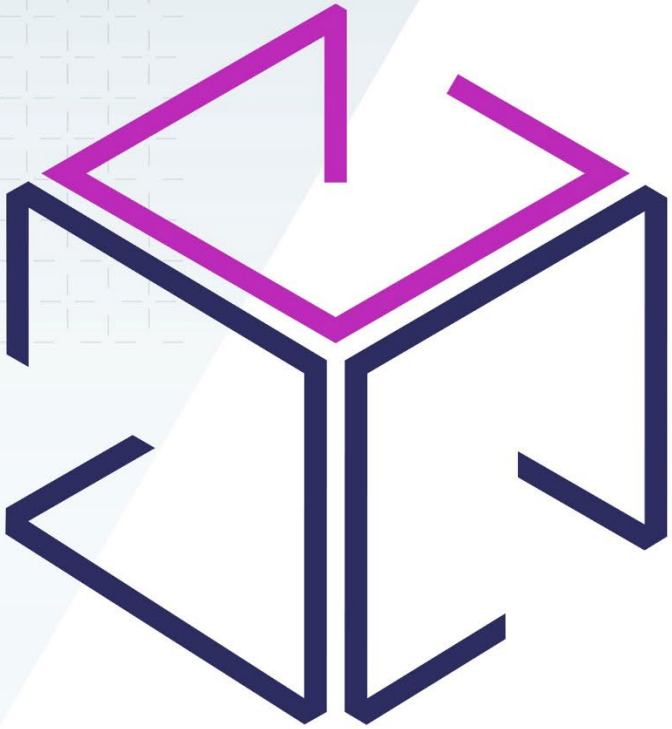
Workforce Foresighting Hub



The manufacturing of Lithium-Ion cells for transport applications in large-scale giga factories

Workforce Foresighting Hub findings report
in collaboration with WMG.

Date: January 2025

UKRI Innovate UK

Right skills, right time, right place

Acknowledgements

Attributions - 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 September - November 2024 using the data set and tools available at that time.

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1.0 Executive Summary

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1.1 Foresighting cycle summary

It is anticipated that by 2040 the UK will require almost 200GWh of battery manufacturing capability in order to meet the needs of industry across the UK with a primary driver being the shift to electric vehicles. To achieve this, up to 10 gigafactories, with their attendant supply chains, will be required. 35,000 roles would be created within gigafactories themselves with a further 65,000 roles created within their supply chains (Faraday Institution 2024).

At present UK battery manufacturing is limited and is predicted to only meet 9% of the need by 2040. Investment from Agratas is anticipated to provide an additional 20% of the need by 2040 which leaves no identifiable solution for meeting the remainder. A key component of meeting this need is ensuring that organisational capability can be achieved through the identification of roles, specification of training and delivery of interventions. This will ensure that the workforce can be trained when required and that investors can be assured that training systems possess the ability to meet their needs (An Opportunity for a National Electrification Skills Framework 2021).

Foresighting into the requirements for battery manufacturing was undertaken in 2021 in support of the development of the Battery Skills Framework and re-skill and up-skill interventions created through the Emerging Skills Project. This work proved the concept of the value of Foresighting for this technology and the way in which the intelligence could be translated into interventions to meet an identified need. However, the lack of specificity in the focus of the work meant that a range of technical capabilities were not fully integrated and that the impact of wider manufacturing trends was not fully considered.

The publishing of the Battery Technician Apprenticeship standard in 2023 took much of the earlier work and applied it in a more focused way on the technical workforce. This standard paved the way for National Occupational Standards to be developed to support similar work in the devolved nations. Further development of degree level standards has also led to an increase in battery specific apprenticeship opportunities and further development work by UKBIC, WMG and the Faraday Challenge as led to a much greater range of provision of short, re-skill and up-skill, courses becoming available.

With the investment from Agratas in a UK based gigafactory the need to revisit earlier Foresighting work, to apply the more rigorous approach developed by the Workforce Foresighting Hub, and to ensure that as investment increases the most up to date understanding of capability needs is articulated has driven the undertaking of a series of battery related Foresighting projects of which this is the first.

Cycle 1 The manufacturing of Lithium-Ion cells for transport applications in large-scale gigafactories - From receipt of cell and components to the assembly of Lithium-Ion battery modules and packs for transport applications from single cell voltages to hazardous voltage.

Cycle 2 From receipt of cell and components to the assembly of Lithium-Ion battery modules and packs for transport applications from single cell voltages to hazardous voltage.

Cycle 3 Battery recycling Expertise in recycling processes, especially as it is projected that by 2035, the UK will need to recycle or repurpose 148,000 Tonnes of automotive batteries annually.

This cycle was sponsored by UK Battery Industrialisation Centre (UKBIC) as the UK leaders in the scale up and industrialisation of batteries. Representing significant government investment in the sector UKBIC represents a non-partisan choice of sponsor and they are ideally positioned to support the dissemination of the findings, to integrate them into their working practices and to support others in ensuring that the outcomes of the report are actioned.

The analysis of the cycle undertaken highlights a shift in the requirements for the workforce from those identified in 2021. There is a much greater emphasis on the need to engage with data across manufacturing functions and the importance of sustainability running as a thread throughout all Future Occupational Profiles (FOPs). The critical role of logistics has been highlighted in the work and the opportunity has been taken to articulate the types of capabilities that it would be beneficial for a regulatory body to have.

Overall, the findings demonstrated a workforce shift in key areas, notably the need to ensure that there is a trained workforce for operator, technician and first line management roles. This proves out the case for the development of the L3 Battery Technician apprenticeship which matches closely to the capabilities identified for these role types. As well as supporting the existing provision it demonstrates that it is future proof and will meet industry need until it is due for review.

The clear identification of manufacturing, logistics, quality assurance and regulators as the supply chain partners has enabled the Foresighting work to articulate manufacturing competencies in terms of the activities within the gigafactory and the regulatory environment that may impact on it in the future. The opportunity was taken to identify what capabilities regulatory professionals would need, in the absence of an existing regulatory framework, and what capabilities would need to exist within the manufacturing environment to ensure that future regulation can be adhered to. The importance of logistics has been given greater prominence in the work demonstrating the critical role that it plays in efficient manufacturing.

Likewise, a greater emphasis has been placed on the role of data, automation and sustainability as cross-cutting capabilities across the whole workforce. For example, first line management and technician roles have competencies around the identification and gathering of data for reporting and compliance whilst graduate level roles include competencies around the interpretation and presentation of data. Sustainability is a key concern with senior roles identified to lead organisational sustainability efforts and newly identified roles to operationalise these efforts. The inclusion of these also supports a mobile workforce and demonstrates how workers with engineering competencies, and/or experience, can move between sectors.

1.2 Organisational change

As the UK moves towards large scale manufacturing of Lithium-ion cells it must learn from existing practice in established facilities as well as look to the future of manufacturing in order to ensure that the workforce is ready as demand grows. By understanding the key shifts from current practice, the UK can be ready to take advantage of inwards investment opportunities.

Functional Shifts

The Foresighting process identified five primary functional areas where organisational changes are most pronounced:

1. **Design**: Gigafactories will have a role in the proving of new product design, and may well innovate designs themselves, but this Foresighting cycle identified the

need to ensure that large scale manufacturing capabilities exist as the UK already has a well-developed research, development and design capability in this area. The importance of design within the overall supply chain investigated is borne out by the need to develop in areas such as logistics.

2. **Implementation**: The scaling of manufacturing will be accompanied by greater use of automated systems and a reduced emphasis on manual assembly of components. The monitoring of equipment, reporting of data and engagement with digital systems will be significantly more prevalent. Consequently, the proportion of implementation-based competencies has reduced relative to its previous position. Importantly, the move in this area supports a more agile workforce who can bring experience from other, potentially declining, sectors into battery manufacturing.

3. **Logistics**: Much greater emphasis has been placed on the role of logistics within the gigafactory setting including the receipt of materials, warehousing, internal movement, packaging and storing of product and dispatch. As production scales the importance of effective logistics increases. Early consideration of existing standards suggests a poor alignment to future needs. Further examination reveals that much of the excess in the current standards relates to workplace behaviour, rather than technical competencies. The core of the logistics activities covered within existing standards is not redundant but needs augmenting with the findings of this report to include a greater emphasis on automation and relationship that workers have with these systems.

4. **Support**: The relative proportion of capabilities in this area has remained constant with an emphasis on the role of quality assurance and testing within the manufacturing process.

5. **Enterprise**: There is a greater emphasis on capabilities in this area focused on sustainability, environment and preparation for the likely introduction of a body with regulatory responsibility. This does not exist yet, but this cycle considered the type of capabilities that the gigafactory would need to be able to engage effectively with a regulator and the types of capabilities that a regulator could have. There are few existing discreet standards in the area of sustainability, and there is definitely a need for them. However, there is a greater need to ensure that sustainability competencies are distributed across a wide range of technical training options to ensure that it runs as a thread throughout the workforce.

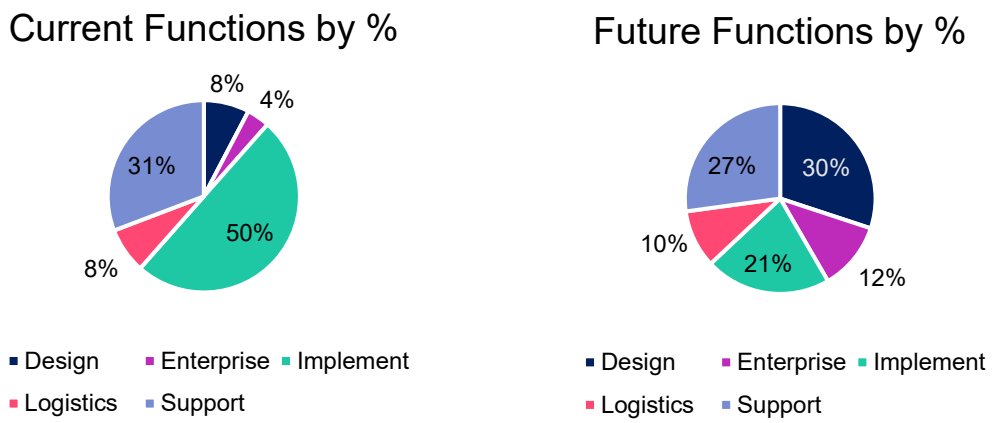

Figure 1: Current and Future Supply Chain - Capability Functions Summary by %

1.3 Future Occupational Profile Highlights

The Future Occupational Profiles (FOPs) developed in this cycle serve as crucial tools for aligning current workforce capabilities with future industry needs. These profiles were created through Workforce Foresighting workshops, combining capabilities from existing occupational standards and new data gathered during the process. The primary purpose of FOPs is to provide a framework for comparing current occupations with future requirements, facilitating the identification of skills gaps, and informing workforce development strategies.

This cycle has revealed a diverse array of Future Occupational Profiles (FOPs) across a range of academic and industrial competency levels from awareness to expert and from level 2 to level 8 qualifications, underscoring the necessity for tailored training programs to meet specific industry demands. Notably, the role of technicians is anticipated to become more prominent in future industry landscapes than previously expected, highlighting the importance of enhancing technical education and training to equip these professionals with the skills required for emerging roles.

Role Adaptation and Development:

- FOPs outline the expected evolution of current roles, suggesting necessary adaptations to meet future demands. This includes identifying areas where current occupational standards require updates and where new capabilities should be incorporated.
- New occupations profiles have been defined in particular to enable compliance with regulation, automation within logistics and the importance of sustainability both as a cross-cutting theme and as an occupation in conjunction with recycling.
- Trailblazer groups should use FOPs to evaluate and modify existing apprenticeship standards, ensuring that their workforce is equipped with the skills needed for future roles. This can be achieved through targeted short courses and continuous professional development (CPD) initiatives.
- In all cases there are opportunities to evolve existing apprenticeship standards to incorporate the new capability requirements rather than creating new ones entirely. The L3 Battery Technician and L6 Product Design and Development Apprenticeship provide the core of manufacturing capability.

Education and Training Alignment:

- Policy makers and educators should review and adapt current curricula based on the requirements highlighted by FOPs. This ensures that new entrants to the workforce are trained in line with future industry needs. Rapid re-skill and up-skill should be the initial focus of this work to ensure that demands are met, not just from education leavers, but also from those either seeking to move roles, those facing the threat of their existing role ceasing to exist and those looking to re-enter the workforce with relevant transferable experience.
- The alignment between current educational provisions and FOPs is quantitatively evaluated using fit and surplus metrics. These metrics measure how much existing standards cover the FOPs (fit) and identify any redundant material not required for future roles (surplus). An optimal alignment would have a high fit and low surplus. Further detail on these matches is shown in section 1.4 below.

Priority Future Occupational Profiles:

- The report identifies priority FOPs across various role levels, with a number not achieving a good fit with existing interventions. These priority profiles highlight the most critical areas for development to meet future capabilities. Priorities include

technician grade roles, at all levels, logistics specialist operators as these roles constitute the bulk of the workforce within the gigafactory.

Data-Driven Insights:

- The development and refinement of FOPs are supported by a robust data set, including international occupational standards and employer feedback. This data-driven approach ensures that the profiles are relevant and comprehensive, reflecting the real-world needs of the industry.
- Visualisation tools and detailed instructions provided in the report enable stakeholders to interact with and understand the data, supporting informed decision-making for workforce planning and educational program development.

In summary, the Future Occupational Profiles offer a strategic approach to bridge the gap between current workforce capabilities and future industry needs, providing actionable insights for both employers and educators. It is important that the implications of changes underway in the industry are understood by both industry and trainers to inform a conversation about how those changes may create new roles and change some existing roles, to ensure the industry is fit and adaptable for a changing future. These profiles are instrumental in guiding the adaptation of roles and the development of educational content, ensuring a well-prepared and future-ready workforce. FOPs are not template job roles and should be used to inform the structuring of the workforce making use of the capabilities that each delivers.

1.4 Specific areas of concern

The report identifies several critical areas requiring attention to ensure that the industry's workforce can meet future demands. These areas are based on the comparison of current Institute for Apprenticeships and Technical Education (IFATE) standards with the Future Occupational Profiles (FOPs). The specific concerns are as follows:

Low Suitability of Existing Standards:

Many of the FOPs identified yield poor matches against existing provision. The following have a 50%, or less, match against existing provision:

- Logistics and Warehousing Manager
- Logistics Manager
- Operations Engineer
- Quality Control Manager Operations
- Warehouse Manager
- Quality Assurance and Validation Manager
- Data Scientist (analyst)
- Quality Control Operations Auditor
- Operations Manager
- Compliance and Regulatory Professionals
- Sustainability Officers
- Warehouse Operator
- Recycling Operator
- Quality Assurance and Validation Engineer
- Operations Senior Engineer
- Compliance and Environmental Auditor

Only two FOPs yielded a match over 70%, both in the area of quality assurance. Most surprising, and concerning, is the low match in the area of logistics and warehousing which suggests that current provision is not fit for purpose.

Mismatch in Skill Requirements:

There is a significant gap between the skills and competencies required for future roles and those provided by current standards. This gap highlights the need for substantial updates and revisions to the existing training frameworks and curricula to ensure they align with emerging industry needs. This work needs to be understood in the context of changing government priorities for apprenticeships and short course training. It is worth considering that a mismatch does not mean that the standard cannot be used as a basis for future provision, merely that adjustment is required to ensure that the capabilities not currently catered for, are integrated.

Need for Enhanced Collaboration:

The findings emphasise the necessity for increased collaboration between industry stakeholders, educators, and standard-setting bodies. Such collaboration is essential to develop and implement new standards, qualifications and short courses, that can adequately prepare the workforce for future challenges. This includes regular updates to training programs and the incorporation of new technologies and methodologies. Those involved in this cycle were guided towards becoming involved in trailblazer groups to support the evolution of standards relevant to the roles identified.

Adaptation of Training and Development Programs:

Current training and development programs need to be adapted to include short courses and continuous professional development (CPD) opportunities. This adaptation will help in bridging the gap for incumbent workers and those transitioning into new roles. A focus on immediate, short, re-skill and up-skill courses is needed with these then informing the specification of longer courses.

Feedback and Continuous Improvement:

The Foresighting process should be continuously updated based on feedback from employers and other stakeholders. This iterative process will help in refining the Future Occupational Profiles and ensuring that the workforce development plans are responsive to evolving industry requirements.

To Summarise:

- Only two of the FOPs have a good match to current IFATE standards, these are the Quality Assurance Operator, matching 70.8% with the existing Process Industry Manufacturing Technician standard and Quality Assurance Operations Technician matching 70.8% with the Engineering Technician standard.

- Four of the 24 FOPs match with some suitability to existing standards with fit ranging from 52% to 68.6%.

- The remaining 18 FOPs do not match with a good degree of suitability to existing standards. The competencies not matching tend to be those that focus on non-technical workplace behaviours which were not the focus of this cycle. Adjustment to existing standards can be made to bring them up to date in order to better serve the identified need.

1.5 Recommended actions

Use the Future Occupational Profiles to:

- To address skill gaps, leverage Future Occupational Profiles (FOPs) to update standards and provide CPD courses for current and transitioning workers. There are opportunities to update existing standards and to make use of the competencies to drive the development of short, as well as long, course outputs.

- Advocate for revised standards aligned with future workforce needs. Those involved with the cycle have been encouraged to join trailblazer groups related to the standards that would be relevant to different aspects of the identified workforce profile.

- Inform the capabilities that a regulatory body should possess in the future. Whilst there is no such body at present it is recognised that preparing the gigafactory workforce for the introduction of such would be beneficial. The opportunity has been taken within this cycle to shape how such a body may operate.

It is recognised that that the establishment gigafactories in the UK will require significant investment in skills to ensure that the workforce is ready as the sector expands. At present there is little strategic direction to achieve this, but it can be achieved through re-skilling and up-skilling those already in the workforce and new-skilling those entering the workforce.

Re-skilling can be achieved through the use of short courses to bring those with parallel competencies into the sector. As other areas draw down, and battery demand decreases, there will be a natural migration to gigafactories and employers can make use of experience and existing competencies, provide additional training, and develop a highly trained workforce. It is important to bear in mind that the specification of capabilities for gigafactories sits within the context of a wider battery manufacturing ecosystem where there will be transferable capabilities.

Up-skilling can be used to support those who wish to progress in their careers. A goal of this cycle has been to ensure that there are no barriers to progression and that clear lines of sight can be established from one role to the next. This is likely to be achieved through a mix of short and longer courses depending on need.

New skilling is likely to be achieved through longer courses, for example degrees, apprenticeships and technical qualification, that will bring young people into the workforce. This will be a necessary longer-term ambition but the numbers coming through will not satisfy the projected growth of the sector and therefore an emphasis must be placed on delivering short courses that will form part of longer courses to ensure future parity.

Recommendations leading to action

Review and Dissemination of Findings:

- Engage with the Electrification Skills Network (ESN) to disseminate findings as part of the ESN National Forum.
- Plan policy briefings to integrate report findings into government skills inquiries and promote the report to stakeholders like the Auto-Council Skills Working Group.

Short-term Action:

- Review and update existing short course provisions based on new insights, particularly for battery manufacturing.
- Make amended short course programs available and ensure providers are aware and trained.
- Conduct an immediate review of logistics training and standards to address mismatches.

Mid-term Actions:

- ESN to engage with trailblazer groups to update standards based on report findings.
- Collaborate with Awarding Organisations (AOs) to integrate findings into qualifications.
- Engage Higher Education (HE) institutions to develop qualifications, especially for degree-level apprenticeships related to battery manufacturing.

General Action for Educators:

- Educators to work with employers and policymakers to address gaps in provision and support the review of standards.
- Employers to actively participate in designing and delivering training interventions to ensure a qualified workforce.

Further Foresighting Subjects:

- Propose cycles focusing on module and pack assembly, battery recycling, and electrode manufacturing.

Lessons Learned:

- Address challenges in engagement due to the limited number of active organisations in the UK.
- Incorporate greater flexibility and improve the user experience of the online data tool.

1.6 Introducing the Visualisation Tool

Data Capture Overview | HVMC Foresighting

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 curriculum 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 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.

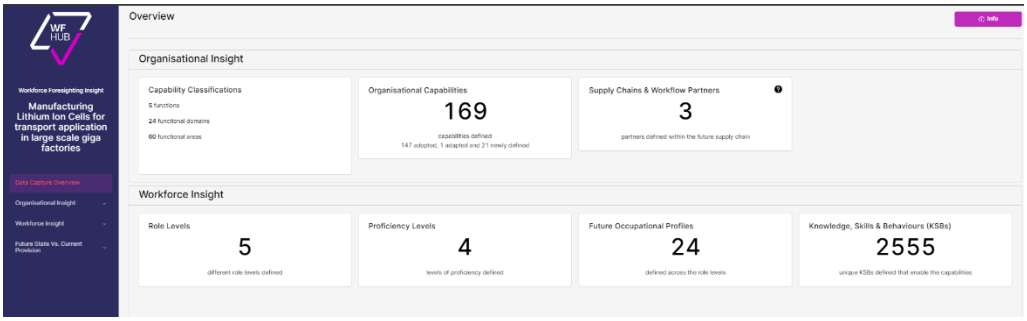

Figure 2 - Visualisation Tool Dashboard

Figure 3 - Supply Chain Capabilities Identified During the Workshop

The range of design roles and capabilities has grown compared to existing functions. This is largely due to the expansion of design within the overall supply chain, especially within logistics, and the overall expected growth of in-house solutions. Specific implementation roles and capabilities have reduced largely due to the expected growth of automation meaning that additional capabilities are needed to engage with equipment rather than undertake hands on tasks. The importance of logistics within the manufacturing setting has increased and a greater emphasis has been placed on the automation of internal logistics. Support functions remain largely unchanged by enterprise, by virtue of the focus on sustainability and regulation, has grown significantly.

2.0 Aligning the Challenge and Solutions with national priorities

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Section	Title
2.1	Positioning and context of national challenge
2.2	Potential and prioritised technology solutions to the challenge
2.3	Workforce Foresighting for chosen prioritised technology solutions
2.4	Current and predicted scale of technology deployment in the UK
2.5	Key Stakeholders in Industry and Government

2.1 Positioning and context of national challenge

As part of the UK government's long-term strategy for growth, the country remains committed to achieving zero tailpipe emissions for all new vehicles by 2035. This ambitious goal involves phasing out the sale of new internal combustion engine vehicles and prioritising Battery Electric Vehicles (BEVs) as the primary technology to meet this target. Between January and May 2024, BEV registrations in the UK exceeded 107,000, far surpassing hydrogen vehicle sales, which remain limited to the hundreds. According to the Society of Motor Manufacturers and Traders (SMMT) In 2023, the UK produced over one million vehicles, marking a 17% increase from the previous year.

On 27 November 2024, the government announced its intention to go to rapid consultation regarding the sale of EVs and further clarity on the policies required to achieve these milestones will be required once they are known. This announcement was made in response to calls for industry about the policy landscape, and gigafactories were specially mentioned both within the latest consultation and the recently published green paper, "Invest 2035: The UK's Modern Industrial Strategy," released on October 14, 2024. This paper launched an invitation for response, aimed at shaping the new industrial strategy, with a final version expected in spring 2025, alongside the multi-year Spending Review.

To meet current future manufacturing demands, the UK is projected to require approximately 200 GWh of battery production capacity by 2040. This would necessitate the establishment of around ten large battery cell production facilities, each with a capacity of 20 GWh. The Faraday Institution informs through their research that battery production capacity projections indicate that by 2030, the UK will have an estimated 57.6 GWh of battery production capacity. However, the anticipated demand is around 100 GWh, suggesting a sizeable potential shortfall.

The "rules of origin" legislative requirements mandate that a higher percentage of vehicle components be sourced domestically to qualify for tariff-free trade under agreements like the UK-EU Trade and Cooperation Agreement. This adds pressure to increase local battery production to meet these criteria. There is significant pressure to establish flexibility in this area from industry, who have expressed a potential unfairness of an influx of imports that are not expected to conform to this regulatory burden, making home grown product difficult to position as price competitive to the consumer.

Investing in the development of a skilled workforce and expanding battery production facilities, including the establishment of gigafactories, is essential for maintaining the UK's competitiveness in this field. The policy landscape is rapidly changing, however the need for skilled workers remains unchanged, regardless of the uncertainty of rollout owing to the complexity of establishing the size of this manufacturing need.

2.2 Potential and prioritised technology solutions to the challenge

The UK's commitment to achieving its zero-emission targets by 2035 hinges on advancements in battery cell manufacturing. High-performance battery cells are pivotal to the mass adoption of BEVs and other mobility solutions. To meet production demands, the Faraday Institution predicts that by 2030, the UK will need the equivalent of six gigafactories (large, high volume battery manufacturing facilities) each producing 20 GWh per year of batteries. By 2040, the demand is expected to rise to the equivalent of 10 such gigafactories. This demand could be met by fewer, larger gigafactories reaching the same total capacity. Beyond automotive applications, battery cells are integral to other industries, such as consumer electronics and various mobility solutions. To ensure the success of this transition, the government will need to stimulate further investment and address the skills gap within the battery cell manufacturing and assembly sectors. Recent announcements by AESC and Tata Group to establish gigafactories in the UK have generated significant enthusiasm about the potential to develop a dynamic and highly skilled battery industry. Projections indicate that the electric vehicle (EV) and battery sectors could support up to 270,000 jobs in the UK by 2040.

However, the Faraday Institution's September 2024 update highlights that 47% of the projected demand for UK batteries by 2030 remains unaddressed by existing gigafactory development plans. Furthermore, 71% of the projected demand for 2040 has yet to be met.

These findings underscore the necessity for continued investment and strategic planning to fully realise the potential of the UK's battery manufacturing sector.

2.3 Workforce Foresighting for chosen prioritised technology solutions

To support the expanding battery manufacturing industry, the UK must focus on developing a workforce capable of handling various stages of battery cell manufacturing, assembly, and recycling. The workforce will need skills in:

Cell production: Understanding the intricacies of manufacturing high-performance lithium-ion or solid-state battery cells.

Battery assembly: Competencies in assembling cells into modules and packs for specific applications, which differ from traditional vehicle assembly processes.

Battery recycling: Expertise in recycling processes, especially as it is projected that by 2035, the UK will need to recycle or repurpose 148,000 Tonnes of automotive batteries annually.

This report will focus on **Cell Production - the manufacturing of Lithium-Ion cells for transport applications in large-scale gigafactories.**

Battery assembly and Battery Recycling will be addressed in the subsequent reports in this series.

A strong focus must be placed on bridging the skills gap through training programs and partnerships between industry and educational institutions, ensuring that the UK has a workforce ready to support the growth of Gigafactories and other related industries. Due to the devolved nature of delivery of education, a strong national industrial strategy will be required to allow educators the necessary headroom to develop the educational resources required in their respective areas, opportunities for collaboration across borders will be useful – especially for larger national employers who may quickly exceed local populations for their workforce.

2.4 Current and predicted scale of technology deployment in the UK

The UK's battery production and recycling industries are set to expand significantly. The country is positioning itself as a leader in zero-emission vehicle technology, which will be supported by the creation of large-scale battery production facilities and a comprehensive recycling infrastructure. By 2035, it is expected that the UK will have to recycle or repurpose a substantial portion of batteries, addressing both the environmental and supply chain challenges associated with large-scale BEV adoption.

In addition to automotive applications, an extra 50% battery production capacity will be required to serve other industries such as consumer electronics and alternative mobility solutions, highlighting the critical need for investment in battery cell manufacturing.

2.5 Key Stakeholders in Industry and Government

The transition to zero-emission vehicles and the growth of the battery manufacturing sector will require collaboration across a broad ecosystem of stakeholders. Each group plays a distinct yet interconnected role in driving the necessary change, overcoming challenges, and ensuring a sustainable, skilled, and competitive transition.

Government Bodies:
Government agencies play a pivotal role by creating regulatory frameworks, offering incentives, and fostering public-private partnerships. Specific examples include:

- **Regulation:** Government bodies set safety and operational regulations to ensure compliance and mitigate risks. For instance, the *Health and Safety Executive (HSE)* enforces the *Electricity at Work Regulations 1989*. HSE supports health and safety legislation while managing workplace electrical risks. Some regulations impose "absolute" duties that demand full compliance regardless of cost, while others operate on a "reasonable practicability" basis, balancing risks against costs and feasibility.

- **Collaboration:** Partnerships between government agencies like HSE and industry stakeholders are essential to develop a shared understanding of safety protocols and protect workers in emerging sectors such as electric vehicle (EV) battery manufacturing.

- **Incentives:** Financial mechanisms like grants, subsidies, and tax relief encourage investment in battery production facilities and subsequently EV adoption.

Battery Manufacturers:
Battery manufacturers are central to scaling production and driving innovation in battery technologies. Their role includes:

- Establishing domestic gigafactories to ensure reliable supply chains and reduce reliance on imports.
- Innovating to enhance energy density, reduce costs, and improve sustainability.
- Collaborating with vehicle manufacturers and recycling companies to address the full battery lifecycle.

Vehicle Manufacturers:
Vehicle manufacturers integrate advanced battery technologies into their designs, ensuring that vehicles meet zero-emission targets. Their contributions include:

- Partnering with battery producers to align vehicle designs with next-generation battery systems.
- Investing in research and development for lightweight materials, battery efficiency, and vehicle range improvements.
- Adopting circular economy principles to facilitate battery reuse and recycling.

Educational Institutions and Training Providers:
A skilled workforce is critical for supporting the transition. Collaboration with Further Education (FE), Higher Education (HE) institutions, and independent training providers ensures the workforce is equipped with the right skills:

- Programs focused on automotive electrification, battery technologies, and safety standards.
- Accreditation schemes, such as the IMI TechSafe accreditation, which ensures professionals are trained to work safely with high-voltage automotive systems.
- Continuous professional development programs facilitated by industry bodies like the Institute of the Motor Industry (IMI).

Professional Bodies:
Professional bodies play an essential role in upholding standards and promoting excellence across the sector:

- Certifying skills through professional registers, such as the IMI Professional Register.
- Driving adoption of recognised safety standards, including IMI TechSafe for high-voltage automotive applications.
- Ensuring ongoing workforce development through training frameworks and industry collaboration.

Recycling and Circular Economy Companies:
Recycling companies address the critical challenge of managing battery lifecycles sustainably:

- Developing advanced recycling technologies to recover raw materials and reduce waste.
- Supporting manufacturers by ensuring batteries are disposed of or repurposed responsibly.
- Closing the loop by reintegrating recycled materials into new battery production, thus reducing environmental impact.

Supply Chain Partners:
A resilient supply chain ensures that raw materials, components, and technologies are accessible:

- Partnerships across mining, processing, and logistics sectors to secure critical materials like lithium, nickel, and cobalt.
- Innovation in material sourcing to improve sustainability and reduce geopolitical dependencies.

3.0 Results – Findings, Data and Insight

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Section	Title
3.1	Findings, methodology and presentation
3.2	Insight into organisational changes
3.3	Occupational change insight
3.4	Future Occupational Profiles compared with current provision
3.5	Summary and use of the findings
3.6	Recommended next steps

3.1 Findings, Methodology and Presentation

This section describes the future organisational capabilities that will be required to meet the Challenge using the proposed Solution (technology) and which occupations are likely to change to deliver these capabilities. 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. This section of the report is aligned to the needs of those responsible for workforce planning – employers, educators, and skills providers. The two parts interpret the data findings and contain links to the relevant visualisation elements.

Organisational changes

Providing insight into Organisational Changes – this indicates how organisations will need to adapt their current capabilities to achieve the implementation of the Solutions that respond to the Challenge addressed by this Foresighting project.

Typically, this will also require the adoption of new capabilities and a change in the distribution of these capabilities across value chain partners. This change in capabilities for an organisation and their value chain partners then defines the skill changes required in the different role groups of each supply chain partner.

Occupational changes

A set of 'Future Occupational Profiles' (FOPs) is produced by the foresighting 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 level, function, proficiency and capability similarity. As part of the foresighting process the generated FOPs are reviewed, revised, and distilled by the Employer group. This 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) occupational standards; to assess which current training and education provision could be used in the future. 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.

Highlighted changes to future provision

The report identifies suggested changes to education and training provision – principally occupational 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 occupational 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, occupational 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.

Method

The Workforce Foresighting Hub process uses a series of structured workshops and surveys to capture and summarise input from relevant sector experts – covering technology, workforce development and education. At several points in the workshop and analysis sequence the Foresighting process utilises large language models and artificial intelligence (AI) to parse and assist in the analysis of the content generated by workshop participants. For example, the AI model can compare capability statements with existing standards more thoroughly and rapidly than human comparison could achieve. All AI derived outputs are reviewed and validated by the participant groups through the workshops and integral quality assurance reviews of the foresighting process.

3.2 Insight into organisational changes

Organisational insight indicates how diverse types of organisations in the value chain will need to make functional changes to align their future capabilities to those required to respond to the Challenge being addressed. This provides useful insight for these organisations and in turn, provides a data rich and well-founded basis to understand how future occupations and their skillsets may need to change to meet that challenge. This is developed in section 3.3 of this report.

Organisation functions

The Workforce Foresighting Hub process uses a data structure 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.

This functional structure is developed to levels of detail that enable the Foresighting 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 ~ 40 Domains which are broken down to ~ 140 Functional Areas. This 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, 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.

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 in the future. The pie-charts reflect the distribution of capabilities across the five functions. The future state data is captured in three Technologist workshops and the current state data is generated using information collected about current occupational standards used across the existing supply chain. This latter information is not as detailed as that produced by the workshops and is indicative and used to provide a point of comparison.

The initial pie charts illustrate the changing proportions of the five functions comparing future needs with current state. This indicates an overall relative:

- Increase of Design, Enterprise and Logistics related capabilities
- Decrease of Implement and Support related capabilities

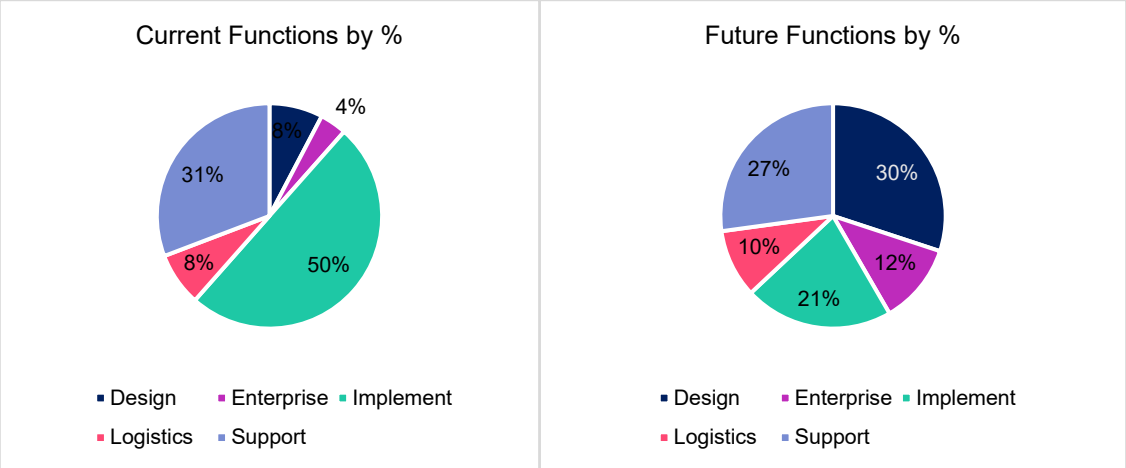


Figure 4: Current and Future Supply Chain - Capability Functions summary by %

Please note the current state has been built by proxy using a review of the existing commonly used apprenticeships standards in the industry, while the future state is dependent on data captured through the workshops which may have omissions, so this information is to be used to provide context to trends rather than specific analysis.

The charts in Figure 8 demonstrate that the relative importance of the design component has grown. This can largely be attributed to the wider consideration of the supply chain partners involved in the gigafactory setting.

This information is useful to indicate relative changes, but the underlying change will be a result of future scale as well as how functions change relative to each other. To gain more detailed insight, these overall comparisons of functional areas are analysed using the current and future capability counts within each function using the next level of classification architecture – Functional Domain.

The graphs show the change in capabilities at domain level within each of the five main Functions. The domain data is ranked with greatest change at the top of the list. These graphs provide insight into both the relative importance of each domain and scale of the changes that will be required from the current state.

The charts that highlight the domain changes across different cycles, will have some variability and empty rows due to the nature of the data.

Figure 5 - Design Function - Current to Future - Domain changes

Figure 9 demonstrates that many of the design functions have not been readily defined previously. The strong emphasis on technical research, system/equipment design and implementation and prototype design are indicative of a shifting focus towards turnkey solutions within the gigafactory environment.

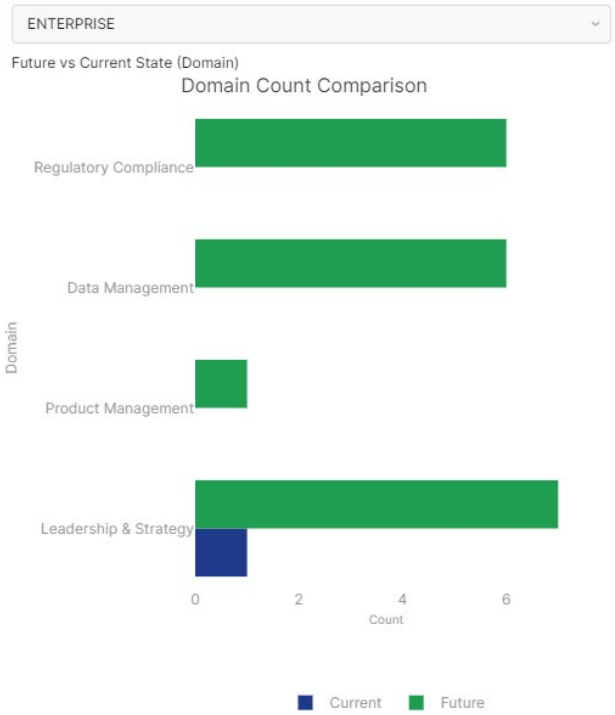


Figure 6: Enterprise Function - Current to Future - Domain changes

Enterprise represented one of the biggest shifts in workforce proportions. Again, as figure 10 shows, this is largely due to not having fully considered these domains previously. The importance of regulatory compliance, data management and leadership and strategy are shown, and these represent wide reaching, cross-cutting, capabilities that add value across much of the workforce.

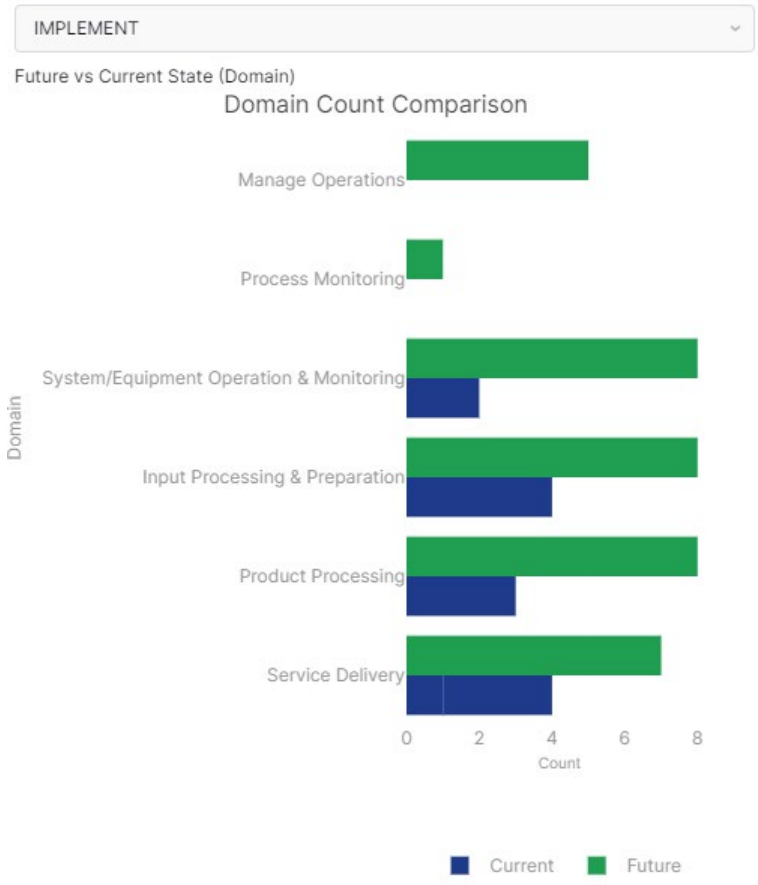


Figure 7: Implement Function - Current to Future - Domain changes

Figure 11 shows the growing importance of all domains within the implementation function. However, the management of operations has been introduced where it was not previously considered. Equipment monitoring and operation has grown in importance linked to the shift towards greater automation in manufacturing process. Therefore, input processing and preparation, product processing and service delivery are also consequently increase in importance as value is added within the process.

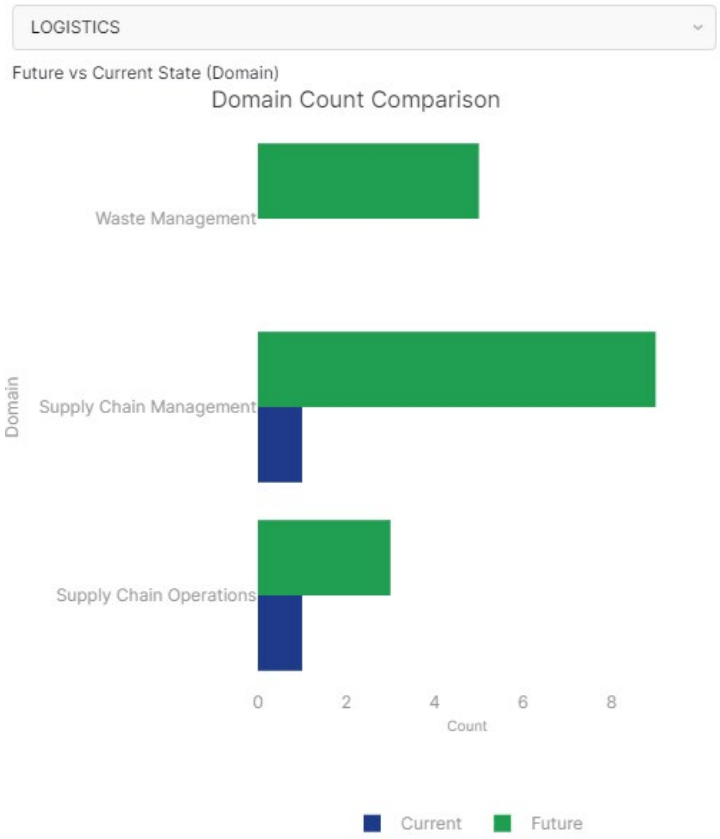


Figure 8: Logistics Function - Current to Future - Domain changes

One of the largest shifts seen during this cycle is in the function of Logistics. Waste management has been introduced as sustainability becomes a clearer focus for manufacturing. The importance of supply chains, and their management, has also grown significantly.

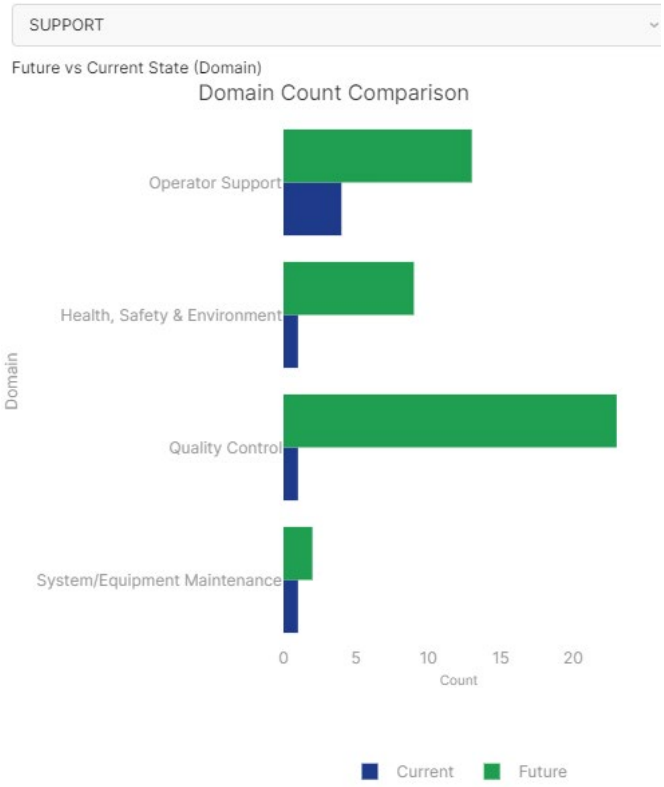


Figure 9: Support Function - Current to Future - Domain changes

The current and future support comparison for Support reflects the growth in importance across the whole function. Quality control has grown in importance significantly and the role of health and safety within the manufacturing environment is increased as well. With the focus on manufacturing, rather than maintenance, there is little movement in the systems/equipment maintenance domain, but this is expected.

Visualisation Instructions

Detailed instructions can be found in the appendix.

Visualisation Data Link	What is it and what can it be used for?
Organisational Capabilities | HVMC Foresighting	*The data presented here can provide an indication of how well served the sector is.* *This page provides a high-level summary of each capability statement generated in the cycle.* *The capability statement describes the depth and nature of each capability within an Organisation against a defined reference.* *The page also provides a way of reviewing the capabilities through the lens of the Capability Classification Framework (Design/Implement/Logistics/Support/Enterprise). This information can be used to provide insight about the types of capabilities and their distribution across the classification framework.* *This can be used to identify which capabilities may be supported by existing provision, and where there may be gaps that require new development to support.*

3.3 Occupational Change Insight

This 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 value chain partner may also need be updated to reflect change for each role group within that Partner.

Please note that this report is based on the functionality of the Visualisation report from Dec 2024 Due to the continued development of the system / processes and visualisation tool, there may be additional tabs / information developed following this report publication.
Following the publication of the report new standards may have come about which will not feature in this data set. If you have any questions, please contact the Workforce Foresighting Hub.

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. Gigafactory
2. Quality Assurance
3. Regulators

This categorisation enables the analysis and reporting of the major areas of occupational change by business function for each partner, recognising that each will have distinctive characteristics and requirements.

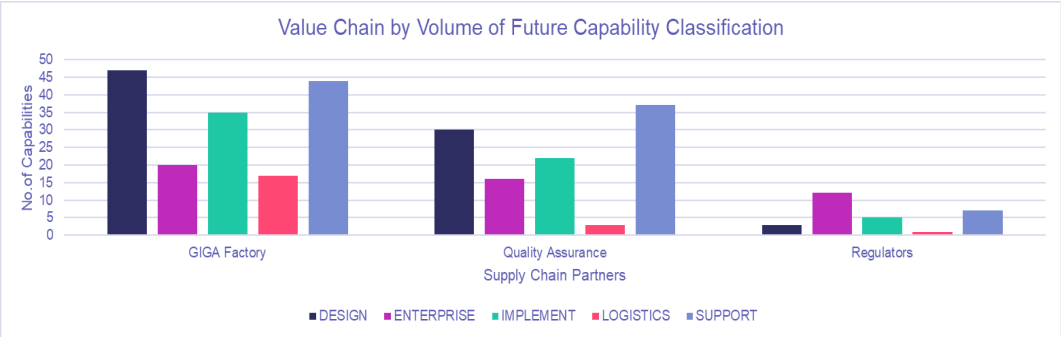


Figure 14: Supply Chain by Volume of Future Capability Classification

This graph illustrates the distribution of capabilities by function across the Value Chain Partners. These capability sets are used to form the set of Future Occupational Profiles within each Role Level. Roles associated with support have grown significantly in importance as can be seen in all three supply chain partners. Implementation is equally high given the importance of undertaking the core function of manufacturing. The number of capabilities in the design classification was not initially anticipated but given the importance of ongoing product evolution it will lead to a more futureproof profile.

Visualisation Instructions

Detailed instructions can be found in the appendix.

Visualisation Data Link	What is it and what can it be used for?
Value Chain Capabilities | HVMC Foresighting	This page provides an overview of the identified capabilities at a Supply Chain / Workflow Partner level. By selecting/deselecting each Supply Chain / Workflow Partner you can review the capabilities identified as required in that area of the Supply Chain / Workflow. This can be used to generate organisational capability profiles for each area of the workflow /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. 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 "current state plus." It was viewed as important that a strong structure could be identified with role having reporting lines and that proficiencies were allocated effectively.

For this cycle, the following role levels were determined through the workshops:

1. Operators
2. Technicians, QC Technician
3. Supervisors. 1st Level line management
4. Managers (Quality) & Graduate Engineers
5. Senior / Engineers

Proficiencies

Each of these role groups will require proficiency that relates to their role and the needs of each Supply Chain Partner. The foresight process uses the following proficiencies:

Awareness (A) - Has a foundational knowledge of tools, technology, techniques relevant to sector, industry, and company. 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. 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. Can implement improvements personally or direct and guide others.

In the workshops participants apply their insight to assign proficiency for each role group for each capability. Individual responses are aggregated to arrive at a consensus. Significant focus was placed on ensuring that competency is reflective of the level of role.

Consequently, operators have a higher proportion of awareness level competencies than other roles and a much lower number of expert ones. Conversely senior roles have higher levels of expert competencies. As well as reflecting the level of the roles this approach also provides clearer progression opportunities through competency development. This ensures that progression can be made within the organisation and that responsibilities are distributed effectively.

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

	Operators	Technicians, QC Technician	Supervisors.1st level line management	Managers (Quality) & Graduate engineers	Senior / Engineers
Awareness	37%	14%	16%	9%	19%
Practitioner	57%	74%	50%	59%	17%
Expert	7%	12%	34%	31%	63%

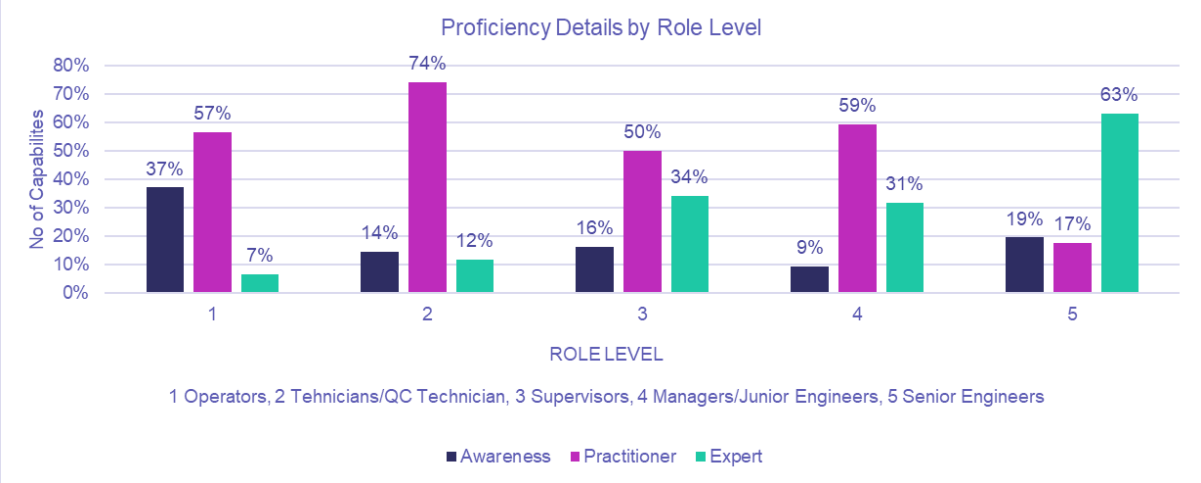


Figure 10: Proficiency details by Role Level

Future Occupational Profiles

The FOPs (Future Occupational Profiles) are a construct created and used during Workforce Foresighting workshops and analysis to capture future skills needs in a form that may be compared with current occupation definitions – typically occupational standards.

The familiar nature and structure of 'FOP's assists with their evaluation and validation by employers and educators and enables the analytical comparison that results in useful indications of matches, surplus and gaps of future skills needs compared with current state. This then allows recommendations for action to be made based on future need and current fit to those needs.

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 occupational 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.

Educators may react to these specified skill requirements from Industry by editing, adapting, or creating new content.

FOPs and indicative skills need

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

Operators Role Level FOPs

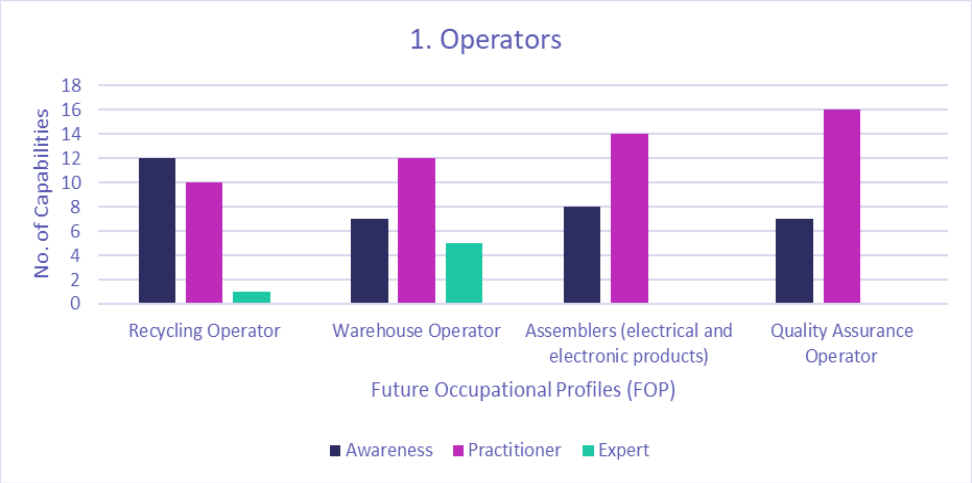


Figure 18: Priority FOPs – Operators Role Level

Technicians, QC Technician Role Level FOPs

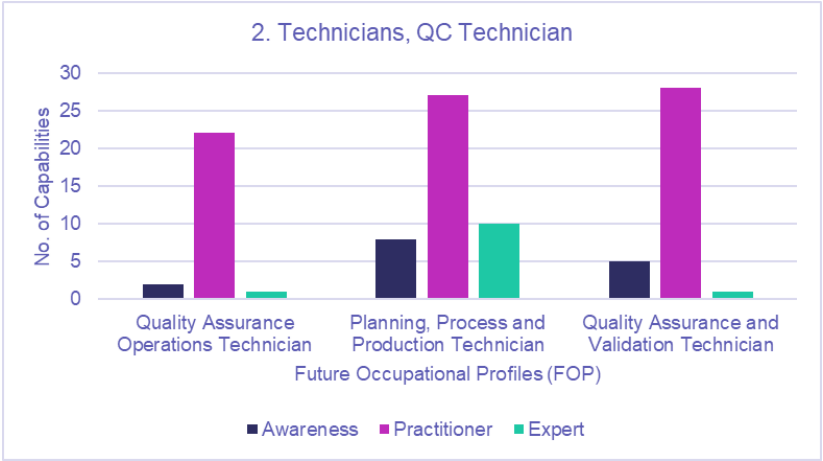


Figure 11: Priority FOPs – Technicians, QC Technician Role Level

Supervisors. 1st level line management Level FOPs

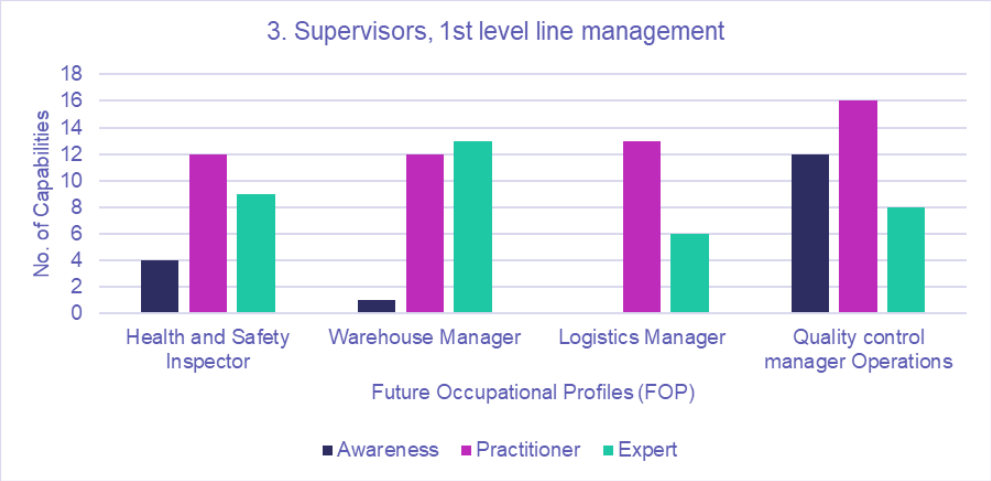


Figure 12: Priority FOPs – Supervisors. 1st level line management Role Level

Managers (Quality) & Graduate engineers Role Level FOPs

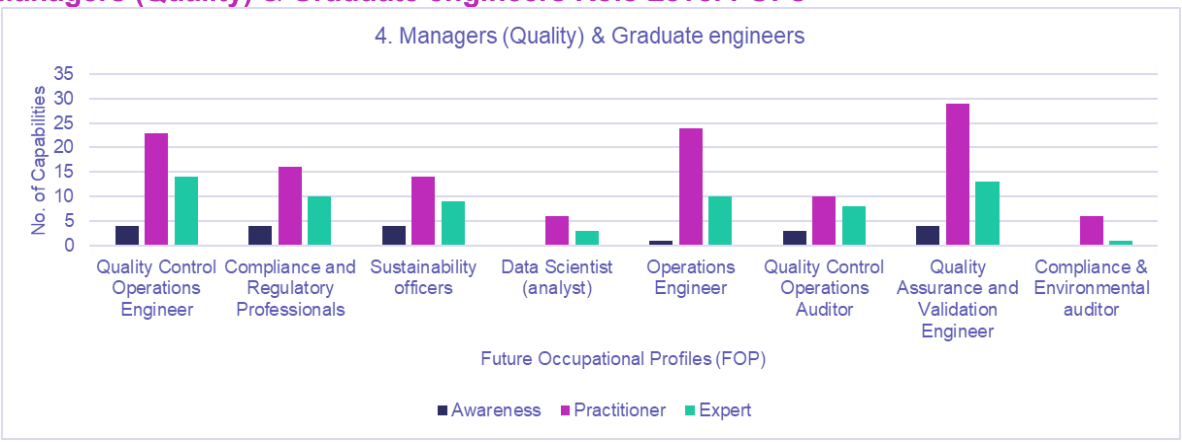


Figure 19: Priority FOPs – Managers (Quality) & Graduate engineers Role Level

Senior / Engineers Role Level FOPs

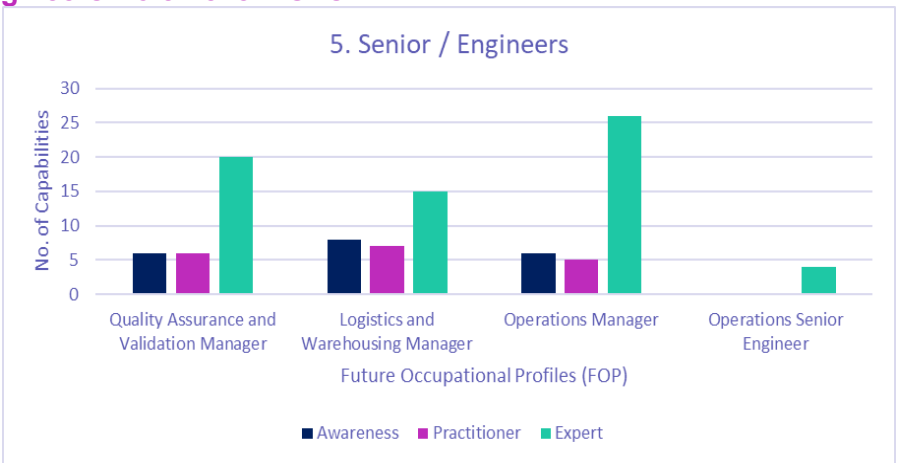


Figure 19: Priority FOPs – Senior / Engineers Role Level

Visualisation Instructions
Detailed instructions can be found in the appendix.

Visualisation Data Link	What is it and what can it be used for?
Prototype Future Occupational Profile (P-FOP) Matrix | HVMC Foresighting	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 P-FOPs in a role level by selecting one (or more) of these from the drop down. This will then allow you to select the P-FOPs aligned to that role level. The populated table allows you review and compare different P-FOPs within or across role levels. You can view the capabilities in each P-FOP and the assigned proficiency levels. You can also toggle 'Hide Empty Capabilities' on/off to reduce the view down to only those capabilities included in the role level you are reviewing.

3.4 Future Occupational Profiles compared with 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 redundant 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.

By looking at how current occupational standards fit the Future Occupational Profiles, the most suitable and efficient route for change can be determined, e.g. a fit factor of less than 33% probably indicates that the current standard is unlikely to a good candidate for change, however a fit factor of 66% suggests that less adaptation will be necessary to meet future needs.

This 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

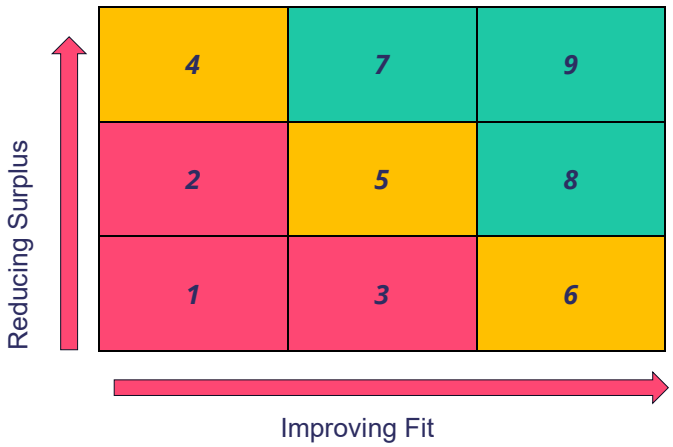


Figure 20: Fit Factor scores and Suitability Grid

For this Foresighting cycle, it was found that a higher threshold on surplus factor is more useful in filtering out less relevant IFATE standards whilst a slightly lower threshold on fit factor is useful to ensure relevant standards might be included.

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

High Suitability – 7,8,9 – Standards have good coverage for the FOPs identified
Represents good candidates from current occupational 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 – Standards that have some / partial coverage for the FOPs identified.

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 / low coverage for the FOPs identified.

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. This can be assessed using the data visualisation tools.

FOP findings compared with current standards

Using the approach described above and applying the 'RAG' scores to each FOP indicating the suitability of current occupational standards selected from the IFATE set, the following table begins to identify areas of action and concern for the provision of future skills for each Supply Chain Partner to respond to the Challenge.

Across the range of roles identified the fit to existing qualifications tends to be poor. Figures 21 to 23, along with supporting tables, demonstrate that most roles are not well served by existing qualifications within the IFATE catalogue. However, this does not mean that there is a lack of suitability within the capabilities targeted by existing provision. With a tight focus on manufacturing, it is likely that a poorer fit was the outcome due to a number of capabilities within standards that address wider capabilities. In addition, much of what is already contained with the standards is relevant, but the content needs to be updated to reflect the greater focus on cross-cutting themes identified within the cycle.

What the poor fit does mean, is that it is not easy for employers, or providers, to simply pick up and use existing programmes. Greater care is needed to ensure that the underpinning competencies are delivered within the existing standard and that additional competencies can be catered for. There is, therefore, a greater need to focus on the use of short courses to close gaps. These can then be used as part of the standard revision process to ensure parity of outcome between those that come through a re-skill, or up-skill route and those that come through a longer course route.

Supply Chain Partner – Gigafactory

Role Levels	Primary Value Chain / Workflow Partner	P-FoP	Current Suitability
Technicians QC Technician	Gigafactory	Quality Assurance Operations Technician	Some Suitability
Technicians QC Technician	Gigafactory	Planning, Process and Production Technician	Some Suitability
Supervisors' 1st Level Line Management	Gigafactory	Warehouse Manager	Low Suitability
Supervisors' 1st Level Line Management	Gigafactory	Quality control manager Operations	Low Suitability
Supervisors' 1st Level Line Management	Gigafactory	Logistics Manager	Low Suitability
Supervisors' 1st Level Line Management	Gigafactory	Health and Safety Inspector	Some Suitability
Senior Engineers	Gigafactory	Operations Senior Engineer	Low Suitability
Senior Engineers	Gigafactory	Operations Manager	Low Suitability
Senior Engineers	Gigafactory	Logistics and Warehousing Manager	Low Suitability
Operators	Gigafactory	Warehouse Operator	Some Suitability
Operators	Gigafactory	Recycling Operator	Some Suitability
Operators	Gigafactory	Assemblers (electrical and electronic products)	Low Suitability
Managers Quality Graduate Engineers	Gigafactory	Sustainability officers	Low Suitability
Managers Quality Graduate Engineers	Gigafactory	Quality Control Operations Engineer	Some Suitability
Managers Quality Graduate Engineers	Gigafactory	Quality Control Operations Auditor	Low Suitability
Managers Quality Graduate Engineers	Gigafactory	Operations Engineer	Low Suitability
Managers Quality Graduate Engineers	Gigafactory	Data Scientist (analyst)	Low Suitability
Managers Quality Graduate Engineers	Gigafactory	Compliance and Regulatory Professionals	Low Suitability

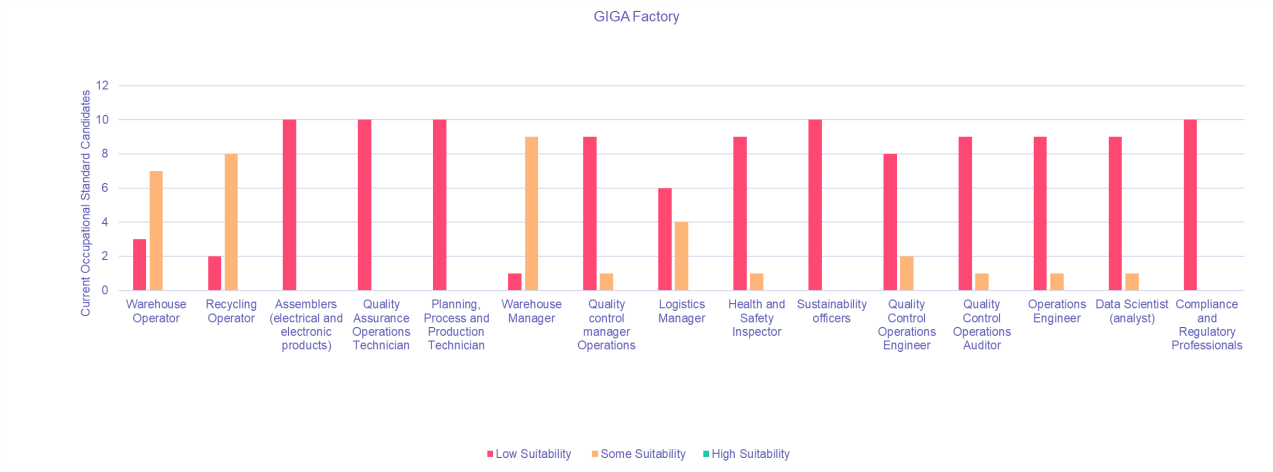


Figure 21: Count of current provision (IFATE Standards) and suitability to FOPs

Supply Chain Partner – Quality Assurance

Role Levels	Primary Value Chain / Workflow Partner	P-FOP	Current Suitability
Technicians QC Technician	Quality Assurance	Quality Assurance and Validation Technician	Some Suitability
Senior Engineers	Quality Assurance	Quality Assurance and Validation Manager	Low Suitability
Operators	Quality Assurance	Quality Assurance Operator	Some Suitability
Managers Quality Graduate Engineers	Quality Assurance	Quality Assurance and Validation Engineer	Some Suitability

Figure 22: Count of current provision (IFATE Standards) and suitability to FOPs

Supply Chain Partner - Regulators

Role Levels	Primary Value Chain / Workflow Partner	P-FOP	Current Suitability
Managers Quality Graduate Engineers	Regulators	Compliance & Environmental auditor	Low Suitability

Figure 23: Count of current provision (IFATE Standards) and suitability to FOPs

3.5 Summary of findings

Top Fits

From a FOP perspective and utilising the suitability grid we can determine which of the groups of current occupational standards are more applicable than others. The FOPs with 'some suitability' as a score resulting from their comparison with current IFATE standards and provision are:

Quality Assurance Operations Technician
Planning, Process and Production Technician
Health and Safety Inspector
Warehouse Operator
Recycling Operator
Quality Control Operations Engineer
Quality Assurance and Validation Technician
Quality Assurance Operator
Quality Assurance and Validation Engineer

This is a wide-ranging field so 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. This suggests that there is little suitable in the IFATE standards to support these Future Role Profiles.

Role Levels	Primary value chain	FOP title	Low Suitability	Some Suitability	High Suitability	Overall Suitability RAG
Technicians QC Technician	Gigafactory	Quality Assurance Operations Technician	3	7	0	Some Suitability
Technicians QC Technician	Gigafactory	Planning, Process and Production Technician	2	8	0	Some Suitability
Supervisors' 1st Level Line Management	Gigafactory	Warehouse Manager	10	0	0	Low Suitability
Supervisors' 1st Level Line Management	Gigafactory	Quality control manager Operations	10	0	0	Low Suitability
Supervisors' 1st Level Line Management	Gigafactory	Logistics Manager	10	0	0	Low Suitability
Supervisors' 1st Level Line Management	Gigafactory	Health and Safety Inspector	1	9	0	Some Suitability
Senior Engineers	Gigafactory	Operations Senior Engineer	9	1	0	Low Suitability
Senior Engineers	Gigafactory	Operations Manager	9	1	0	Low Suitability
Senior Engineers	Gigafactory	Logistics and Warehousing Manager	10	0	0	Low Suitability
Operators	Gigafactory	Warehouse Operator	6	4	0	Some Suitability
Operators	Gigafactory	Recycling Operator	6	4	0	Some Suitability
Operators	Gigafactory	Assemblers (electrical and electronic products)	9	1	0	Low Suitability
Managers Quality Graduate Engineers	Gigafactory	Sustainability officers	9	1	0	Low Suitability
Managers Quality Graduate Engineers	Gigafactory	Quality Control Operations Engineer	6	4	0	Some Suitability
Managers Quality Graduate Engineers	Gigafactory	Quality Control Operations Auditor	9	1	0	Low Suitability
Managers Quality Graduate Engineers	Gigafactory	Operations Engineer	10	0	0	Low Suitability
Managers Quality Graduate Engineers	Gigafactory	Data Scientist (analyst)	8	2	0	Low Suitability
Managers Quality Graduate Engineers	Gigafactory	Compliance and Regulatory Professionals	9	1	0	Low Suitability
Technicians QC Technician	Quality Assurance	Quality Assurance and Validation Technician	2	8	0	Some Suitability
Senior Engineers	Quality Assurance	Quality Assurance and Validation Manager	10	0	0	Low Suitability
Operators	Quality Assurance	Quality Assurance Operator	0	10	0	Some Suitability
Managers Quality Graduate Engineers	Quality Assurance	Quality Assurance and Validation Engineer	6	4	0	Some Suitability
Managers Quality Graduate Engineers	Regulators	Compliance & Environmental auditor	9	1	0	Low Suitability

FOPs with the lowest scores are:

Warehouse Manager
Quality control manager Operations
Logistics Manager
Operations Senior Engineer
Operations Manager
Logistics and Warehousing Manager
Assemblers (electrical and electronic products)
Sustainability officers
Quality Control Operations Auditor
Operations Engineer
Data Scientist (analyst)
Compliance and Regulatory Professionals
Quality Assurance and Validation Manager
Compliance & Environmental auditor

As discussed, a poor fit does not mean that there is no value in existing standards, However, the spread of poor fit across role types is a concern as it suggests that there is significant work to be undertaken in order to prepare the UK for a scale up in battery manufacturing.

Review of Findings

The findings of this section should be reviewed by those involved in the process prior to formal handover. Whilst the data acquisition and analysis were continually quality assured during the workshops and reporting, review and feedback will secure the validity of the actions proposed by the Convener in line with the recommendations that follow in Section 3.6.

The Future Occupational Profiles are the major output of the process and are used to evaluate the need for action. Further work to adapt combinations of FOPs to better fit emerging roles is anticipated as employers plan their actions to meet future needs.

Use of the findings

Whilst some of the FOPS (Future Occupational Profiles) are generic, some are more specific to this cycle. Building on this initial highlighting of opportunities and issues, further direction from Employers is required regarding workforce development plans and the level of demand for specific roles. This feedback shared with Educators can enable the development of the education and training provision for the future. Using the analysis of current IFATE occupational standards to inform the content, level, and delivery of this provision. This deeper investigation will be supported by the data sets and visualisation tools accompanying this report.

Within an organisation a job role might incorporate several occupational profiles or only parts of one depending on the size and scope of the employer. Similarly, a college course might be designed to address one or several occupational profiles alongside or independent of other pre-existing course material. The Future Occupational Profiles and the associated capability sets provide employers with building blocks to help in the design of future roles and inform workforce planning. Similarly, the findings and data provide educators with

building blocks to guide the development of course modules and content to prepare the future workforce.

In summary, FOPs can be used to:

- Highlight where roles related to a current occupational standard require updating. For incumbent or transferring workers this could be met by short course and CPD events.

- Influence and inform changes to occupational standards used to define the education and training of new entrants to the future workforce.

Lessons learnt

The Foresighting process is continually updated and improved for future cycles. Some areas for further consideration include:

- Capturing the “Current state” in terms of existing workforce capabilities at the outset would enable helpful comparisons and remove the need to develop a “proxy” current state as for this cycle.

- Additional consultation with stakeholders during the ‘Identify’ and ‘Prepare’ phase of the Foresighting Cycle to ‘seed’ the process with capability sets and existing workforce occupational profiles could reduce the need for level of quality assurance and prevent potential data omissions.

- Allowing sufficient time, 2 weeks has been suggested, for Technologists to quality assure the ‘Data-Cube’ future capability outputs in between the early workshops in the ‘Carry-out’ phase of the Foresighting cycle, would remove a need for further data cleansing later in the process.

The above points will be drawn into future WMG Workforce Foresighting projects.

Visualisation Instructions

Detailed instructions with illustrations can be found in the appendix.

Visualisation Data Link	What is it and what can it be used for?
Prototype Future Occupational Profile (P-FOP) Detail | HVMC Foresighting	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 Levels and linked P-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 | HVMC Foresighting	This page provides a view of the complete set of capabilities within the cycle along with all the associated KSB tags which are linked to them. It is the superset of all details displayed on the P-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.
match explorer - 3.0 | HVMC Foresighting	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 Occupational 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 | HVMC Foresighting	This page allows you to review the 'Fit' and 'Surplus' of Prototype Future Occupation Profiles (P-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.
	This page is a visual representation of the 'Fit and Surplus Factor' insight. You can visually review 'Fit' and 'Surplus' of Prototype Future Occupation

fit_surplus_matrix - 3.0 | HVMC Foresighting	Profiles (P-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.
P-FOP Capability Matches | HVMC Foresighting	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 (P-FOPS) or review all P-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 P-FOPs, from Job / Occupation level through to Knowledge, Skill, and Behaviour level.
fop_vs_provision - 3.0 | HVMC Foresighting	This page allows you to compare FOPs against existing IFATE Standards. This is displayed as a Matched/Not Matched Capability, comparing the Capability in a FOP to the Duties in a Standard. The left-hand side allows you to select the Role Level and FOP, while the right-hand modal allows you to compare against the top 10 matched IFATE Standards for that Occupational Profile.
p-fop_priorities - 3.0 | HVMC Foresighting	This page provides a summary of the maximum Education/Training Provision's Fit Factors identified for each P-FOP

3.6 Recommended next steps

The recommendations in this report emphasise the importance of immediate and coordinated efforts by educators, employers, and other stakeholders to address the anticipated skills gap. Actions can be divided into short-term and mid-term strategies.

Based on the findings of the report the actions set out short-, medium- and longer-term actions that should be taken to address the gaps found. Short term actions focus on ensuring that growth can be facilitated through re-skill and up-skill training. Medium term actions require longer courses to be adapted, and standards changed to meet ongoing demand. Longer term actions will see ongoing maintenance of the workforce through engagement with providers.

	Topic	Actions	Who	When	Result
Short Term Actions	Reskilling and Upskilling Current Workforce	Develop course content to address the capability gaps identified in the Foresighting work to enable those migrating from other sector areas or furthering their engineering competence. Tailor course content to match new capabilities with existing occupational standards, focusing on design and other lifecycle activities. Highly likely that new courses will be required	Educators, Awarding Bodies, Employers	Immediately, scope for this already exists. Prepare ahead of the scale-up need. Start preparing immediately	Availability of short-term training for the current workforce to meet immediate technology demands.
	Recruitment from Other Industries	Identify and reskill individuals with transferable skills from other sectors, A broad view of transferable skills needs to be taken. Action should be undertaken alongside identified draw-down of parallel sectors so as not to impact the workforce in those areas.	Employers, Training Providers	Immediate	Mitigation of workforce shortages in high-demand areas through targeted recruitment and training initiatives.
	Up-skilling of providers to meet need	A significant gap in provision is the competency level of providers themselves. Short courses can be used to ensure that providers have the capability to deliver against growing need.	Providers	Immediate	Training providers will have the capabilities required to meet future needs as demand grows.
Medium term actions	Integration of Future Skills Training	Formalise changes to occupational standards and training programs for new entrants, integrating future skills requirements defined by the Future Occupational Profiles (FOPs).	Educators, Awarding Bodies, Employers	As soon as possible for prioritised FOPs	Development of training programs that meet both current and future skills needs, reducing lead time for new workforce entrants

	Modular Approach to Course Updates	Implement modular changes to existing courses rather than complete redesigns, facilitating quicker adaptation to evolving skills requirements. Short courses designed as immediate actions can be used to create larger modular adaptations to longer courses such as technical and vocational qualifications as well as degrees.	Educators, Training Providers	Ongoing	Flexibility in educational programs, enabling rapid response to industry needs.
	Integration with organisations with access to the workforce	A significant challenge will be accessing sufficient numbers to manage growth in the sector. By engaging with organisations that work with those who may be considered “non-traditional” in the workforce it will support growth.	Employers, Skills Frame-works	Ongoing	A wider pool of available workforce to meet employment needs.
General Actions for Educators	Assessment and Feedback	Review Institute for Apprenticeships and Technical Education (IFATE) standards and relevant qualifications with employers, providing feedback and identifying gaps. Role for employers and educators in shaping standards and qualifications through engagement groups.	Educators, Employers	Ongoing	Comprehensiv e understanding of current training provisions and identification of areas for improvement.
	Commissionin g New Continuing Professional Development (CPD) Courses	Evaluate existing CPD provisions, commission new courses where necessary, and facilitate collaboration to maintain a unified approach.	Educators, Training Providers	Short-term	Enhanced CPD offerings to upskill current workforce members across all role families.
Additional Recommen dations	Dissemination of Findings	Set up a working group to create an action plan, share findings widely among stakeholders to influence workforce development initiatives.	Convener, Sponsor, Stakeholde rs, Industry Groups	Following Publication	Broad access to insights and strategic direction for workforce initiatives
	Ongoing Review and Adaptation	Regularly review findings with stakeholders and adapt Future Occupational Profiles to better fit emerging roles	Stake-holders, Sponsor Leads, Partici-pants	Before Formal Publication	Robust and validated actions.

Table of abbreviated recommendations leading to action:

A Review and Dissemination of Findings	Convener and sponsor to engage closely with the Electrification Skills Network (ESN) to effectively disseminate this work as part of the ESN National Forum. For example, this work can be used to inform the development common skills standards currently in development by ESN. Policy briefings will also be planned to ensure that Government, both nationally and regionally, are able to prepare effectively to meet future needs. This will include the integration of the report findings into responses to current, and future, government skills inquiries. The report itself will be promoted widely to other stakeholder groups, such as the Auto-Council Skills Working Group, as part of guided discussions. Plans are already in place for ESN to disseminate the findings as part of their work with providers to support them to prepare.
B Short-term action	A review of existing short course provision is needed in light of the new insight gained from this report. For example, the outputs of the Emerging Skills project developed a number of short courses to support battery manufacturing. With the outputs of this cycle these can be updated. Amended short course programmes need to be made available, and providers need to be made aware and trained where necessary. An immediate review of logistics training and standards is needed as there is a clear mismatch between what is currently available and what is required.
C Mid-term actions	ESN need to own actions to engage with trailblazer groups to ensure that standards are updated considering the report findings. Awarding Organisations (AOs) will be engaged with the ensure that the findings are used to inform their ongoing work in the review and development of qualifications. This work is already underway with some AOs to ensure that new training is both accredited and can be integrated into existing qualifications. Higher Education (HE) institutions will be engaged with to ensure that development of qualifications takes into account the changes needed. This is particularly pertinent with the approval of the L6 Product Design and Development Engineer standard which has led to the development of degree level apprenticeships related to battery manufacturing.
D General action for Educators to support Employers' demand for future skills	Educators need to engage with employers, and policy makers, to ensure that solutions are found for the gaps in provision and that employers effectively support the review of standards where appropriate. This will be supported by ESN who have working groups that bring employers and educators together to develop, check and implement training interventions. Employers must play an active role in the specification, design, and where relevant, delivery of interventions to ensure that they are able to access a sufficient number of capable and qualified staff. There is a consideration of the split between the gaining of a qualification and the gaining of workplace competencies, and this is borne out in the capabilities defined within each FOP.

E Further Foresighting subjects	Cycles focusing on the remainder of the battery lifecycle are proposed to include module and pack assembly and battery recycling. There has been interest in the establishment of a cycle focusing on electrode manufacturing which is missing from the UK battery supply chain at present.
F Lesson Learnt	There are challenges in the process as it currently stands where engagement groups are necessarily small due to the number of available organisations active in the UK. Greater flexibility needs to be incorporated to accommodate this. There are other recommendations in relation to the user experience of the online data tool.
G Recommendations to Workforce Foresighting Steering Board	The steering board should encourage the Hub to explore greater integration between cycles to share expertise where it crosses over appropriately.

By implementing these recommended next steps, stakeholders can ensure that the construction sector is supported by a skilled and adaptable workforce, capable of meeting the challenges and opportunities of a rapidly evolving industry.

4.0 Appendices

4.0 Appendices

Section	Title
4.1	Mission – What is workforce foresighting
4.2	List of participants
4.3	Cycle timeline
4.4	Access to output data - link and authorisation
4.5	Glossary - common language
4.6	References
4.7	Visualisation links and illustrations
4.8	Supply Chain Capabilities

4.1 Mission – What is Workforce Foresighting?

Addressing future workforce challenges

The global marketplace is changing at a rapid pace, and the continued development of innovative technologies is creating opportunities for growth in all sectors.

Whilst we are well placed to take advantage in the UK, the Government and industry have identified that we need a workforce able to adapt to new capabilities that require different and often higher skill sets. The 'Manufacturing the Future Workforce' report, published in 2020, states: "Failure to address the workforce development challenge will mean missing out on opportunities to build the UK's manufacturing base and to take market leading positions."

Developing this workforce and preventing a skills shortfall will provide future-thinking organisations with the capabilities to successfully adopt innovation and enable the UK to build a prosperous economy.

The Skills Value Chain

A Skills Value Chain (SVC) approach promotes connectivity between upstream UK innovation and downstream skills systems, as well as enabling better co-operation within education and training provider eco-systems. It aligns and integrates innovation and skills strategies with a common purpose.

The SVC approach was proposed in the 'Manufacturing the Future Workforce' report, which examined global best practice and convened UK pioneers to explore how the UK can develop skills to exploit innovative technologies.

And it starts with workforce foresighting.

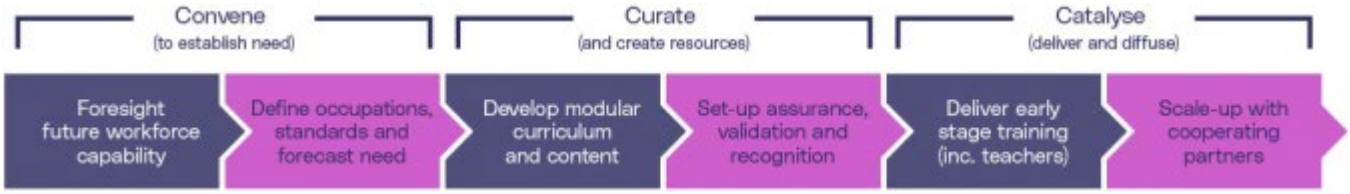


Figure 113: The Skills Value Chain

Workforce Foresighting

Using the Skills Value Chain approach, the UK can start building the skilled workforce required by tomorrow's industries and employers, and understanding what these future needs will be is where Workforce Foresighting comes in.

Workforce Foresighting is a systemic approach to identifying the organisational capabilities and workforce skills necessary to enable industry to adopt and exploit innovative technologies which respond to global, national and sector challenges.

The Workforce Foresighting Hub, initiated and funded by Innovate UK, and built in collaboration with the Catapult Network, provides the processes and data that inform insight and support the recommendations required for industry, policymakers, and educators to respond to continuing change.

Our Vision: To foster the organisational capabilities and workforce skills required to adapt to continuing change and enable adoption of innovative technologies to enable a prosperous UK industry.

Our Mission: To provide the process, insight and recommendations required to identify and address future skills demands to enable the UK to adopt innovation and succeed in the dynamic global marketplace.

Our Goals:

Define future capabilities required across a sector in response to a challenge, or technology innovation and consequently define the skill sets of the workforce of the future.

Understand and explain gaps between technology adoption, organisational capability and workforce profiles that could hamper innovation.

Identify and communicate insights, future requirements and the action required by industry and educators.

Enable and deliver a consistent approach to Workforce Foresighting.

Outcomes:
The process integrates insight from experts in three categories – domain specialists/technologists, employers, and educators. Using a structured and facilitated series of collaborative information-gathering workshops, combined with data from open-source global data sets, the Workforce Foresighting process can produce a wealth of detailed quantitative data to inform action.

At the heart of the Foresighting process are working groups consisting of the industry sponsor and centre of innovation, with support from the Workforce Foresighting Hub team, who undertake detailed analysis to report and summarise key data insights and recommendations for action. This report details future supply chain capabilities, prototype future occupational profiles and identifies changes required to current training provision for the sponsor to take forward and address skills challenges relating to the specific topic.

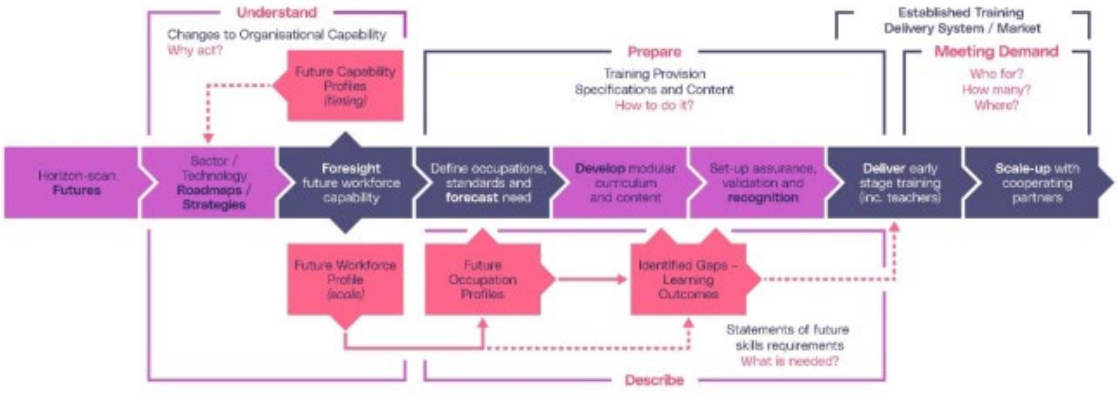


Figure 2: Workforce Foresighting & Skills Value Chain

Approach used - principles and implementation

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 several other national and international open-source workforce datasets to be integrated through the same common language. This 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 innovative 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

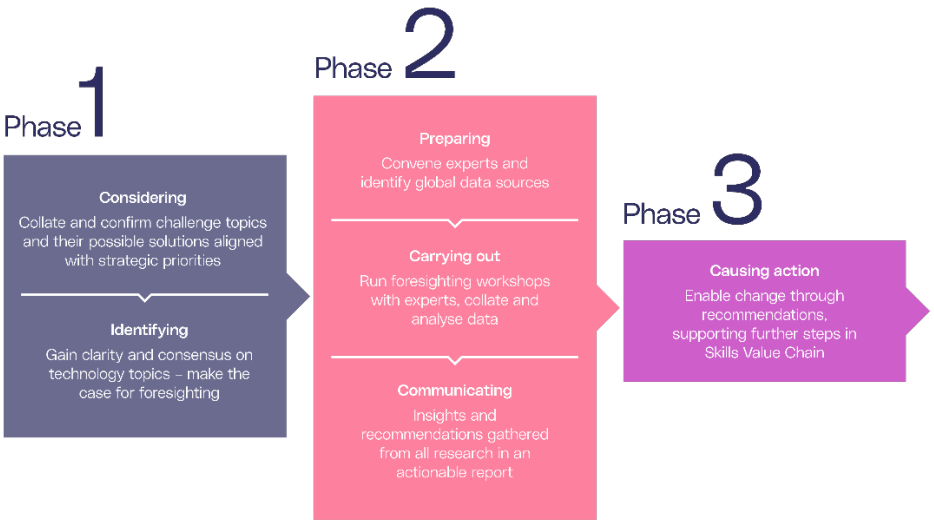


Figure 3: The Workforce Foresighting Process

Forecasting and Foresighting

The result of Workforce Foresighting is understanding why skills requirements will need to change to enable the adoption of innovative technologies, and to define what this change is likely to be in terms of future occupations and shorter-term skills gaps. Forecasting of demand can then take these future focused findings and work with industry and government stakeholders to estimate the quantity of workers necessary for an industry to fulfil emerging skill demands at a given time and place. The two approaches are linked in that Workforce Foresighting identifies the requirements and forecasting can then determine the quantity needed, the people needing the skills and therefore prepare programmes to deliver them.

Outcomes - insights and recommendations

Workforce Foresighting is a data intensive approach that can provide sponsors, stakeholders, and participants with detailed insight about future workforce requirements. A dynamic data set is provided for each cycle to allow all stakeholders and participants to freely access and interrogate the data. Additionally, the Workforce Foresighting Hub team will support the production of a report that provides targeted recommendations that require action to address gaps in training and education provision relevant to the challenge and planned technology solution.

The dynamic data portal provides a range of standard data sets and visualisations. Additionally, users can download data to undertake their own more detailed interrogation of data to guide and inform subsequent actions.

The key aspect is to provide insight about gaps – which capabilities required in the future are not addressed by aspects of current provision – apprenticeship standards, qualifications, or other provision. Gaps represent:

Short term CPD – topics required across the workforce to upskill members of current workforce

Medium term – topics to be included as current provision / standards are reviewed and updated
Longer term – new qualifications and standards that may be needed to equip new entrants

The insight produced by a Workforce Foresighting cycle provides:

Technologists and technical leads with insight of the organisational capability sets required across future supply chain partners in response to the identified challenge.

Employers with insight about possible future roles and occupations that may be required across the whole workforce, operators to researchers, to ensure they are equipped and ready.

Educators with details of the gaps to be addressed by short-course training to upskill the existing workforce and insight about qualifications and provision that will be required to support new entrants in the future.

4.2 List of Participants

- Automotive Technology
- Batri
- City & Guilds
- Electrification Skills Network
- Fortescue Zero
- Institute of the Motor Industry
- North Warwickshire and South Leicestershire College
- Pro Moto
- SectorTech
- UKBIC
- VOLKLEC
- WMG University of Warwick

4.3 Cycle timeline

This cycle started the workshops as part of the Carry Out phase in September 2024. The Carry Out phase concluded in November 2024. This report was prepared following the data validation period and published in January 2025.

4.4 Access to output data - link and authorisation

Data Capture Overview | HVMC Foresighting

4.5 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

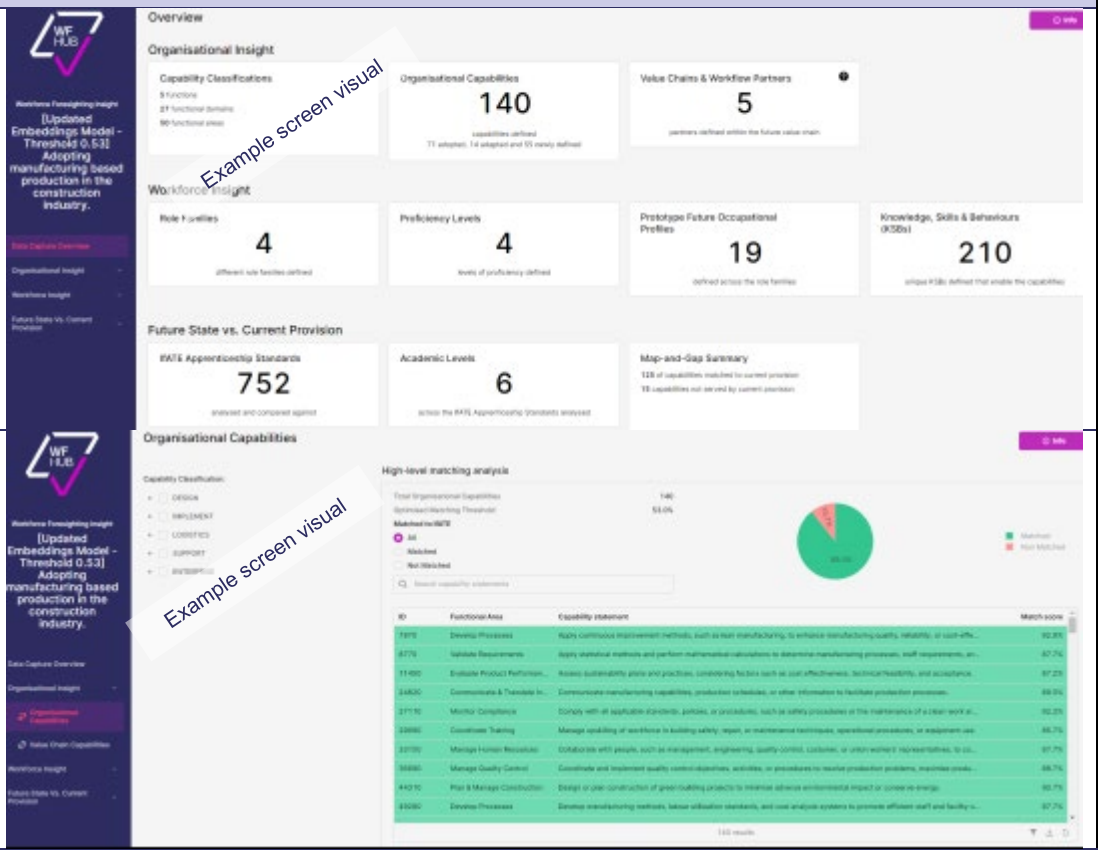
4.6 - References

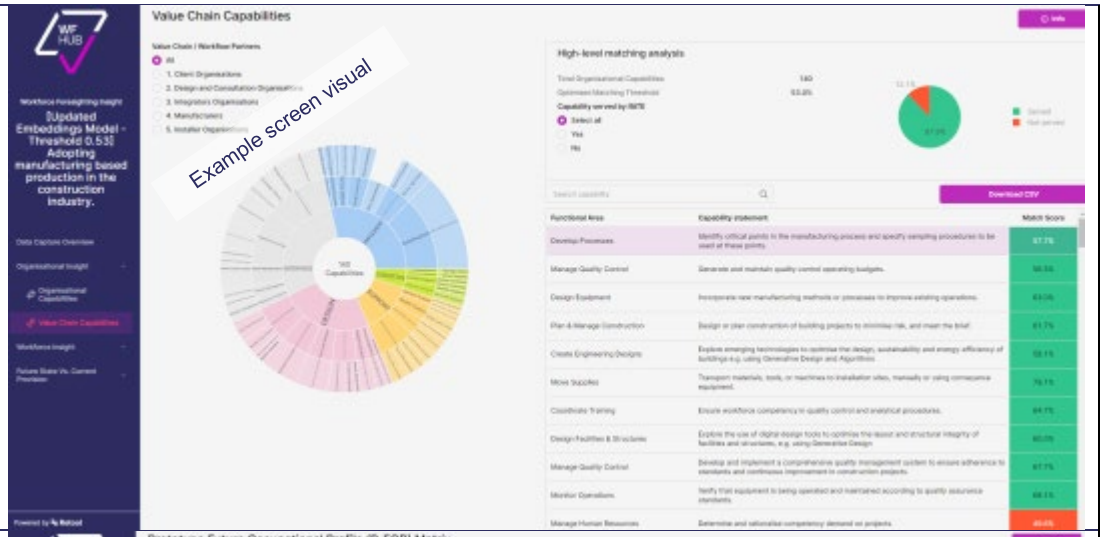
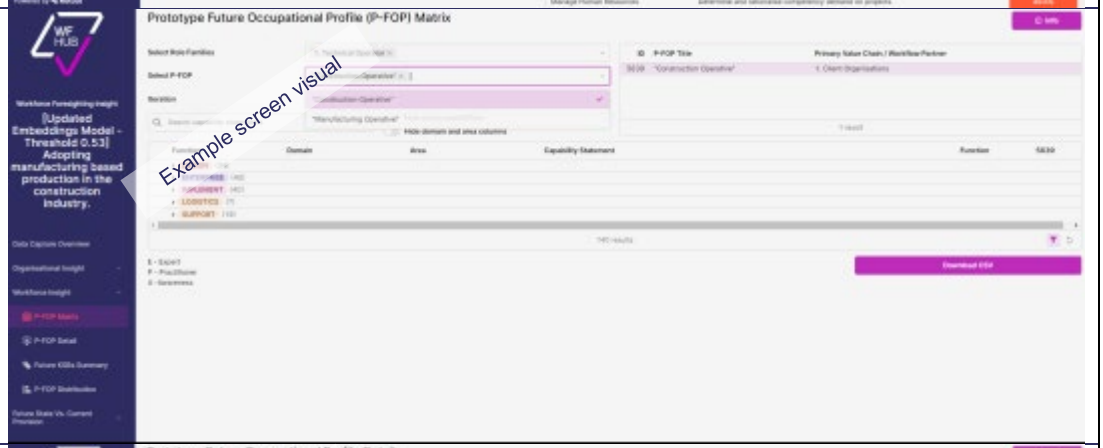
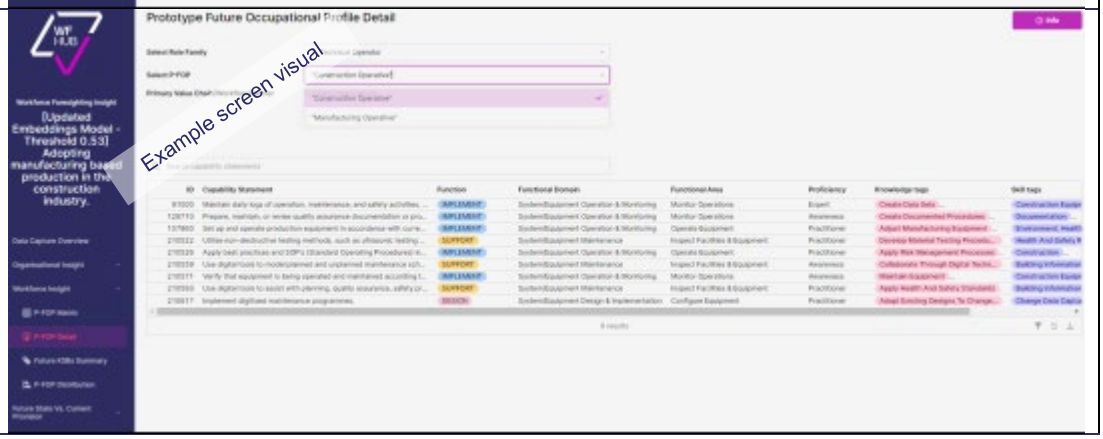
https://www.faraday.ac.uk/news-ev-battery-prod-2040-update-sept2024/

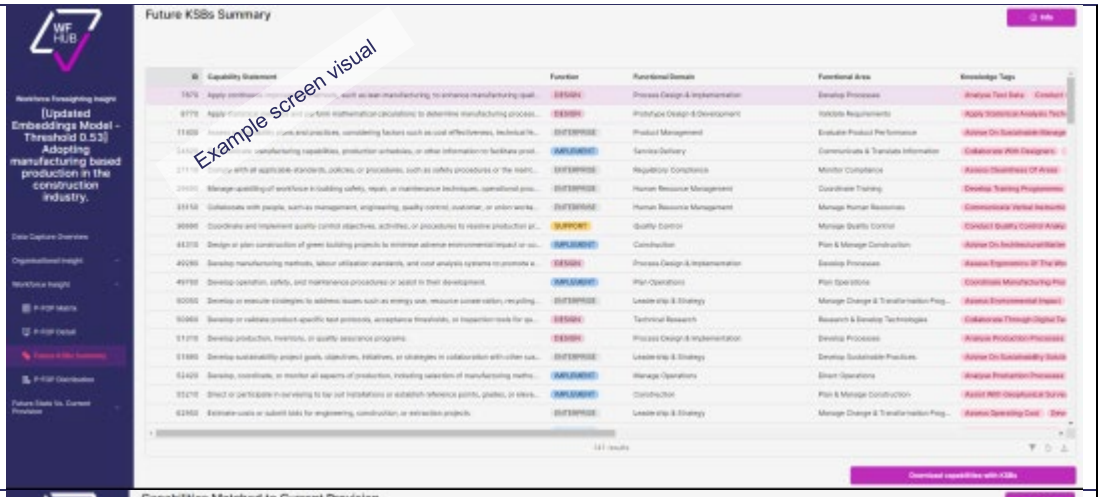
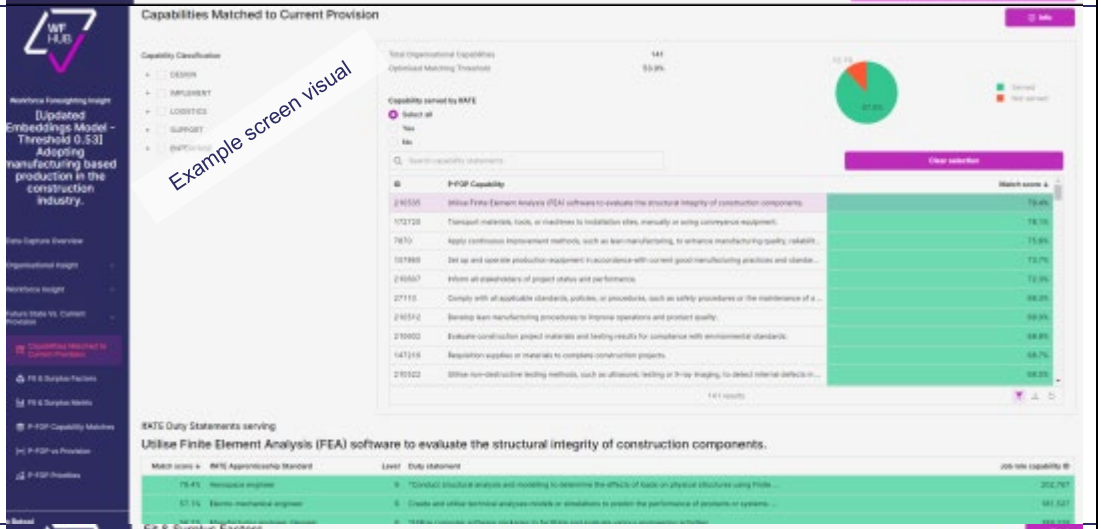
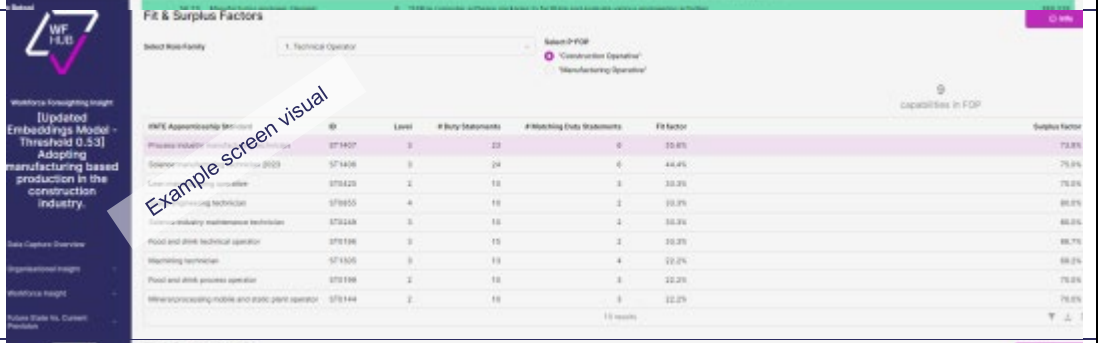
https://www.smmt.co.uk/2024/01/uk-auto-makes-one-million-vehicles-and-welcomes-23-7-billion-investment-boost

https://transportandenergy.com/2024/09/18/report-predicts-ev-and-battery-production-potential

4.7 – Visualisation links and Illustrations

Link to Visualisation	View of data
Data Capture Overview | HVMC Foresighting	
Organisational Capabilities | HVMC Foresighting	

Value Chain Capabilities | HVMC Foresighting	
Prototype Future Occupational Profile (P-FOP) Matrix | HVMC Foresighting	
Prototype Future Occupational Profile (P-FOP) Detail | HVMC Foresighting	

[Future KSBs Summary | HVMC Foresighting]	
[match_explorer - 3.0 | HVMC Foresighting]	
[Fit & Surplus Factors | HVMC Foresighting]	
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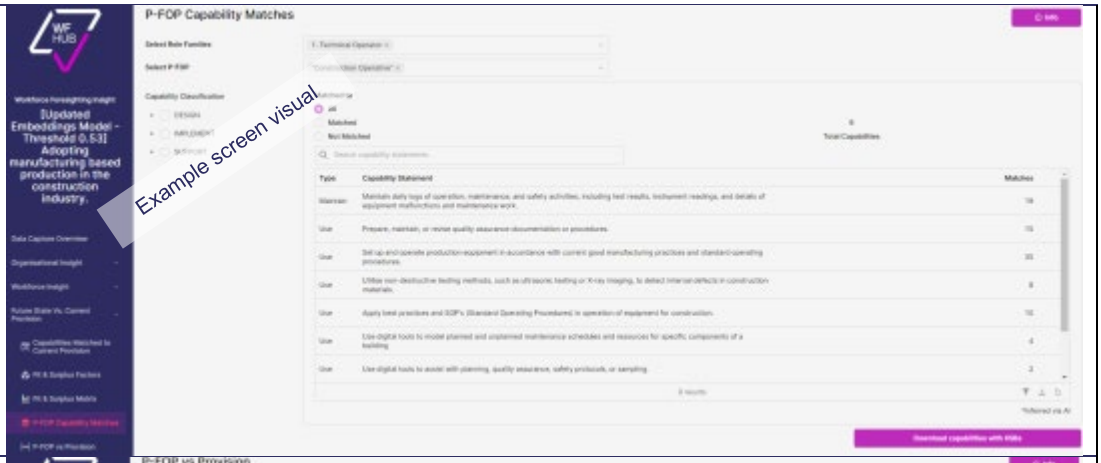
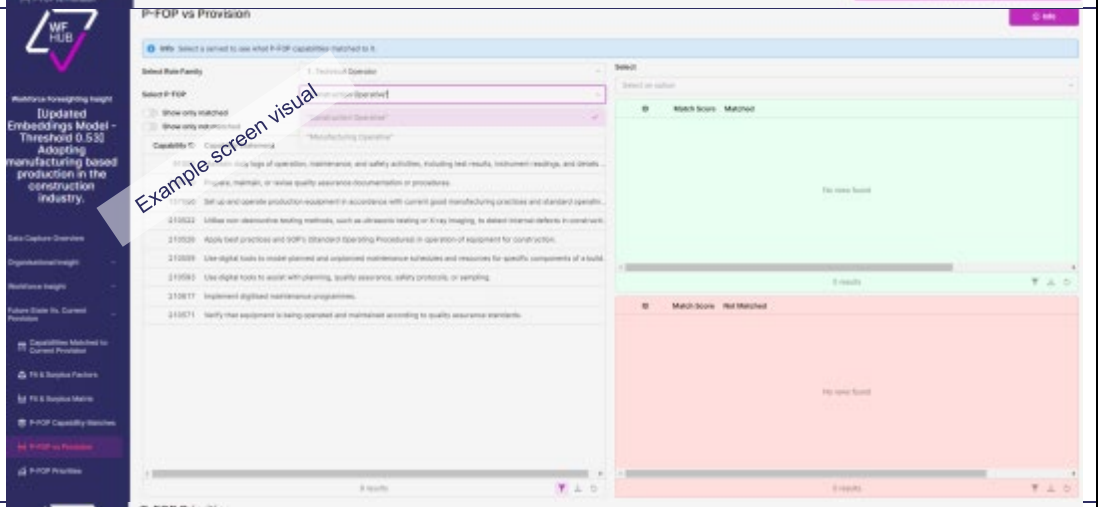
[P-FOP Capability Matches | HVMC Foresighting]	
[fop_vs_provision - 3.0 | HVMC Foresighting]	
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4.8 – Supply Chain Capabilities

This is an overview of the identified capabilities at a Supply Chain / Workflow Partner level and shows how the supply chain organisations' workforce structure needs to change to deliver the required capabilities.

Supply Chain Partner	Example of required change to deliver capabilities
Gigafactory	**Technicians and Operators**: • **Change Examples**: **Training**: Implement short courses on operating automated systems, understanding hazardous materials, and advanced safety protocols. **Technology Adoption**: Introduce robotics for assembly, automated quality inspection tools, and IoT-enabled production monitoring. **Processes**: Transition from manual handling to semi-automated workflows, integrating digital manufacturing execution systems (MES). • **Capability Outcome**: Enhanced efficiency in production lines, reduced errors, and better safety compliance. **Supervisors and Line Managers**: • **Change Examples**: **Training**: Leadership and logistics programs focusing on automation and digital inventory management. **Technology Adoption**: Adoption of warehouse management systems (WMS) and real-time tracking tools for materials and dispatch. **Processes**: Shift to data-driven decision-making for logistics and operational efficiency. • **Capability Outcome**: Improved coordination of production and material flow, supporting large-scale operations. **Senior Engineers and Managers**: • **Change Examples**: **Training**: Advanced programs in system design, automation, and sustainability practices. **Technology Adoption**: Integration of AI for design optimisation and predictive maintenance. **Processes**: Agile workflows for iterative prototyping and scaling production capabilities. • **Capability Outcome**: Leadership in innovation and large-scale production, ensuring competitiveness and sustainability.
Quality Assurance	**Technicians and QC Specialists**: • **Change Examples**: **Training**: Targeted courses on automated quality systems, statistical process control (SPC), and data analytics. **Technology Adoption**: Use of digital inspection systems and predictive analytics for quality monitoring.

	Processes: Replace manual checks with sensor-based inspections and real-time quality data dashboards. • **Capability Outcome**: Enhanced quality control processes with minimal disruptions and improved compliance. **Managers and Senior Engineers**: • **Change Examples**: **Training**: Programs in regulatory compliance, sustainability standards, and advanced quality systems. **Technology Adoption**: Digital twin technology for simulating and forecasting quality performance. **Processes**: Establish cross-functional frameworks for proactive issue resolution and regulatory adherence. • **Capability Outcome**: Robust quality systems and compliance mechanisms, supporting product integrity and market trust.
Regulators	**Compliance and Sustainability Officers**: • **Change Examples**: **Training**: Development of specialised courses in evolving regulatory frameworks, sustainability metrics, and environmental impact assessments. **Technology Adoption**: Implementation of data systems for tracking compliance and environmental performance. **Processes**: Introduction of automated compliance reporting and predictive risk assessment tools. • **Capability Outcome**: Effective monitoring and enforcement of standards, ensuring regulatory adherence across the supply chain. **Senior Engineers and Regulatory Experts**: • **Change Examples**: **Training**: Advanced knowledge-sharing programs on regulatory technology integration and international standards. **Technology Adoption**: AI-driven analysis tools for assessing compliance risks and sustainability improvements. **Processes**: Collaborative frameworks with industry stakeholders to align regulatory requirements with manufacturing innovations. • **Capability Outcome**: Enhanced capacity to set, monitor, and adapt regulations in line with industry advancements.

Summary of Key Changes by Supply Chain Partner

1. **Gigafactory**: Focus on automation, safety, and scaling production capabilities through advanced systems and processes.
2. **Quality Assurance**: Elevate quality systems using automation, analytics, and compliance integration.
3. **Regulators**: Modernise regulatory frameworks with technology-driven tools and collaborative approaches for sustainability.