills gaps** in RF components, systems, cybersecurity and quantum engineering persist across all supply chain partners.
- **University provision** shows relatively strong alignment in some areas (e.g. RF & Microwave Design Engineers, analogue electronics), while IfATE **apprenticeship standards lack sufficient depth**, particularly for technician and governance roles.
- **Cross-sector capability needs** such as AI-enhanced diagnostics, regulatory compliance, and supply chain security are not well-represented in current frameworks. Ensure that L2 Secondary & L3 A Level Science, Engineering and Technology curriculum is also re-shaped / tuned, to prepare young students for the new tech roles Industry will demand post 16, post 18.
- Without targeted education reform and rapid development of CPD and apprenticeship pathways and retention, there is a risk of **delays in rollout**, **over-reliance on imported expertise**, and **missed innovation opportunities**.
- It is important that any new content that is developed, particularly for post-16 learners, is supported by an awareness campaign, which will raise the profile of the sector for those influencing learner decision making (i.e. teachers, careers advisors or parents) and give information about the future possibilities to ensure that these courses have sufficient uptake.
- Identifying and validating relevant **FOPs provides an evidence base** to inform new standards, qualifications, and training resources aligned to actual workforce needs.
- Writing new IfATE, and other apprenticeship specs for these specific topics and disciplines with EPA's (End Point Assessment) criteria to match the FOP, will ensure that degree level Apprentices can gain sign off academically and vocationally in relevant projects and tasks aligned to the FOPs.
- Short term Industrial Short Courses are a good idea, they can be both stand alone for industrial upskilling and can also be offered into Degree route programmes as perhaps 20 credit modules in a specialism to allow the student to tailor their learning and qualification to the new FOPs.
- The insights will guide **policy intervention**, **funding allocation**, and **industry collaboration** across the compound semiconductor and telecom sectors.

One of the most surprising findings is the **low suitability of existing apprenticeship standards** across critical roles, even for job functions that align closely with current industry demand. For example, FOPs such as **RF Cybersecurity Specialist** or **Quantum RF**

Engineer demonstrated poor fit with IfATE standards - highlighting a clear misalignment between training provision and technology advancement.

This lack of readiness indicates a need to:

- **Modernise apprenticeship standards** to reflect systems engineering approaches.
- **Develop short-term CPD solutions** while longer-term qualifications are co-developed.
- These gaps must be addressed to ensure the UK doesn't fall behind in the global race to implement secure and interoperable 5G, 6G and future telecom solutions.

The success of this foresighting cycle relied on **deep collaboration with a diverse network of stakeholders**:

- Industry leaders across the telecom and compound semiconductor supply chains provided crucial insight into real-world capability needs.
- Trade associations and industry councils validated emerging roles and provided pathways for standardisation.
- Engagement with educational institutions—including Russell Group universities—surfaced key opportunities to enhance alignment and extend existing programmes.
- Cross-sector conversations (e.g., with AI, quantum, and cybersecurity stakeholders) revealed the growing interdependencies in future systems design and delivery.
- The active participation of these stakeholders underscores a **willingness and readiness across sectors to act**. However, continued coordination, shared ownership, and national leadership will be essential to drive forward the recommendations outlined in this report.

The below table counts the number of identified standards by suitability score for each FOP. For the purpose of this report, we've utilised the suitability grid to highlight the top 10 standards that support each FOP. The table identifies if they have low, some or good suitability and colour-coded their overall suitability.

Role Level	Primary Supply Chain / Supply Chain Partner	Future Occupation Profile	Low Suitability	Some Suitability	Good Suitability	Overall Suitability RAG
Technician	Module / Chip Fabless Design Manufacturers, System Integrators , Providers (equipment), Network Providers	Computer system and equipment installers and servicers	3	7	0	Low
Technician	Module / Chip Fabless Design Manufacturers, System Integrators , Providers (equipment), Network Providers	Network and systems administrators	10	0	0	Low
Technician	Semiconductor Manufacturers, Module / Chip Fabless Design Manufacturers	RF Test Validation Technician	4	6	0	Low
Technician	Semiconductor Manufacturers, Module / Chip Fabless Design Manufacturers, Providers (equipment)	BIM and CAD technicians	9	1	0	Low
Engineer	Module / Chip Fabless Design Manufacturers, Software Developers, System Integrators , Providers	RF Cybersecurity Specialist	0	9	1	Some

	(equipment), Network Providers					
Engineer	Module / Chip Fabless Design Manufacturers, System Integrators	Data architects	10	0	0	Low
Engineer	Module / Chip Fabless Design Manufacturers, System Integrators , Providers (equipment), Network Providers	Antenna Propagation Engineer	8	2	0	Low
Engineer	Module / Chip Fabless Design Manufacturers, System Integrators , Providers (equipment), Network Providers	Technical support managers	9	1	0	Low
Engineer	Semiconductor Manufacturers, Module / Chip Fabless Design Manufacturers, Software Developers	Quantum RF Engineer	1	8	1	Some
Engineer	Semiconductor Manufacturers, Module / Chip Fabless Design Manufacturers, Software Developers, System Integrators	Software developers	0	10	0	Some
Engineer	Semiconductor Manufacturers, Module / Chip Fabless Design Manufacturers, Software Developers, System Integrators , Network Providers	Engineering project manager	7	3	0	Low
Engineer	Semiconductor Manufacturers, Module / Chip Fabless Design Manufacturers, Software Developers, System Integrators , Providers (equipment), Network Providers	RF Microwave Design Engineer	2	6	2	Some
Engineer	Semiconductor Manufacturers, Module / Chip Fabless Design Manufacturers, System Integrators	Control and instrumentation engineers	0	9	1	Some
Engineer	Semiconductor Manufacturers, Module / Chip Fabless Design Manufacturers, System Integrators	RF Integration Packaging Engineer	0	9	1	Some
Engineer	Semiconductor Manufacturers, Module / Chip Fabless Design Manufacturers, System Integrators , Providers (equipment), Network Providers	Cyber security management and governance specialists	10	0	0	Low
Engineer	Semiconductor Manufacturers, Module / Chip Fabless Design Manufacturers,	Laboratory managers	8	2	0	Low

	System Integrators , Providers (equipment), Network Providers					
Engineer	Semiconductor Manufacturers, System Integrators , Providers (equipment)	IT systems architects	2	8	0	Some
Engineer	Software Developers, System Integrators , Providers (equipment)	Network managers	9	1	0	Low
Senior Engineer	Module / Chip Fabless Design Manufacturers, Software Developers, System Integrators , Providers (equipment)	Materials engineers	4	6	0	Low
Senior Engineer	Module / Chip Fabless Design Manufacturers, Software Developers, System Integrators , Providers (equipment)	Production managers and directors in manufacturing	9	1	0	Low
Senior Engineer	Semiconductor Manufacturers, Module / Chip Fabless Design Manufacturers	Research and development (R) design managers	3	7	0	Low
Senior Engineer	Semiconductor Manufacturers, Module / Chip Fabless Design Manufacturers, Software Developers, System Integrators , Providers (equipment), Network Providers	Business development managers	9	1	0	Low
Senior Engineer	Semiconductor Manufacturers, Module / Chip Fabless Design Manufacturers, Software Developers, System Integrators , Providers (equipment), Network Providers	RF Systems Architect	4	6	0	Some
Senior Engineer	Semiconductor Manufacturers, Module / Chip Fabless Design Manufacturers, Software Developers, System Integrators , Providers (equipment), Network Providers	Supply chain directors	10	0	0	Low

Top Fits

By reviewing the FOPs (Future Occupational Profiles) against the suitability grid, we can assess which current apprenticeship standards are most relevant. The RF Integration & Packaging Engineer FOP has one standard that aligns well with the selected criteria, while the remaining standards are rated as having only partial suitability.

Several FOPs have been identified as having only some suitability when compared to existing IfATE apprenticeship standards and provision. These include:

1. RF & Microwave Design Engineer
2. Antenna Engineer
3. RF Integration & Packaging Engineer
4. Quantum RF Engineer
5. RF Cybersecurity specialist

Suitable standards are listed in the table below:

Role Level	Future Occupation Profile	Current provision or Standard	Suitability
Engineer	RF Cybersecurity Specialist	Bristol - BEng Electrical and Electronic Engineering (combination of modules)	Good
Engineer	RF Cybersecurity Specialist	Sheffield - BEng/MEng Electrical and Electronic Engineering (combination of modules)	Good
Engineer	RF Cybersecurity Specialist	Cardiff - MSc/MRes Wireless and Microwave Communication Engineering (combination of modules)	Good
Engineer	RF Cybersecurity Specialist	Leeds - BEng/ MEng Electronic and Electrical Engineering (combination of modules)	Good
Engineer	RF Cybersecurity Specialist	Cambridge - BA/ MEng in Engineering (combination of modules)	Good
Engineer	RF Cybersecurity Specialist	Manchester - BEng Electrical and Electronic Engineering (combination of modules)	Good
Engineer	RF Cybersecurity Specialist	Imperial - Electrical and Electronic Engineering / Electronic and Information Engineering MEng and BEng (combination or modules)	Good
Engineer	RF Cybersecurity Specialist	Edinburgh - BEng/ MEng Electronics and Electrical Engineering (combination of modules)	Good
Engineer	RF Cybersecurity Specialist	Strathclyde - BEng/ MEng Electronic and Electrical Engineering (combination of modules)	Good
Engineer	RF Cybersecurity Specialist	Warwick - BEng/MEng Electronic Engineering (combination of modules)	Good
Engineer	Quantum RF Engineer	Bristol - BEng Electrical and Electronic Engineering (combination of modules)	Good
Engineer	Quantum RF Engineer	Cardiff - MSc/MRes Wireless and Microwave Communication Engineering (combination of modules)	Good

Engineer	Quantum RF Engineer	Sheffield - BEng/MEng Electrical and Electronic Engineering (combination of modules)	Good
Engineer	Quantum RF Engineer	Leeds - BEng/ MEng Electronic and Electrical Engineering (combination of modules)	Good
Engineer	Quantum RF Engineer	Cambridge - BA/ MEng in Engineering (combination of modules)	Good
Engineer	Quantum RF Engineer	Surrey - BEng/MEng Electrical and Electronic Engineering (combination of modules)	Good
Engineer	Quantum RF Engineer	Imperial - Electrical and Electronic Engineering / Electronic and Information Engineering MEng and BEng (combination or modules)	Good
Engineer	Quantum RF Engineer	UCL - BEng Electronic and Electrical Engineering (combination of modules)	Good
Engineer	Quantum RF Engineer	Manchester - BEng Electrical and Electronic Engineering (combination of modules)	Good
Engineer	Quantum RF Engineer	Queen Mary - BEng/MEng in Electrical and Electronic Engineering (combination of modules)	Good
Engineer	RF Microwave Design Engineer	Cardiff - MSc/MRes Wireless and Microwave Communication Engineering (combination of modules)	Good
Engineer	RF Microwave Design Engineer	Sheffield - BEng/MEng Electrical and Electronic Engineering (combination of modules)	Good
Engineer	RF Microwave Design Engineer	Bristol - BEng Electrical and Electronic Engineering (combination of modules)	Good
Engineer	RF Microwave Design Engineer	Leeds - BEng/ MEng Electronic and Electrical Engineering (combination of modules)	Good
Engineer	RF Microwave Design Engineer	Cambridge - BA/ MEng in Engineering (combination of modules)	Good
Engineer	RF Microwave Design Engineer	Edinburgh - BEng/ MEng Electronics and Electrical Engineering (combination of modules)	Good
Engineer	RF Microwave Design Engineer	Strathclyde - BEng/ MEng Electronic and Electrical Engineering (combination of modules)	Good
Engineer	RF Microwave Design Engineer	Surrey - BEng/MEng Electrical and Electronic Engineering (combination of modules)	Good
Engineer	RF Microwave Design Engineer	Manchester - BEng Electrical and Electronic Engineering (combination of modules)	Good
Engineer	RF Microwave Design Engineer	Imperial - Electrical and Electronic Engineering / Electronic and Information Engineering MEng and BEng (combination or modules)	Good
Engineer	Control and instrumentation engineers	Sheffield - BEng/MEng Electrical and Electronic Engineering (combination of modules)	Good
Engineer	Control and instrumentation engineers	Cambridge - BA/ MEng in Engineering (combination of modules)	Good
Engineer	Control and instrumentation engineers	Imperial - Electrical and Electronic Engineering / Electronic and Information Engineering MEng and BEng (combination or modules)	Good
Engineer	Control and instrumentation engineers	Southampton - BEng/MEng Electrical and Electronic Engineering (combination of modules)	Good

Engineer	Control and instrumentation engineers	Bristol - BEng Electrical and Electronic Engineering (combination of modules)	Good
Engineer	Control and instrumentation engineers	Queen Mary - BEng/MEng in Electrical and Electronic Engineering (combination of modules)	Good
Engineer	Control and instrumentation engineers	Leeds - BEng/ MEng Electronic and Electrical Engineering (combination of modules)	Good
Engineer	Control and instrumentation engineers	Electro-mechanical engineer	Good
Engineer	Control and instrumentation engineers	Manchester - BEng Electrical and Electronic Engineering (combination of modules)	Good
Engineer	Control and instrumentation engineers	Product design and development engineer (degree)	Good
Engineer	RF Integration Packaging Engineer	Sheffield - BEng/MEng Electrical and Electronic Engineering (combination of modules)	Good
Engineer	RF Integration Packaging Engineer	Leeds - BEng/ MEng Electronic and Electrical Engineering (combination of modules)	Good
Engineer	RF Integration Packaging Engineer	Bristol - BEng Electrical and Electronic Engineering (combination of modules)	Good
Engineer	RF Integration Packaging Engineer	Cardiff - MSc/MRes Wireless and Microwave Communication Engineering (combination of modules)	Good
Engineer	RF Integration Packaging Engineer	Manchester - BEng Electrical and Electronic Engineering (combination of modules)	Good
Engineer	RF Integration Packaging Engineer	Cambridge - BA/ MEng in Engineering (combination of modules)	Good
Engineer	RF Integration Packaging Engineer	Aerospace engineer	Good
Engineer	RF Integration Packaging Engineer	Imperial - Electrical and Electronic Engineering / Electronic and Information Engineering MEng and BEng (combination or modules)	Good
Engineer	RF Integration Packaging Engineer	Electrical or electronic technical support engineer (degree)	Good
Engineer	RF Integration Packaging Engineer	Electro-mechanical engineer	Good

This suggests that some capabilities required for the potential Future Occupational Profiles (FOPs) are well supported by current higher education provision.

The use of the data visualisation tool is recommended to access the next layer of detail and review the specific standards that have been identified as having Good Suitability / Some Suitability or Low Suitability.

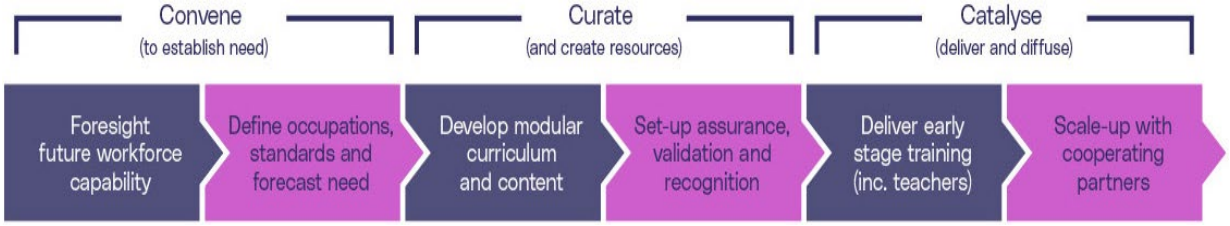
As a comparison we can also list the standards that score lowest against the required FOPs, suggesting that there are very little suitable in the IfATE / NOS standards to support these Future Occupational profiles.

FOPs with the lowest scores are:

1. Computer system and equipment installers and servicers
2. Network and systems administrators
3. RF Test & Validation Technician
4. BIM and CAD technicians
5. Data architects
6. Antenna Propagation Engineer
7. Technical support managers
8. Engineering project manager
9. Cyber security management and governance specialists
10. Laboratory managers
11. IT systems architects
12. Network managers
13. Materials engineers
14. Production managers and directors in manufacturing
15. Research and development (RD) design managers
16. Business development managers
17. RF Systems Architect
18. Supply chain directors

4.2 What this means for Industry and the Workforce

Foresighting has been developed to provide insight and the detailed information required to enable action by relevant stakeholders but is the first step of the Skills Value Chain. Collective action will be required by all stakeholders to ensure that the changes identified by foresighting – to the supply chain, the workforce and education provision are implemented.



This section summarises the actions required as a result of this foresight cycle.

Employers in the Compound Semiconductor sector must take proactive steps, both individually and collectively, to ensure that the development of skilled professionals meets industry needs. It is essential for employers to embrace upskilling and reskilling initiatives across various sectors, actively fostering a pipeline of future talent from schools, colleges, and universities.

As the industry evolves, particularly with advancements in technology, greater technical collaboration among partners will be crucial. This collaboration should commence early in the project lifecycle, especially in the design phase. We may see an increase in working groups and interface design teams, led by industry leaders, to address the specific needs of emerging roles. Employers should review organisational structures that have been identified and start to plan for the changes across their entire supply chain. This insight is valuable in strategic planning and coordinated thinking.

To effectively tackle the anticipated skills gap, the creative technology sector must engage with key stakeholders to develop realistic workforce demand forecasts. This includes collaboration with educational institutions and industry organisations to ensure that training

programmes are aligned with current and future job requirements. By taking these coordinated actions, the sector can secure a skilled workforce capable of meeting the demands of rapidly evolving technologies.

4.3 What this means for Education

The findings from the foresighting study indicate that future needs can be addressed through modifications to existing courses and degrees. The capabilities and potential occupational profiles generated through the foresighting cycle suggest that, in general, **modifications to existing courses** and degrees are sufficient to meet future needs. **A modular approach** is more likely to be achievable within the required timescales, compared to wholesale course redesign.

Education modules for HE and FE courses can be developed with reference to the FOPs and capability sets for example analogue electronics, mechanical and systems integration engineering.

Other standards identified by the fit- / surplus-factor analysis may also be suitable for adaptation including example RF technician, and production / manufacturing technician roles. This would make such courses suitable across a wide range of electrical careers. Routes for career progression through FE and HE ought to be identified and incorporated into industry job classifications.

Where there are more specialist technical areas that require capability development, these should be addressed through routes such as PhD sponsorships and engagement with industry. University-led PhD studies working closely with industry can investigate problems and technologies in detail, before professionals in industry and RTOs provide support to refine and scale up solutions. It is important that these types of specialist areas are identified in good time. The CDT model for doctoral training may be a good route for such sponsorship. It may also be worthwhile dovetailing this strategy with the forthcoming industry strategy in the, to be announced, National Semiconductor Centre.

A challenge for academia is to engage with industry proactively, supporting ongoing dialog so that research topics can be identified collaboratively.

4.4 Recommended next steps

Following this cycle CSA Catapult will convene a working group to Cause Action. This will include IfATE and equivalent bodies across the devolved nations, Innovate UK (IUK), employers, industry representatives, and education providers.

The Future Occupational Profiles will be further validated through iterative workshops and employer feedback loops.

CSA Catapult will identify a ‘champion’ for development of selected skills for the sector such as a sector body or lead employer to drive skills development and adoption. Together an action plan will be established to address short-term and mid-term actions such as:

- Short-term: Identify CPD needs and adapt current provision.
- Mid-term: Co-develop new standards and integrated qualifications.

In collaboration with the Workforce Foresighting Hub, CSA Catapult will evaluate the opportunity for further foresighting studies in the Semiconductor domain and explore foresighting in adjacent domains like AI-driven network orchestration, supply chain security, and quantum communications. They will also look to create a CDT specifically for RF & microwave technologies.

Summary of next steps:

1. **Leverage Future Occupational Profiles (FOPs):**
   - Utilise FOPs to address current and anticipated skill gaps by updating industry standards and creating Continuing Professional Development courses for both, those currently employed in this sector and those transitioning from other sectors.
   - Advocate for the revision of apprenticeship standards to align with future workforce needs, ensuring the sector remains competitive.

2. **Short-term Actions:**
   - Reskilling and Upskilling:
     Educators, awarding bodies, and employers should collaborate to tailor course content that aligns with new capabilities and existing apprenticeship standards, focusing on design and lifecycle activities.
     Immediate efforts are needed to prepare short-term training solutions that meet the current demands of technology.
   - Recruitment from Other Industries:
     Identify and reskill individuals with transferable skills from other sectors to fill high-demand roles.

3. **Mid-term Actions:**
   - Integration of Future Skills Training:
     Formalise the integration of future skills requirements into existing apprenticeship standards and training programs, particularly for new entrants, based on prioritised FOPs.
   - Modular Course Updates:
     Implement modular changes to existing educational programs rather than complete overhauls. This approach allows for quicker adaptation to evolving industry needs, ensuring flexibility and responsiveness.

4. **General Actions for Educators:**
   - Assessment and Feedback:
     Continuous review of the Institute for Apprenticeships and Technical Education (IfATE) standards and relevant qualifications in partnership with employers is essential and the equivalent for devolved nations. This process should focus on identifying gaps and providing necessary feedback.
   - Commissioning New CPD Courses:
     Evaluate existing CPD provisions and commission new courses where necessary, promoting collaboration among stakeholders and industry to maintain a unified approach to workforce development.

5. **Dissemination and Review:**
   - Dissemination of Findings:
     Establish a working group to create an action plan and widely share the findings among stakeholders. This will influence workforce development initiatives and ensure strategic alignment.
   - Ongoing Review and Adaptation:

Regularly review findings with stakeholders, adapting Future Occupational Profiles (FOPs) as needed to better fit emerging roles. This will ensure that actions remain robust and validated.

Conclusion

The recommendations in this report highlight the need for immediate and unified action by standards bodies, industry stakeholders, and systems engineering experts to address emerging skills challenges. As AI-driven and software-defined technologies reshape the RF and microwave landscape, the proposed short- and mid-term strategies provide a structured roadmap to support national ambitions for a robust, future-ready workforce and UK leadership in integrated, sustainable communications infrastructure.

By implementing the recommended actions, the advancement of standards and protocols for the integration of compound semiconductor technologies into secure, resilient, and energy-efficient RF and microwave systems will be significantly strengthened. This will ensure a highly skilled workforce capable of supporting the demands of next-generation communication technologies. These strategies emphasise the critical need for coordinated collaboration among policymakers, industry leaders, and academic institutions to address capability gaps and position the UK as a global leader in intelligent, AI-enhanced, and interoperable network systems.

5.0 Appendix

5.1 Cycle timeline

Workforce Foresighting cycle started the Carry Out phase in Nov 2024. The Carry Out phase concluded in March 2025. The Findings report was prepared following the data validation period and published in May 2025.

5.2 Access to output data - link and authorisation

Data Capture Overview

5.3 – Fit and Surplus against current provision

The Workforce Foresighting process has developed two metrics to quantify the alignment between a FOP and a current standard or qualification:

Fit – expressed as a %, it is a measure of the proportion of a FOP that is covered by an existing standard or qualification.

Surplus – expressed as a %, it is a measure of the not relevant material in an existing standard that is not required for a FOP.

An ideal existing qualification or standard would have a high fit and low surplus – this implies good coverage of the FOP but with little material that is not relevant to the FOP. Conversely a poor candidate would have a low fit and high surplus. Using these two metrics it is possible to quantitively evaluate, rank, and compare a range of existing provisions against a set of FOPs describing future needs.

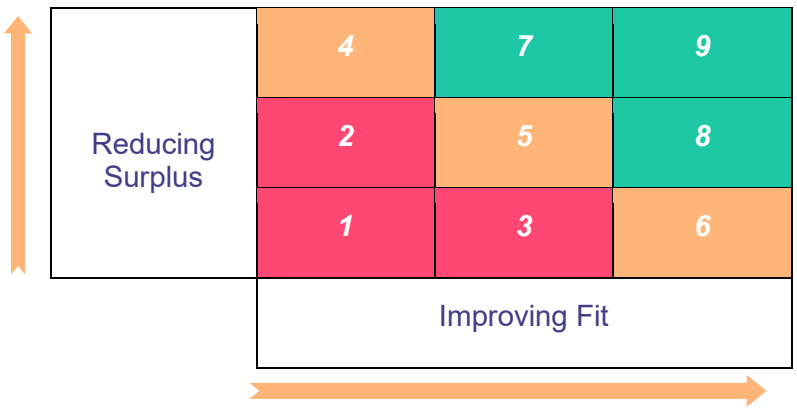
Our interpretation is represented by a simple nine-box model to position the suitability of a given current occupational standard to a future occupational profile:

Factor scores

Fit Factor	Fit score	Surplus Factor	Surplus score
0 - 32%	1	81-100%	1
33-65%	2	51-80%	2
66-100%	3	0 - 50%	3

(Multiplying the Fit score by the Surplus score gives a Suitability Grid score of 1-9 as below)

Suitability Grid



Fit Factor scores and Suitability Grid

Using this score and indicated 'RAG status' the following interpretations can be made:

Good Suitability – 7,8,9 – for standards that have good coverage of FOPs.
Represents good candidates from current apprenticeship standards used as the basis of development to meet FOP requirements and inform elements of short course and CPD provision.

Some Suitability– 4,5,6 – for standards that have only partial coverage of FOPs.
These are likely to require extended work to meet FOP requirements, further review of the data may be necessary. They are likely to contain some useful information to inform elements of short course and CPD provision.

Low Suitability – 1,2,3 – for standards that have poor coverage of FOPs.
These are unlikely to be adaptable to meet future needs but may contain some useful information to inform elements of short course and CPD provision, which can be assessed using the data visualisation tools.

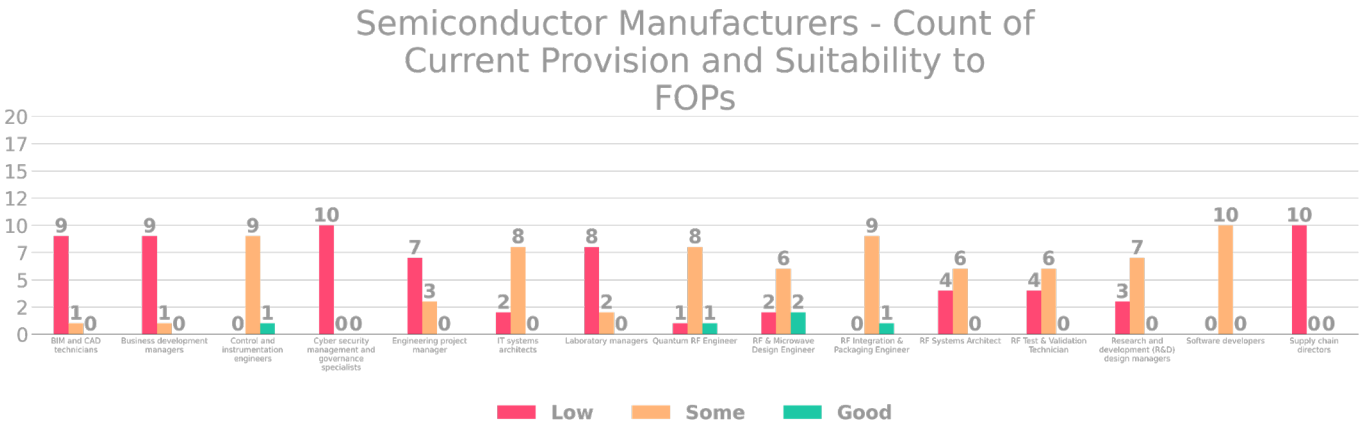
FOP findings compared with current standards

By applying the approach described above—utilising 'RAG' (Red, Amber, Green) scores to assess each Future Occupational Profile (FOP) against the suitability of current apprenticeship standards (as defined by IfATE), selected university provision, and relevant National Occupational Standards (NOS)—the following table begins to highlight key areas for action and concern. These insights help identify where future skills provision must be strengthened, enabling each Supply Chain Partner to effectively respond to the evolving demands of the sector and address emerging capability gaps.

Supply Chain Partner - Semiconductor Manufacturers

Role Level	Selected Future Occupational Profiles	Current Suitability Summary
Technician	BIM and CAD technicians	Low
Technician	RF Test & Validation Technician	Some
Engineer	Control and instrumentation engineers	Some
Engineer	Cyber security management and governance specialists	Low
Engineer	Laboratory managers	Low
Engineer	Quantum RF Engineer	Some
Engineer	Engineering project manager	Low
Engineer	IT systems architects	Some
Engineer	RF Integration & Packaging Engineer	Some
Engineer	RF & Microwave Design Engineer	Some
Engineer	Software developers	Some
Senior Engineer	Business development managers	Low
Senior Engineer	Research and development (R&D) design managers	Some
Senior Engineer	RF Systems Architect	Some
Senior Engineer	Supply chain directors	Low

Detailed breakdown:



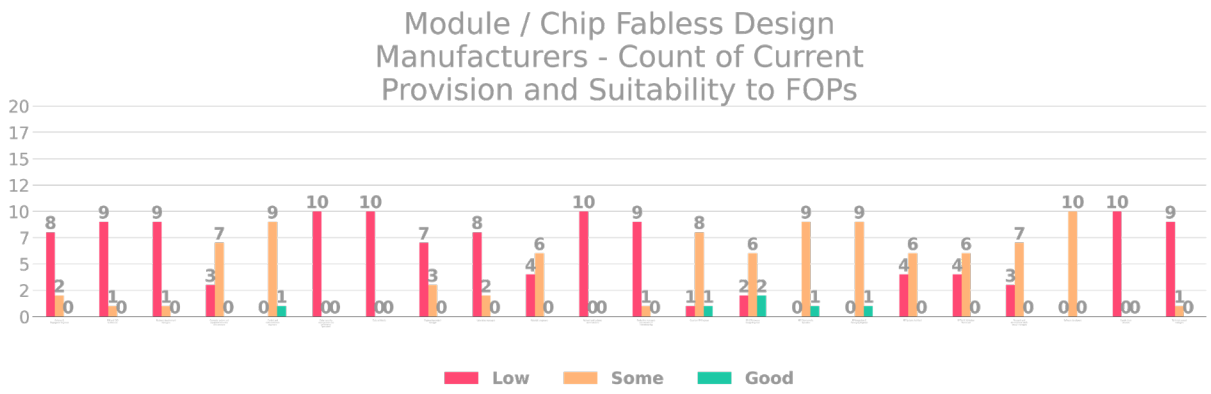
Suitability Summary - Semiconductor Manufacturers

Supply Chain Partner - Module / Chip Fabless Design Manufacturers

Role Level	Selected Future Occupational Profiles	Current Suitability Summary
Technician	Network and systems administrators	Low
Technician	RF Test & Validation Technician	Some
Technician	BIM and CAD technicians	Low
Technician	Computer system and equipment installers and servicers	Some
Engineer	Antenna & Propagation Engineer	Low
Engineer	Control and instrumentation engineers	Some
Engineer	Cyber security management and governance specialists	Low
Engineer	Data architects	Low
Engineer	RF Cybersecurity Specialist	Some
Engineer	RF Integration & Packaging Engineer	Some
Engineer	Software developers	Some
Engineer	Technical support managers	Low

Engineer	Engineering project manager	Low
Engineer	Laboratory managers	Low
Engineer	Quantum RF Engineer	Some
Engineer	RF & Microwave Design Engineer	Some
Senior Engineer	RF Systems Architect	Some
Senior Engineer	Production managers and directors in manufacturing	Low
Senior Engineer	Materials engineers	Some
Senior Engineer	Business development managers	Low
Senior Engineer	Research and development (R&D) design managers	Some
Senior Engineer	Supply chain directors	Low

Detailed breakdown:



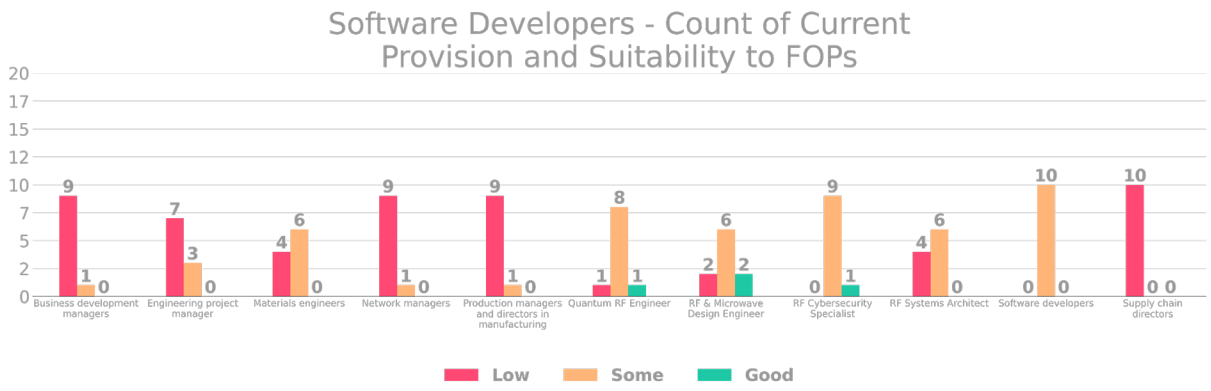
Suitability Summary - Module / Chip Fabless Design Manufacturers

Supply Chain Partner - Software Developers

Role Level	Selected Future Occupational Profiles	Current Suitability Summary
Engineer	Engineering project manager	Low
Engineer	Network managers	Low

Engineer	Quantum RF Engineer	Some
Engineer	RF & Microwave Design Engineer	Some
Engineer	RF Cybersecurity Specialist	Some
Engineer	Software developers	Some
Senior Engineer	Business development managers	Low
Senior Engineer	Materials engineers	Some
Senior Engineer	Production managers and directors in manufacturing	Low
Senior Engineer	RF Systems Architect	Some
Senior Engineer	Supply chain directors	Low

Detailed breakdown:



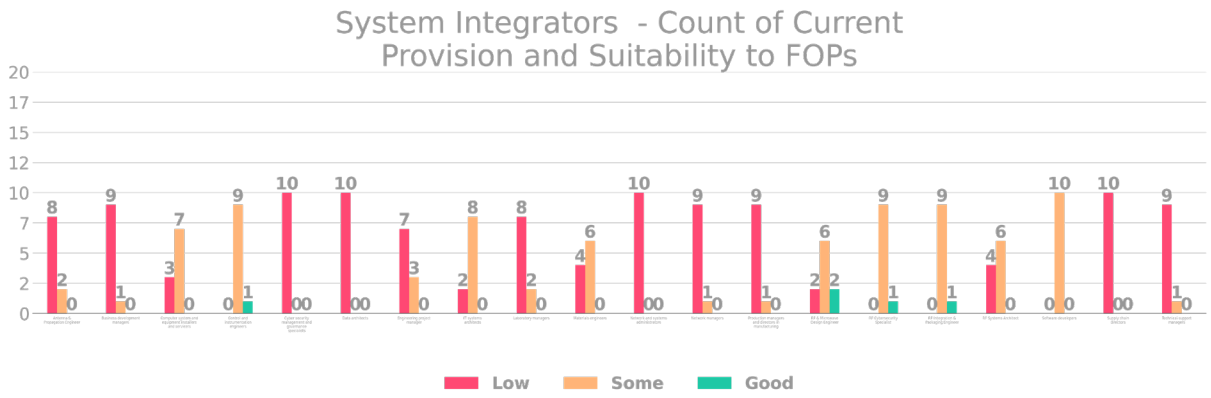
Suitability Summary - Software Developers

Supply Chain Partner - System Integrators

Role Level	Selected Future Occupational Profiles	Current Suitability Summary
Technician	Computer system and equipment installers and servicers	Some
Technician	Network and systems administrators	Low
Engineer	Antenna & Propagation Engineer	Low

Engineer	Control and instrumentation engineers	Some
Engineer	Engineering project manager	Low
Engineer	IT systems architects	Some
Engineer	Cyber security management and governance specialists	Low
Engineer	Data architects	Low
Engineer	RF & Microwave Design Engineer	Some
Engineer	RF Cybersecurity Specialist	Some
Engineer	RF Integration & Packaging Engineer	Some
Engineer	Software developers	Some
Engineer	Technical support managers	Low
Engineer	Network managers	Low
Engineer	Laboratory managers	Low
Senior Engineer	Business development managers	Low
Senior Engineer	Production managers and directors in manufacturing	Low
Senior Engineer	Materials engineers	Some
Senior Engineer	Supply chain directors	Low
Senior Engineer	RF Systems Architect	Some

Detailed breakdown:

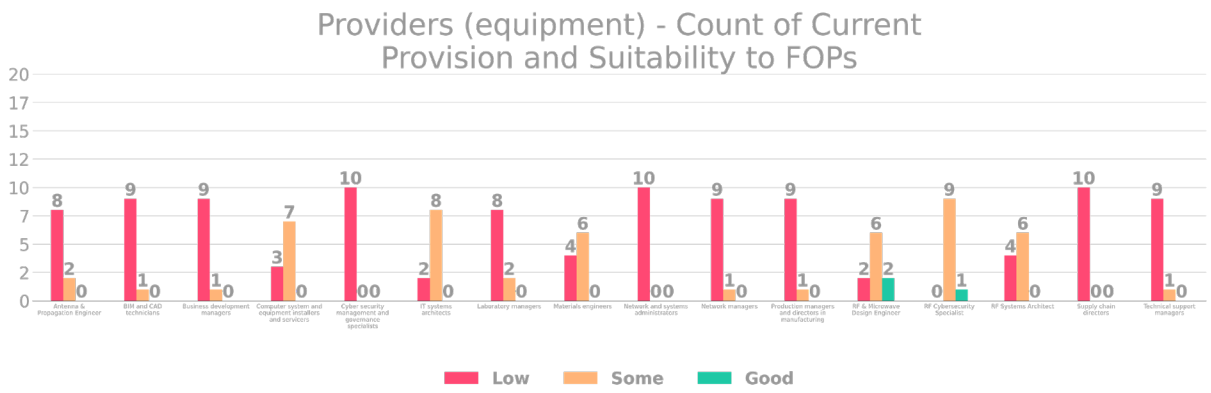


Suitability Summary - System Integrators

Supply Chain Partner - Providers (equipment)

Role Level	Selected Future Occupational Profiles	Current Suitability Summary
Technician	Network and systems administrators	Low
Technician	BIM and CAD technicians	Low
Technician	Computer system and equipment installers and servicers	Some
Engineer	Antenna & Propagation Engineer	Low
Engineer	Network managers	Low
Engineer	Cyber security management and governance specialist	Low
Engineer	IT systems architects	Some
Engineer	Laboratory managers	Low
Engineer	Technical support managers	Low
Engineer	RF Cybersecurity Specialist	Some
Engineer	RF & Microwave Design Engineer	Some
Senior Engineer	Business development managers	Low
Senior Engineer	RF Systems Architect	Some
Senior Engineer	Production managers and directors in manufacturing	Low
Senior Engineer	Materials engineers	Some
Senior Engineer	Supply chain directors	Low

Detailed breakdown:

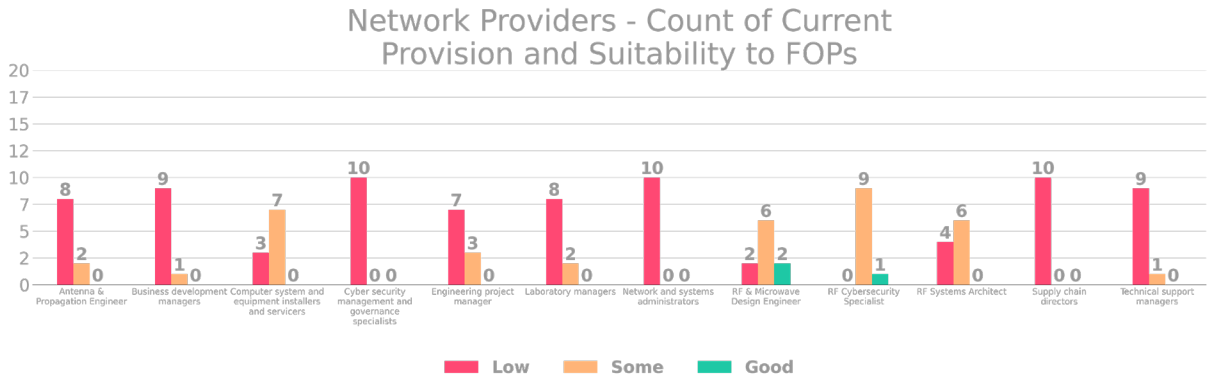


Suitability Summary - Providers (equipment)

Supply Chain Partner - Network Providers

Role Level	Selected Future Occupational Profiles	Current Suitability Summary
Technician	Computer system and equipment installers and servicers	Some
Technician	Network and systems administrators	Low
Engineer	Antenna & Propagation Engineer	Low
Engineer	Cyber security management and governance specialists	Low
Engineer	RF & Microwave Design Engineer	Some
Engineer	RF Cybersecurity Specialist	Some
Engineer	Engineering project manager	Low
Engineer	Laboratory managers	Low
Engineer	Technical support managers	Low
Senior Engineer	Business development managers	Low
Senior Engineer	Supply chain directors	Low
Senior Engineer	RF Systems Architect	Some

Detailed breakdown:



Suitability Summary - Network Providers

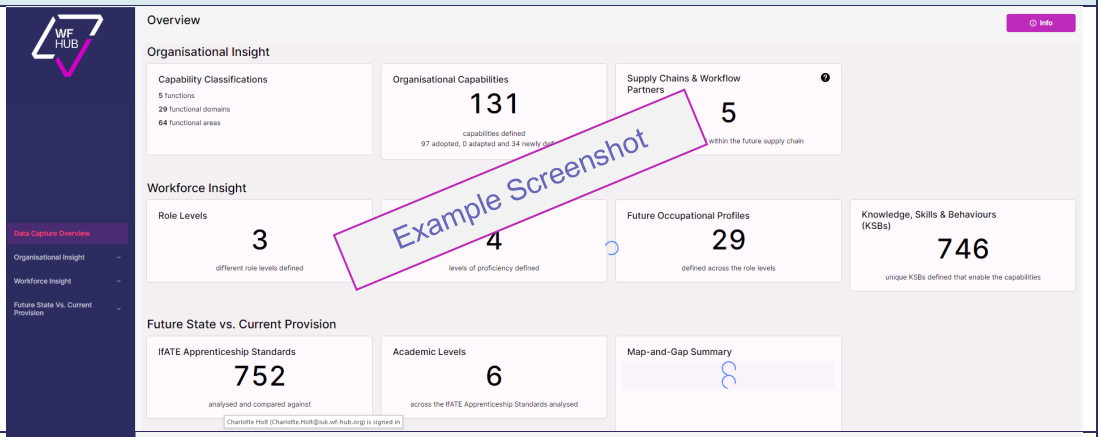
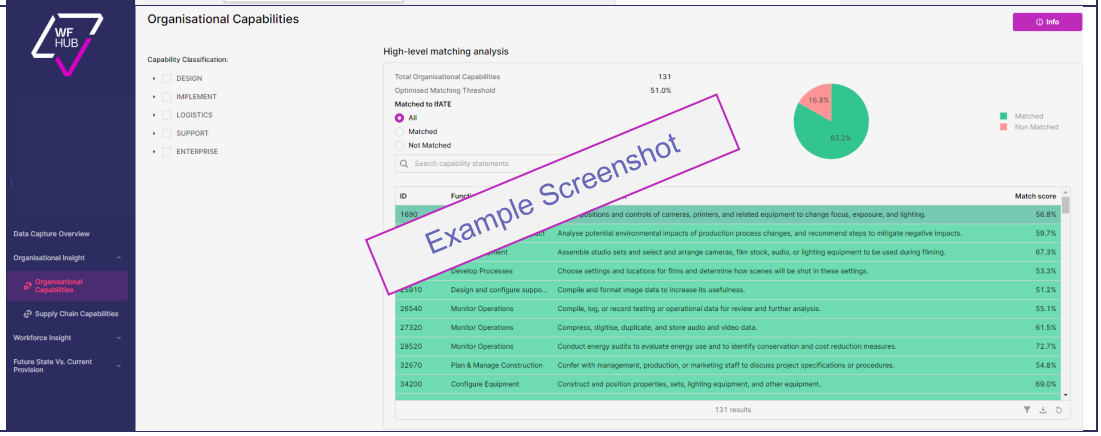
5.4 Glossary - common language

Term	Definition
Impact Domains	Innovate UK domains used as Strategic Categories to assist setting and monitoring priorities
National Challenge (Industry / Sector / Region)	A recognised technological or socio-political threat or opportunity for which there is consensus that workforce action is necessary
Challenge Response	Specific intervention aimed at the challenge
Capability (Organisation)	The collective abilities, and expertise of an organisation to carry out a function, because provision and preparation have been made by the organisation
Capability Classification	Classification provides a common, structured vocabulary to define capability
Capability Statements	Description of the depth and nature of each capability within an organisation
Capability Syntax	Common language to describe each capability application within organisation type
Competencies (Workforce / Individual)	'Proficiency, aptitude, capacity, skill, technique, experience, expertise, facility, fitness related to capability
Competency definition 'KSBs' (Knowledge, Skills and Behaviours)	Knowledge, Skills, and Behaviours are the elements used to express the required competencies for each Role Group
Competency Domain	Used during foresighting analysis to provide focus on existing and emerging competency needs
Delphi Process	Foresighting takes a Delphi approach which has come to represent consulting expert opinion. (Harking back to the Delphic Oracle of ancient Greece)
Foresight Cycle	Set of workshops, analysis and reporting that implements the Foresight Process for each subject
Foresight Process	A series of activities which are convened to understand future competence needs, the opportunities available and actions required to deliver the right skills at the right time and place
Foresighting Champion	An individual nominated within a new user organisation of foresighting to facilitate and lead the use of foresighting processes and tools with the support of the Project Team
Foresighting Subject	The application of specific technologies in the context of a given challenge and which are candidates for foresighting
Future Competency Set	The KBS output from the Educator workshop for each Role Group
Map and Gap Analysis	A combined expert and automated process that maps the Future Competency Set against a selected reference framework
Organisation Type	Simple description of nature of organisation for which capability is required
Proficiencies	Proficiencies differentiate the degree of competencies required from differing Role Groups to support capabilities
Project Sponsor	Typically, a stakeholder in the challenge being successfully met who requires information to under-write plans to act
Role Group	Role groups are a collective of roles that exist in a typical manufacturing business / industrial sector
Syntax	The way in which a statement is phrased to ensure reliable, repeatable and meaningful interpretation

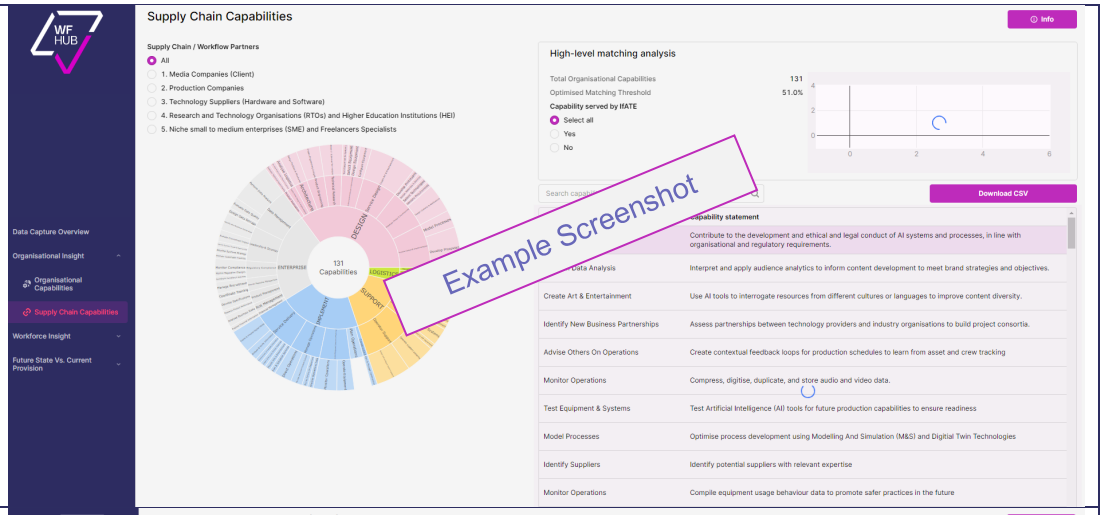
Technologies	The technology that could be used to address the challenge
Working Scenario	To provide further context in relation to the subjects and used to position participants thinking during the detailed identification of future capabilities
Workshops	Online sessions used to undertake each step in the foresight process
Roadmaps	Sector, Industry, Regional view of emerging opportunities and their market entry
Participants	Technologists, Educators, Employers

5.5 – Visualisation links and Illustrations

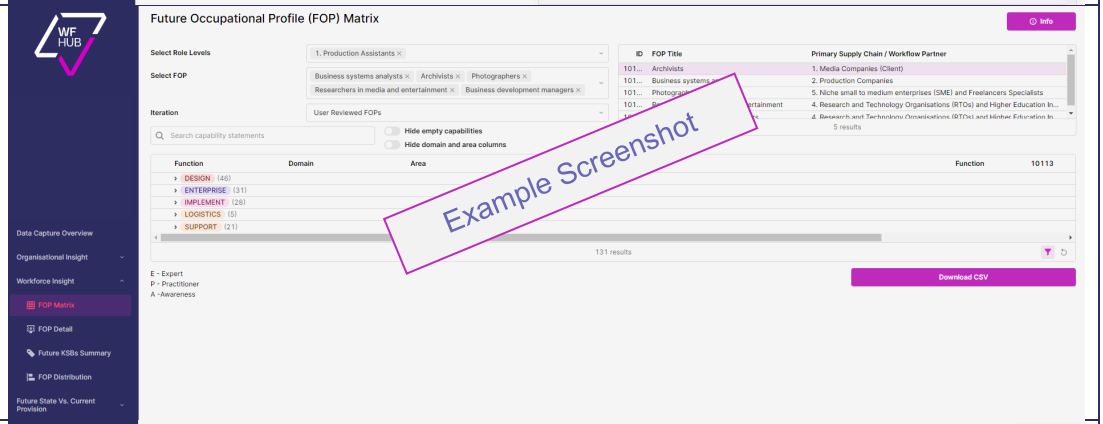
Images are not cycle specific and just for guidance purposes

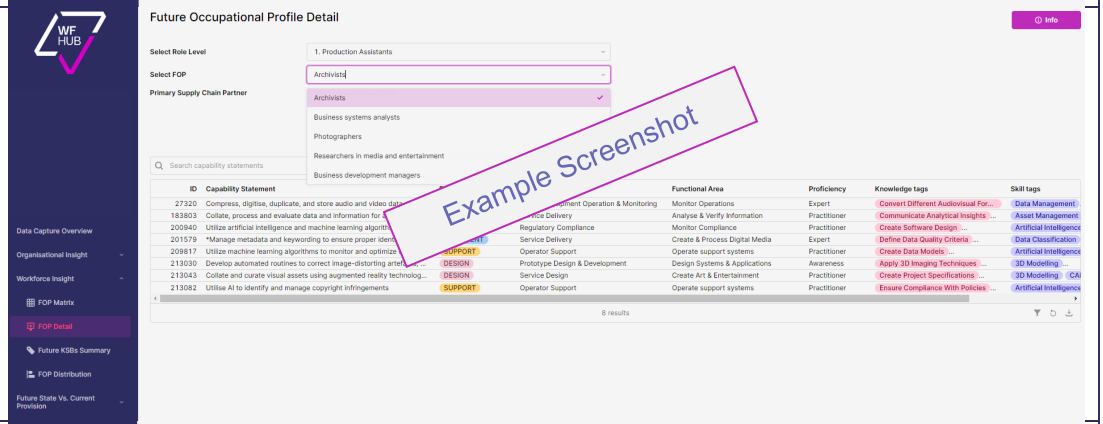
Link to Visualisation	View of data
Data Capture Overview	
Organisational Capabilities	

Supply Chain Capabilities

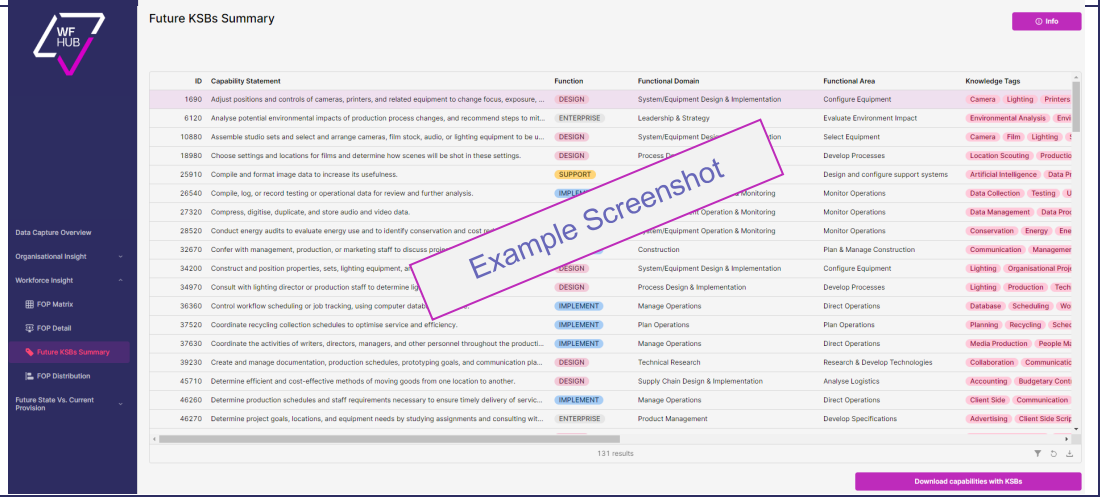


FOP Matrix

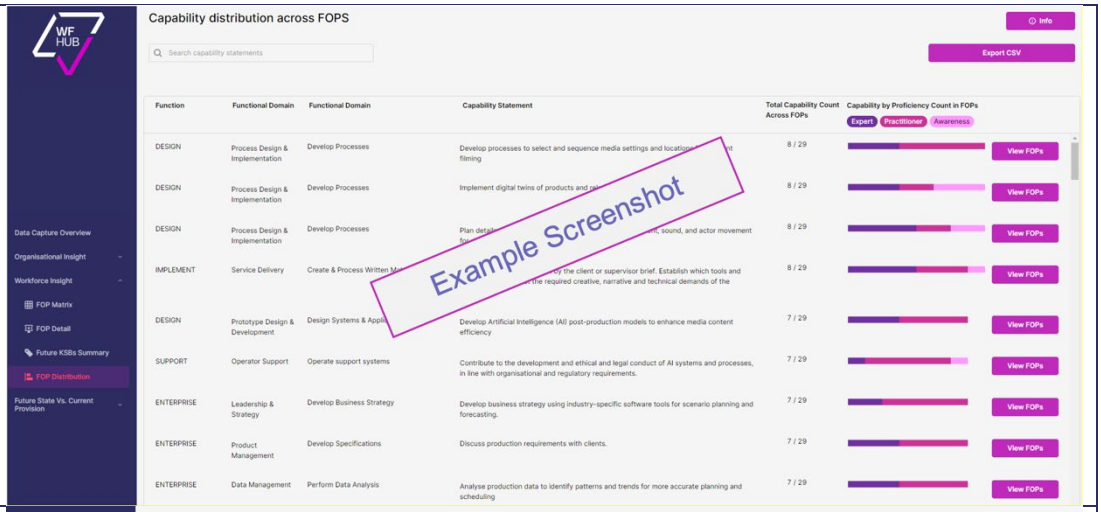




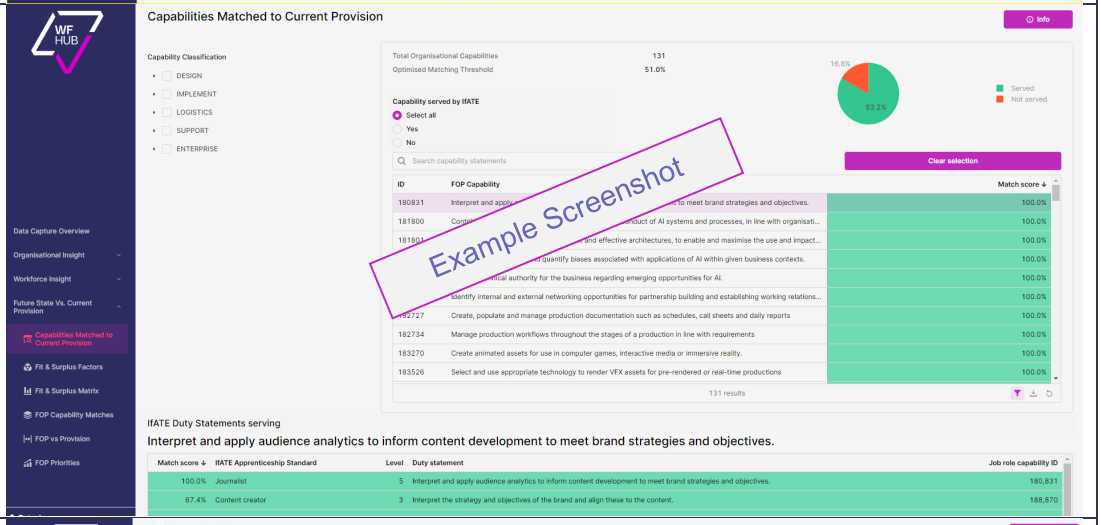
Future KSBs Summary



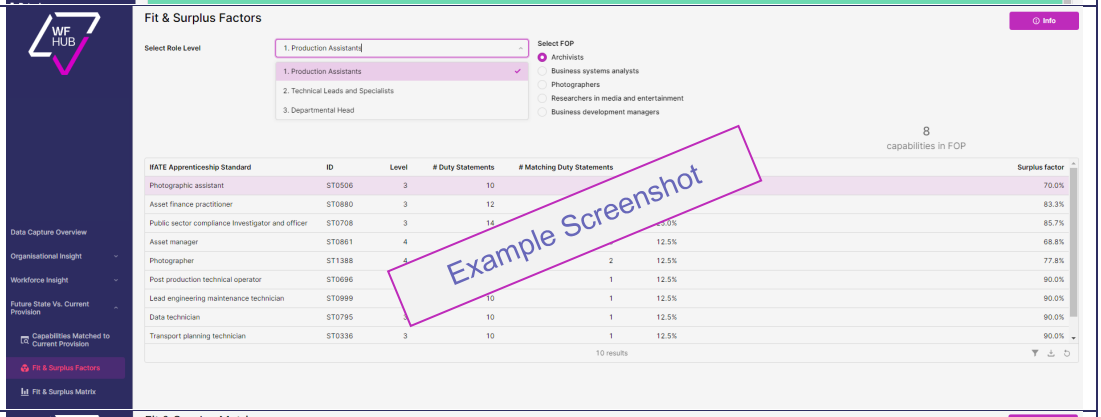
FOP Distribution



Capabilities Matched to Current Provision

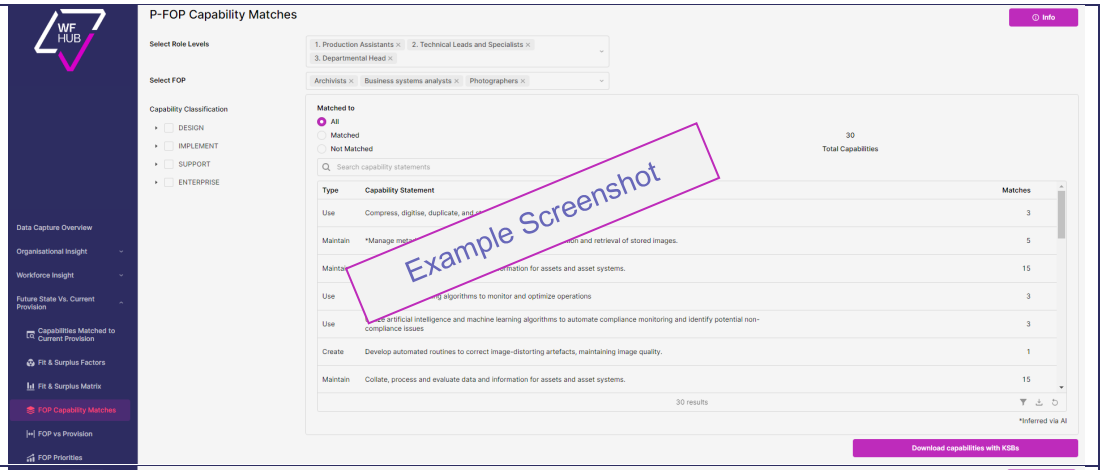


Fit Surplus Factors

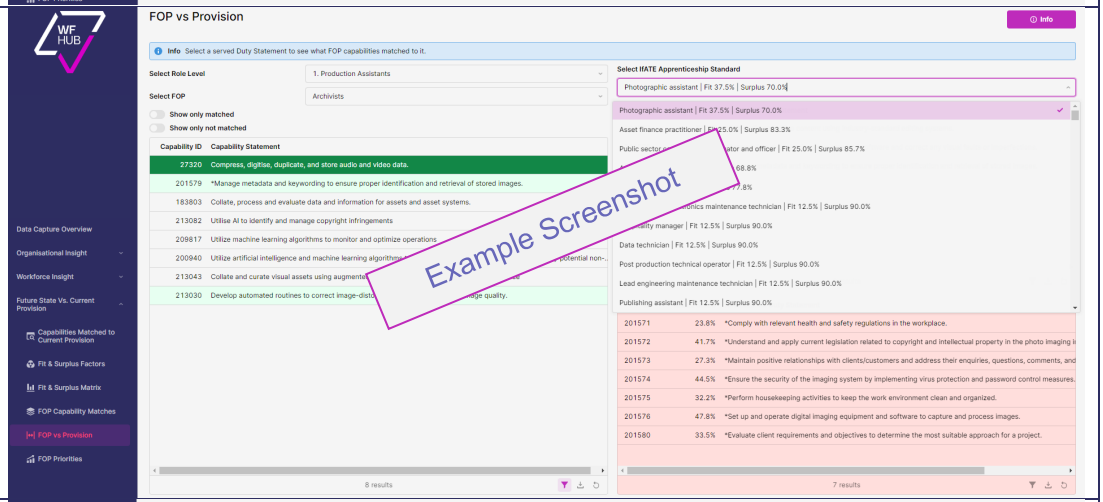


Fit Surplus Matrix

FOP Capability Matches



FOP vs Provision



FOP Priorities