National
Engineering
Policy Centre

Royal Academy
of Engineering

ENGINEERS 2030

Final report

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Foreword

Engineers 2030 is a policy initiative launched to reimagine the engineering and technology skills needed for a future where both people and planet can thrive. It set out to challenge conventional perceptions of engineering and explore how engineering knowledge, skills, and behaviours are evolving in this century and how the engineering workforce must adapt to meet the challenges ahead.

As a product of the National Engineering Policy Centre, this project represents the collective efforts of many individuals and groups: the working group members, consultation roundtables, survey respondents, the Professional Engineering Institutions, and the Academy's Engineering and Skills Committee. Particular thanks must go to the Phase One Chair, Andrew Churchill OBE FREng. His leadership was instrumental in launching this project and agreeing the Engineers 2030 Vision and Principles.

From the outset, we recognised the challenges of our undertaking, given the range of differing perspectives across the engineering profession. Stakeholders bring valuable and diverse views, coupled with a shared ambition to ensure that any recommendations are measurable, realistic and effective in helping the UK to secure the engineering skills required in the era of artificial intelligence and electrification.

The Phase Two Working Group has built on this strong foundation, translating the Vision and Principles into a set of clear, actionable recommendations. These are supported by practical actions and aligned with existing initiatives led by EngineeringUK, the Engineering Council and others. We appreciate that responsibility for addressing the skills challenge cannot rest with a single organisation alone. Collective ownership is required across the profession. Accordingly, the outcomes of Phase 2 are not an extensive engineering skills manual and neither are they intended to be. The Engineers 2030 project has considered three interconnected challenges: future skills, system capacity and career accessibility. While the primary focus has understandably concentrated on skills, the working group acknowledges that capacity and access to engineering careers also have significant influence and must not be overlooked.

The recent establishment of the Royal Academy of Engineering's Skills Centre provides an ideal platform to ensure that the Engineers 2030 recommendations remain visible and that progress continues. This will help sustain momentum toward the project's overarching goal: a resilient, inclusive and future-ready engineering workforce.

I encourage all members of the profession to engage with the Engineers 2030 recommendations, to consider their value, and to act upon them proactively and urgently. Engineers 2030 is not the end of a conversation, it is the beginning of change. It invites us to shape a profession that reflects the values and diversity of the society it serves, and to ensure that engineering continues to drive innovation, prosperity and sustainability for generations to come.

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Introduction

Engineers 2030 is a strategic initiative of the National Engineering Policy Centre, a partnership of 42 professional engineering organisations, led by the Royal Academy of Engineering that looks ahead at the skills needs of the UK engineering workforce in the 21st century. This work was undertaken over 18 months and draws on wide stakeholder engagement across the whole of the UK, policy analysis and evidence gathering.

The Vision and Principles articulated in this report reflect a collective ambition to state what it will mean to be an engineer or technician in 2030 and beyond, as someone who is not only technically excellent, but also socially responsible, trusted by the public and commercially aware.

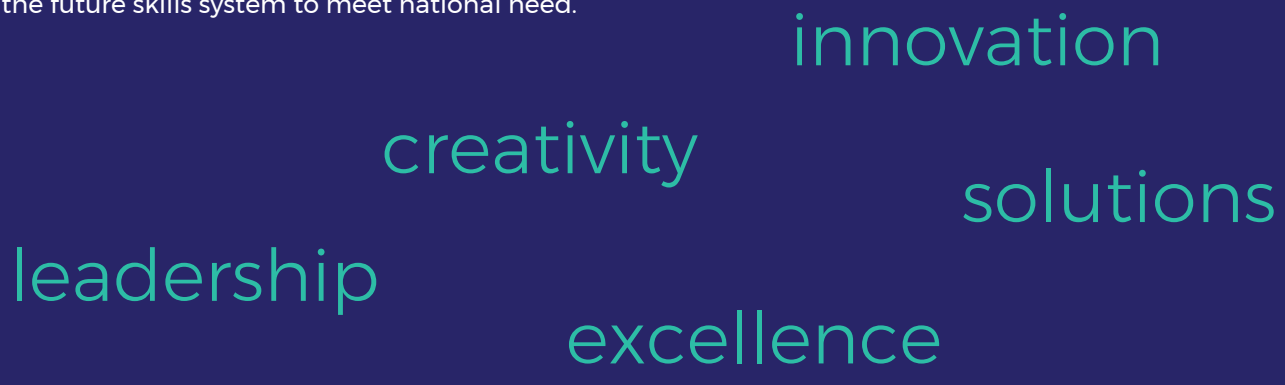
The subsequent sections set out the changes needed to the skills system to deliver the engineer of the future, in sufficient numbers and in the right places. It comprises:

- an analysis of the current state of engineering skills in the UK, examining how the different phases of education and training support the development of those skills.
- the needs of a future skills system, drawing from evidence of demand being felt even now.
- recommendations for the actions needed to deliver the future skills system to meet national need.

This report is grounded in evidence from ideation workshops, national and regional roundtables, literature reviews, and policy research and analysis. It incorporates insights from employers, educators, and engineers and technicians themselves, and is informed by recent research into the needs of the UK education and skills programmes, its communities and the upskilling priorities of the engineering industry.

The recommendations presented here are not exhaustive but are designed to be catalytic. They call for updated and dynamic curricula, coordinated national strategies, and greater ambition for a simplified technical and further education, that continuing educational development, which is easily accessible by individuals and companies.

Together, they aim to ensure that engineering remains a vital, accessible, and aspirational profession that is aware of and capable in its role of driving sustainable growth, technological innovation, and environmental regeneration.



Executive summary

The critical challenges facing the UK have brought the skills and capabilities of engineers and technicians into the spotlight. We simply cannot meet our ambitions for a more sustainable, resilient, secure and prosperous country without equipping our workforce with the right skills, at the right time, and in the right places.[1] This need is recognised in a huge range of activities from the recent UK government's Industrial Strategy and sector-specific skills strategies, the Lifelong Learning Entitlement, local skills improvement plans and the creation of Skills England. However, the scale of activity has not yet provided widespread confidence that such needs will be met.

The UK benefits from outstanding engineers and technicians, and the quality of its skills are a strength in attracting investment.[2] However, as this report sets out, challenges such as the climate and biodiversity crisis mean that we need huge shifts in the number and diversity of engineering skills available.[3] Additionally, the pace of change in technology and the ethical and technical challenges they present mean that engineering skills need to evolve just as rapidly, to stay ahead of need.

Engineers 2030 is both a manifesto for future engineering skills and a wakeup call. It provides a picture of the engineers and technicians the UK will need in future decades, and it sets out the bold changes that will be needed across the skills system to deliver those capabilities.

A Vision and Principles for 2030

The picture of the future engineer and technician is set out in our Vision and Principles. It has been agreed with the wider profession and used to create a guiding framework for creating future engineers and technicians.

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Engineers 2030: Vision

By 2030, engineers play an urgent and pivotal role in sustainable growth, technological development and environmental regeneration with all sectors of engineering working inclusively and across fields.

Engineers are demonstrating leadership, creativity and technical excellence by implementing solutions that shape the future and enable society to navigate immediate challenges.

Engineers 2030: Principles

1. Resilient and future-facing – we navigate the changes that occur rapidly in our career by embracing adaptability, continually developing our skills and knowledge, and collaborating across engineering disciplines.

2. Socially responsible and inclusive – we draw on broad ranging perspectives and communicate widely, including with marginalised groups, to create, design, and implement solutions that work for everyone.

3. Trusted by the public – we recognise our professional ethical responsibilities in designing, creating, and building a better future for people and the planet.

4. Integrated approach – we manage and understand uncertainty in all its forms and work collaboratively to find creative and integrated solutions.

5. Data and digitally fluent – we embrace digitisation, including artificial intelligence, and are skilled in working at the interface between the digital and physical worlds as they continue to merge.

6. Commercially and economically literate – we generate knowledge within enterprise by using our technical knowledge and skills in creative ways for sustainable and equitable growth.

We envision the engineer of 2030 and beyond playing an urgent and pivotal role in sustainable growth, technological development, and environmental regeneration with all engineering sectors working inclusively and across fields.

The report sets out the principles that will underpin that vision, which are discussed in Chapter 1.

The skills system we need

To enable the engineer of 2030, the future skills system must be characterised by three qualities:

1. **Future focused**.
   Engineer and technician formation must begin with a broad and ambitious conception of the engineer and technician of 2030, situated in the context of future technological development and societal and environmental need.
2. **A systems approach**.
   The UK urgently needs a coherent, spatial-temporal approach to aligning skills development with national needs.
3. **Accessible to all, at every point**.
   Careers and learning are a lifelong journey, so we need an ambitious, flexible, person-centred education and skills system, easy for companies and individuals to engage with, as part of a profession that is open and welcoming to all communities.

1. Future-focused

Engineers 2030 is based upon extensive engagement with the engineering community, in all sectors and across the country, on the nature and capabilities of the future engineer and technician. This vision rejects the cliché of engineers and technicians as resources implementing others' decisions, but sees them as leaders, demonstrating creativity and technical excellence by implementing solutions that shape the future and enable society to navigate immediate challenges.

Curriculum development, especially at further and higher education levels, must reflect and work towards that vision and accompanying principles. The Academy's new Skills Centre will provide some of the infrastructure needed to facilitate that change.

This is not a single, once and for all change, but a continual process of updating and adapting, and the future skills system must therefore be sufficiently dynamic and flexible to keep pace with technological, environmental, economic, and social needs, overseen by systems of accreditation and regulation that maintain excellence while enabling positive innovation in a rapidly changing world. This

> The engineer and technician of 2030 must draw on a range of perspectives to deliver outcomes that work for all. To achieve this, employers, educators, and PEIs must enable and accelerate the growth of a diverse engineering workforce and inclusive cultures across engineering

report therefore recommends that all parties support a re-examination of how the process of accrediting higher education programmes as part of the process of registration (AHEP) is applied in practice.

Recommendations

1. *All those with responsibility for designing engineering and technical education in further and higher education must ensure the Engineers 2030 Vision and Principles that set out a blueprint for the future engineer and technician are integrated into their curricula, using models that combine breadth, depth, and cross-cutting capabilities.*
2. *To enable Recommendation One, the Royal Academy of Engineering's Skills Centre together with the Professional Engineering Institutions, should initiate and facilitate the adoption of modernised curricula and teaching methods across engineering education.*
3. *The Engineering Council is reviewing the learning outcomes of the AHEP and should also review the programme recognition process including how AHEP is applied in practice. This review should draw on the support of the Academy and receive the full engagement of the Professional Engineering Institutions, university engineering departments and teaching staff. It should comprise a collective reconsideration of how the design, practices and understanding around accreditation can best promote excellence, both by maintaining high technical standards and by enabling timely adaptation to changing needs.*

2. A systems approach

UK enterprise and industry, and the skills systems of England, Wales, Scotland and Northern Ireland, are hugely complex systems, with a myriad of connections and dependencies within and between them. A central theme of Engineers 2030 has been the need to take a more coherent, systemic approach to those systems, for the benefit of both the UK and of individual engineers in their lifelong journey through education and employment.

Such a system needs to recognise that there are more areas of commonality than difference between sector needs. It also must avoid the overreliance on disconnected interventions seen in the myriad of sector-specific skills initiatives across multiple administrations.

A national plan for the skills system can never be neat, nor complete, but a more coherent systems approach is nonetheless essential. The principles of such a system are that it must be data driven; must strike the right balance of national strategy and local subsidiarity; and must be forward-looking and based upon the needs of tomorrow not just today. It must be funded sustainably and in a way that recognises our wider national objectives; and it must be a partnership between the education and employment systems, on fair terms, making it as easy as possible for each partner to contribute.

Recommendations

4. *Government must develop a holistic, long-term plan for all engineering skills across all education stages, addressing growth across all sectors.*
5. *The government should lead a cross-sector mechanism to track and forecast engineering skills supply and demand working with partners within the higher education sector, the Professional Engineering Institutions, and the Royal Academy of Engineering. This must include a detailed mapping of national and regional needs and must acknowledge uncertainty while enabling planning that is robust across a range of future scenarios.*
6. *Government should align its industrial and education policy by reviewing the cost and funding of delivering practical and laboratory-based subjects underpinning its Industrial Strategy ambitions, and must support their financial sustainability at school, further education and higher education level.*
7. *Employers must consider themselves a fundamental part of the skills system, both by supporting formal education and by providing excellent ongoing learning in the workplace.*[4] *Government should reduce barriers and complexity to employers providing employees with the development they need, especially SMEs and micro-businesses. For instance,*

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Engineers and technicians who combine human curiosity, creativity and practical problem-solving skills are the true drivers of change

strategic authorities should drive collaborative approaches to workforce upskilling for smaller employers, such as expanding the presence and remit of group training associations.

3. Accessible to all, at every point

While national strategies can help shape the direction of travel, innovation is ultimately driven by individuals. Engineers and technicians who combine human curiosity, creativity and practical problem-solving skills are the true drivers of change. The skills system must therefore be designed around the needs and experiences of individuals and the organisations they work in.

Technical and further education play a fundamental role in the skills development of engineers and technicians. It is therefore vital that this type of training is made easier to access, both for individuals seeking to upskill or retrain, and for the organisations providing training opportunities. Simplified qualification routes, improving modular learning formats, and ensuring alignment with occupational standards will help create a more coherent and inclusive system. This is especially important for smaller employers and for learners navigating career transitions, who often face barriers in accessing flexible and responsive education pathways. The system as a whole must be inclusive of all communities, enabling the contribution of a diverse range of perspectives.

Recommendations

8. *The system of apprenticeships and technical qualifications is complex, and hard for individual learners and companies to navigate. Government should continue its work to:*

- *simplify the complex apprenticeship standards by taking a discipline rather than sectoral approach and involve education providers more directly in the development of standards,*
- *institute a more collaborative approach to providing apprenticeships to engage more employers in supporting apprentice training. Governments across the UK should increase support for this collaborative approach through models such as Flexi-job apprenticeship agencies and Group Training Associations,*
- *improve the provision of careers education, information, advice and guidance in schools and for the wider working public.*

9. *Training and skills acquisition by a practising engineer or technician should be recast into flexible and responsive modules, fundable through the Growth and Skills Levy, which can be stacked into a qualification or skills passport. Such a system will make it easier for individuals to showcase their capabilities, move between companies and sectors, enter or re-enter engineering at different career stages, and map their skills to emerging fields.*

10. *The engineer and technician of 2030 must draw on a range of perspectives to deliver outcomes that work for all. To achieve this, employers, educators, and Professional Engineering Institutions must enable and accelerate the growth of a diverse engineering workforce and inclusive cultures across engineering. The Royal Academy of Engineering's Inclusive Cultures in Engineering Report 2023 sets out what employers must do to realise this essential goal, based on wide-ranging research.*

Chapter 1 | **Engineers 2030: Vision and Principles**

The Vision and Principles ask: what kind of engineer and technician does society need in 2030? And how must the engineering community evolve to meet that responsibility? Our new Vision and Principles for Engineers 2030 move us on from viewing engineers and technicians as resources or workers to get things done, to recognising them as people who "make things that work and make things work better." The future engineer and technician also shapes the direction of travel and, whose values guide the work they do. The Vision and Principles take a broad approach enabling each engineer and technician to interpret and apply them in ways that are meaningful to their individual roles and collective practice.

The heart of the Vision is a belief that the future engineer and technician must be more than a technical expert.

Vision

By 2030, engineers play an urgent and pivotal role in sustainable growth, technological development, and environmental regeneration with all sectors of engineering working inclusively and across fields.

Engineers are demonstrating leadership, creativity and technical excellence by implementing solutions that shape the future and enable society to navigate immediate challenges.

Engineers and technicians will need to enhance their leadership, creativity, and technical excellence, implementing solutions that shape the future and help society navigate its most pressing challenges. They will need to be creative, ethical, digitally fluent, socially responsible, and trusted by the public.

Drawing from workshops and consultations with engineers and technicians, educators, industry leaders and policymakers, this Vision extracts a collective desire to overhaul engineering for a more sustainable, equitable, and reliable future. It is a guide for world designers, builders and shapers – not a rulebook, but a call to lead with purpose.

A new path for engineers and technicians

The past decade has revealed the depths of global problems. Climate emergencies, a pandemic and rising social tensions are putting our society and infrastructure systems under strain like never before while accelerating digitalisation is changing how we all live and work. Yet within this complexity lies enormous potential for transformative change, if we choose to seize it.

The engineer and technician of 2030 will need to retain their core competencies and knowledge of science, maths, technology and innovation that they do today, alongside non-technical competencies in engineering and community leadership. However, success in 2030 demands more than just expertise in those areas. It requires enhanced creativity, ethical leadership, systems thinking, and the ability to work

Principles

1. Resilient and future-facing – we navigate the changes that occur rapidly in our career by embracing adaptability, continually developing our skills and knowledge, and collaborating across engineering disciplines.

2. Socially responsible and inclusive – we draw on broad ranging perspectives and communicate widely, including with marginalised groups, to create, design, and implement solutions that work for everyone.

3. Trusted by the public – we recognise our professional ethical responsibilities in designing, creating, and building a better future for people and the planet.

4. Integrated approach – we manage and understand uncertainty in all its forms and work collaboratively to find creative and integrated solutions.

5. Data and digitally fluent – we embrace digitisation, including artificial intelligence, and are skilled in working at the interface between the digital and physical worlds as they continue to merge.

6. Commercially and economically literate – we generate knowledge within enterprise by using our technical knowledge and skills in creative ways for sustainable and equitable growth.

across disciplines. The next decade is a moment of evolution for our profession and the practice of engineering, best met by adherence to, and underpinned by, our Principles.

The six Principles of Engineers 2030

Principle one | Resilient and future-facing

Engineers and technicians must navigate rapid technological and social change by embracing adaptability, continuous learning, and cross-disciplinary collaboration. This principle responds to the accelerating pace of innovation and the evolving nature of engineering roles, particularly in digital, sustainability and renewable energy sectors.

To manage and thrive in this environment of rapid change, engineers and technicians need to demonstrate professional resilience. This involves embracing flexibility, remaining receptive to new concepts, and continually upgrading skills. With new technologies such as artificial intelligence and sophisticated modelling taking centre stage in our line of work, engineers and technicians need to stay at the leading edge, learning how to blend new tools with conventional know-how.

Resilience also suggests an acceptance that things will go wrong. Rather than fearing to fail, engineers and technicians must engage in ordered problem-solving, critical thinking, and a commitment to continuous improvement. In doing so, engineers and technicians will not only be prepared for change but be leading it, developing a profession that remains trusted, forward looking and relevant in the decades to come. We must therefore engage in continually reforming engineering curricula and ensure teaching methods are leading edge so that engineers and technicians of the future have the flexible skill sets necessary to adapt to rapid technological developments and evolving roles within engineering.

Principle two | Socially responsible and inclusive

Engineers and technicians must engage with diverse communities, communicate clearly, and design solutions that work for everyone. This principle addresses the need for inclusive design and the underrepresentation of marginalised groups in engineering.

Engineering exists to serve society. That fundamental reality must be evident in everything that engineers and technicians do. In the coming years, engineers and technicians must give greater attention to understanding the communities they're serving — focusing on the right questions, engaging many different groups, and listening for the voices of those who are not always heard.

Inclusive design will become the standard, with engineers and technicians considering how their work impacts people of all backgrounds and needs. Communication will be paramount: presenting technical solutions in straightforward language ensures openness and trust, engaging in community dialogue and helping to shape their understanding of change. By placing social responsibility at the heart of engineering practice, we can create systems, technologies, and infrastructure that work for all

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people not just the majority. We must therefore change curricula to ensure they are inclusive and adapt workplace cultures to ensure engineering reflects and serves all communities, especially those underrepresented in the engineering workforce

Principle three | Trusted by the public

Engineers and technicians must uphold ethical standards, prioritise sustainability and safety, and communicate transparently. This principle reflects the importance of public trust in engineering decisions, especially in areas like artificial intelligence, infrastructure, and climate action.

Trust is a fundamental asset that engineers and technicians must possess to have the legitimacy to make changes to our systems, society and landscapes. Engineers and technicians have earned the public's trust through their role in building the modern world, but trust must be earned every day. This means placing sustainability and safety into each design decision and maintaining the highest standards of ethics and technical excellence.

In a sea of misinformation, engineers and technicians must be honest voices, explaining risks and uncertainties while correcting errors when they occur. Trust grows when engineers and technicians are open and accountable, when we respond to questions, and when we are dedicated to learning from failure and success. Maintaining public trust is not only good for the profession, but essential for creating a better world. We can help build and maintain that trust by ensuring the profession's system of regulation reflects these principles, and by promoting and following the Royal Academy and Engineering Council's Statement of Ethical Principles.[6] Trust also involves listening to the concerns of society, and public dialogue and inclusive engineering practices are key to this.

Principle four | Integrated approach

Engineers and technicians must apply systems thinking to solve complex, interconnected challenges across technical, environmental, and social domains. This principle responds to the increasing intricacy of engineering problems and the need for holistic, long-term solutions.

Modern challenges don't come in neat, compartmentalised boxes. They are complex, inter-related, and multidimensional. Engineers and technicians must therefore tackle problems by taking a systems thinking mindset, understanding how technical decisions interact with environmental, economic, and social factors.

Systems thinking involves designing for long-term impacts, anticipating consequences unforeseen by other, and envisioning solutions that are robust to future uncertainties. It also involves collaborating - across disciplines and sectors, and co-designing solutions with non-engineers, technicians and communities. This systems approach ensures that engineering delivers sustainable, resilient solutions that last over time. This Principle also informs our calls for a systems-based approach to skills planning and robust forecasting to ensure education and employment systems are aligned with national and regional needs.

Principle five | Data and digitally fluent

Engineers and technicians should be confident in understanding and using data and digital tools, as well as making ethical decisions about emerging technologies. This principle reflects the growing demand for digital fluency and the integration of AI and data science into engineering practice.

The digital revolution is transforming every aspect of society, and engineering is no exception. Tomorrow's engineers and technicians must be as comfortable with data and digital technologies as previous generations were with steel, concrete, and mechanical systems.

This fluency goes beyond the use of new tools. It's about understanding their strengths and weaknesses and making ethical decisions about their use. Engineers and technicians must lead the responsible adoption of artificial intelligence and machine learning and ensure these technologies are used to enhance, not undermine, the integrity of the profession. In embracing digital fluency, engineers and technicians can unlock new possibilities for innovation while keeping people and planet at the heart of progress. It is therefore critical that we emphasise the integration of digital fluency into curricula, teaching methods and professional development pathways to meet the demands of a data-driven future.

Principle six | Commercially and economically literate

Engineers and technicians must understand market dynamics, resource constraints, and value creation to deliver sustainable and scalable solutions. This principle addresses the need for engineers and technicians to contribute to economic resilience and innovation, especially for micro, small and medium sized enterprises and in regional contexts.

Engineering excellence must go hand in hand with commercial awareness. Today's engineers and technicians are expected to balance innovation with practical value delivering solutions that are not just technically sound but also sustainable, scalable, and economically viable.

This encompasses continuing to be responsive to the demands of the market, understanding resource constraints, and being innovative in terms of how to generate value from innovation. Engineers and technicians should be able to provide advice on value for money, develop solutions aligned with business goals, and shape industries that are economically successful, yet socially and environmentally sustainable. Commercial awareness will allow engineers and technicians to translate great ideas into practical reality. We must also address the financial sustainability of engineering education and the connected role of employers in workforce development, particularly in SMEs and regional contexts.

The Engineers 2030 Vision and Principles is a call to action. It invites engineers and technicians to play a broader role as leaders, collaborators, and custodians of the future. The six Principles of resilience, inclusivity, public trust, systems thinking, digital fluency, and economic awareness define the behaviours and values that will bring this Vision to life. Together, they provide a framework for how engineers and technicians can help society navigate the critical decades ahead and the challenges that will shape a sustainable, inclusive, and progressive future.

This Vision and Principles are not part of a checklist or a rulebook. They are a direction of travel, a reminder that engineering is not only about solving today's problems but also future building. The world needs engineers and technicians who are ready to step up, to lead with integrity, and to create a better world for generations to come.

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Chapter 2 | **Current state of the profession**

The UK has many truly outstanding engineers and technicians, yet the sector faces persistent and evolving challenges in ensuring that the workforce is equipped with the right skills, at the right time, and in the right places

The engineering profession is central to the UK's ambitions for economic growth, technological leadership, and a transition to a sustainable future. From infrastructure and energy to advanced manufacturing and digital innovation, engineers and technicians play a pivotal role in shaping the future of the UK's economy and society. The UK has many truly outstanding engineers and technicians, yet the profession faces persistent and evolving challenges in ensuring that the workforce is equipped with the right skills, at the right time, and in the right places.

The UK's engineering education and skills systems are shaped by unique factors, including:

- a devolved education and skills policy landscape
- the legacy and uncertain future of its relationship with Europe and the world in relation to mobility and skills recognition
- new national policies such as an Industrial Strategy, Lifelong Learning Entitlement, and recent and forthcoming curriculum reforms
- regional disparities in skills demand and supply.

The UK's overall science, technology, engineering and mathematics (STEM) workforce comprises of 12.7 million people, and it represents a significant component of the country's 32.7 million labour force. As a sector it has seen rapid growth at: over 22% since 2013, far outpacing that of other sectors in the economy.[6] Within STEM, engineering is a foundational pillar supporting the UK economy, with over 6.4 million people employed in engineering-related roles, nearly one-fifth of the total UK workforce.[7]

Of these, around 4.2 million work in core engineering occupations, while a further 2.2 million contribute through adjacent roles in architecture, construction and technical services (Figure 1).[8]

The importance of engineering skills within the UK economy, combined with government policy choices, technology advancements and social demands, means that demand for engineering skills will remain strong into the future.

Digital technologies, including software development, artificial intelligence, and cybersecurity, are among the fastest-growing areas.[9] The UK's commitment to achieving net zero by 2050 has also accelerated demand for engineers and technicians in renewable energy, energy efficiency, and sustainable infrastructure.[10] Civil and structural engineers and technicians are essential to delivering major infrastructure projects, while advanced manufacturing continues to evolve through robotics, automation, and materials science. Biomedical engineering and health technology are also expanding, reflecting the increasing convergence of engineering and life sciences, while materials and mining engineering skills will maintain their importance even as we transition to the circular economy.

Labour market projections from Skills England suggest that engineering occupations will experience one of the highest rates of employment growth by 2030, outpacing non-priority sectors by a factor of 1.6. The Clean Energy Industries priority

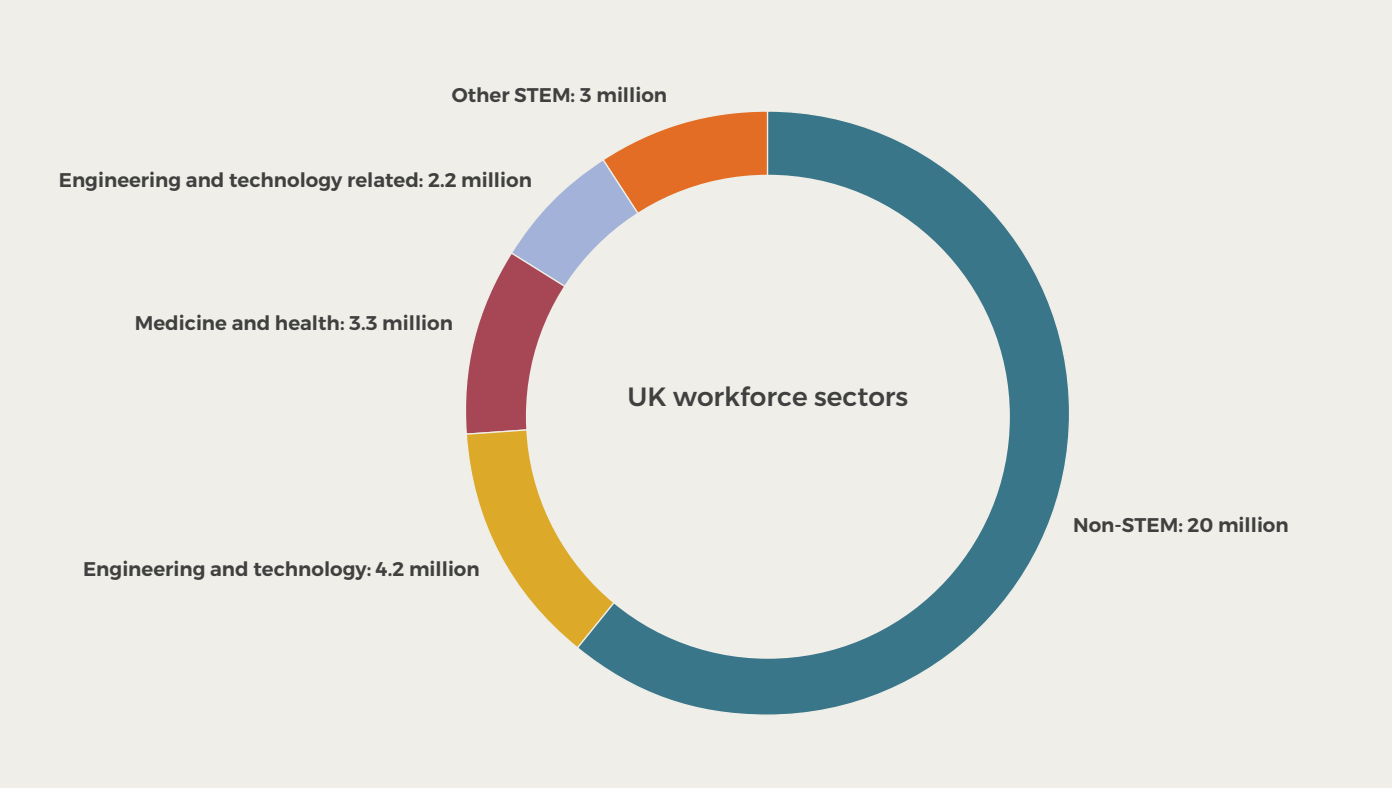

Figure 1 | **The UK workforce** [Rounding discrepancies may apply]

sector as identified by the government, is alone predicted to see job growth of 77% by 2030.[11] EngineeringUK reports that one in four job adverts in the UK now relate to engineering, underscoring the industry's systemic and sustained demand.[12]

However, this demand is not evenly distributed across the country. While London and the South East continue to host the largest number of engineering jobs, their proportional share has declined. Growth is increasingly concentrated in regions such as the North West, West Midlands, and Yorkshire and the Humber, driven by industrial clusters and infrastructure investment. These regional differences highlight the importance of place-based skills strategies and targeted interventions to ensure equitable access to engineering careers.[13]

With engineering roles projected to grow faster than most other sectors, and demand increasingly shaped by regional, technological, and societal shifts, the need for a resilient and responsive skills pipeline has never been greater. Meeting this demand requires a clear understanding of how individuals enter and progress through engineering education and training. The following section explores the current pathways into engineering, from early STEM engagement in schools to technical qualifications, apprenticeships and higher education and considers how well these routes are serving learners and employers.

The current engineering education pathways

The supply of engineering talent in the UK is shaped by a complex and evolving system of education, training, and professional development. From early STEM engagement in schools to advanced technical qualifications and lifelong learning, the pathways into engineering are diverse, but not always coherent or accessible.

Schools

Engineering education in the UK begins with STEM subject engagement at school level. While overall participation by students in engineering related subjects is good, persistent challenges remain regarding splits in STEM enrolments according to gender. Research carried out for the Royal Society and EngineeringUK indicates a steady decline of girls interested in science and computing at school of 10% from 2019 to 2023.[14] Ultimately this split then

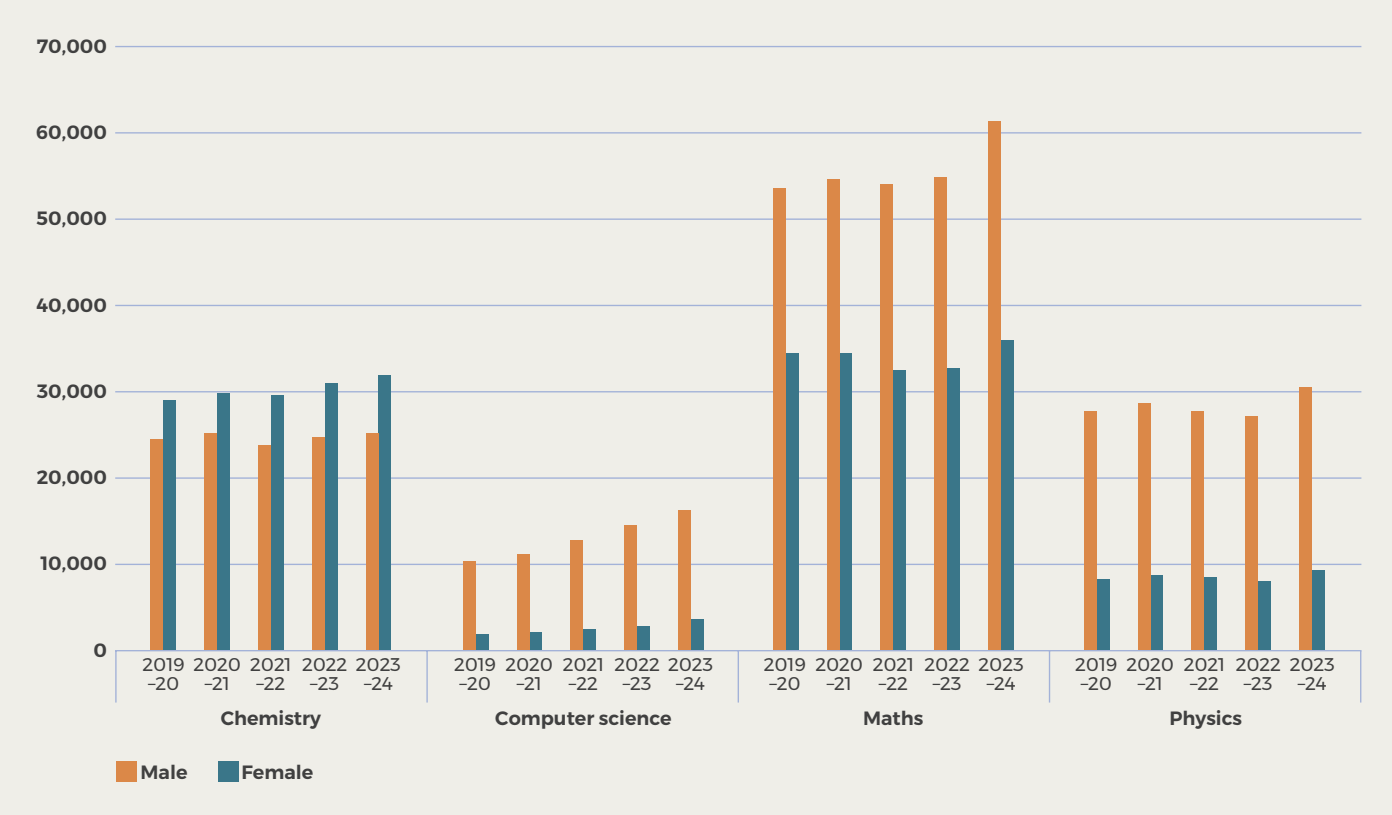

Figure 2 | **A level entries to selected A levels (2019 – 2024)**

influences the composition of students choosing post-school engineering education and training and has later consequences for the composition of our engineering and technician workforce.[15]

Recent GCSE and Scottish National 5 results show an overall stable picture on the number of enrolments and grade achievements across STEM subjects across genders. However, there is a significant difference in boys' and girls' enrolments in non-compulsory STEM subjects such construction, computing, and design and technology (Figure 2).[16]

At the A level and Scottish Higher stage of schooling most recently, there was a small decline in computing A level, but an increase in Scottish Highers students taking design and technology (albeit from a low base) from 2024 to 2025. For A level, there were more male student entries in STEM subjects with a particularly noticeable difference in further mathematics, computing and physics, despite small increases in the number of female students in these subjects. In Scotland, STEM subjects saw small increases in 2025 in enrolments but like A level, stark differences in gender enrolments in engineering science, computing science and physics appear.[17]

These enrolment differences feed a further challenge in the transition to engineering higher education and careers: only 8% of women studying maths and physics at A level progress to engineering or technology degrees, compared to 23% of men.[18] EngineeringUK notes that the implications of this disparity for women studying engineering at higher education levels are a "stark gender divide, with only 18% of those studying undergraduate degrees in engineering and technology being female, compared to 57% for all degree subjects combined."[19]

There have been significant efforts across the engineering community to develop teaching resources to help introduce STEM learning and experiences into the classroom.[20] Similarly, projects, competitions and events all play an important role in drawing in and exposing students to STEM.[21] In engaging with educators throughout this project it was clear what needs to be done to accelerate improvements in student engagement and attainment for all cohorts. Government authorities and the engineering community institutions should continue to support the review of curricula to ensure it is relevant to young people, their concerns and life experiences while perceived and actual biases are

> A more flexible and responsive model of learning is also needed, one that is simplified and enables individuals to build skills incrementally and adaptively throughout their careers

removed from teaching materials. Further, an overall improvement in funding for STEM infrastructure is required to bring these subjects to life and not be a textbook exercise alone.

Further education

Further education plays a critical role in the education and skills system, particularly in the development of technicians and upskilling the existing technician workforce. Yet there is widespread concern across the engineering profession and employers that the system is not working effectively for UK engineering while funding across further education settings is now 11% lower per student in real terms than in 2010–11.[22] This makes the recent government announcements of additional funding for engineering skills particularly welcome.[23]

This report calls for greater employer involvement in the formative education of engineers and technicians. However, financial and bureaucratic complexities make it difficult for many businesses to engage. An additional issue for the further education sector is the confusion for students, parents, careers advisers and employers face in the breadth of learning outcomes and qualifications, from entry-level programmes supporting young people at risk of becoming Not in Education, Employment or Training (NEET), to Higher National Certificates, Higher National Diplomas, Higher Technical Qualifications and degree-level qualifications.

At the same time, the sector has faced frequent reforms. T levels were a recent reform introduced into an already crowded qualifications landscape. Now, the government intends to replace government funded BTECs for 16–18 years with a new V level qualification. As a potential avenue into an engineering career, V levels are a welcome development, but they must be introduced so that continuity in vocational training is maintained during the transition between qualifications. Teaching infrastructure, knowledge and capacity must be protected so that the new qualification can be delivered successfully.

While T levels have faced criticism,[24] their core principles of, alignment with national apprenticeship and employer-defined occupational standards, is sound. This ensures their learning outcomes have labour market relevance. Yet uptake remains low: only 5,643 students completed T levels in engineering, construction, and digital subjects in 2025.[25] A gender divide is starkly evident in T level take-up as well. Women make up just 12% of students who are completing an engineering or technology related T level in 2024.[26] Employer engagement with the mandatory 45-day work placement has been limited,[27] leaving some students unable to complete their courses. Universities have also struggled to interpret the engineering learning outcomes, making them hesitant to offer degree places to T level graduates.[28]

Alongside the challenges of providing T levels, their uptake depends on pupils at 16 or younger being willing to specialise in a single subject and potential career pathway at Level 3. This requirement to specialise early narrows the pool of potential applicants, as it limits flexibility compared to other pathways, such as BTECs / V levels or A levels, which can be taken in combination and allow students to keep multiple options open.

That said, the qualifications landscape is overwhelming, with over 16,800 post-16 qualifications available, of which nearly 3,700 are in engineering and related industries, offered by more than 120 awarding bodies – complexity that may damage employer engagement and understanding.

A more flexible and responsive model of learning is also needed, one that is simplified and enables individuals to build skills incrementally and adaptively throughout their careers. Modular and stackable learning formats, which can be combined into recognised qualifications or skills passports, offer a practical solution. These approaches make it easier for learners to showcase their capabilities, transition between sectors, and re-enter engineering at different career stages. For employers, particularly smaller businesses, they provide a more agile way to upskill staff in response to emerging technologies and market needs.

The government's announcement to introduce and prioritise funding for short flexible, engineering learning modules (called "apprenticeships units")

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Improving careers education, information, advice and guidance is essential to ensuring that individuals can make informed decisions about entering and progressing within engineering

is a welcome development.[29] The system that determines which apprenticeship units are government funded must balance agility that aids rapid unit creation and deployment that keeps pace with technological development with maintaining educational standards that protects learners and employers. The Royal Academy of Engineering stands ready to assist government in developing this system.

Students at all stages of education (as well as those not currently in education) also need better access to high-quality careers support to navigate which pathways may suit them best and how to access them (including access to facilitating qualifications where necessary). Improving careers education, information, advice and guidance is essential to ensuring that individuals can make informed decisions about entering and progressing within engineering. At present, careers support is unevenly distributed across the education cycle, with many learners, particularly those in further education, from underrepresented groups, or returning to learning, facing limited access to tailored guidance. The government's commitment to provide better careers advice at school and in the community is welcomed but can only be realised through appropriate funding commitments and comprehensive roll-out plans.[30]

Research from EngineeringUK and the Careers Research and Advisory Centre highlights that early and sustained exposure to engineering careers significantly improves uptake and retention. However, many places of education lack the resources or expertise to deliver high-quality careers education, information, advice and guidance.[31] Moreover, adults seeking to retrain or re-enter the workforce often struggle to navigate complex qualification routes and funding options. A coherent, lifelong approach to careers guidance, integrated across schools, colleges, universities, and community learning providers, is needed to support diverse entry points into engineering and ensure that talent is not lost because of a lack of information or opportunity.

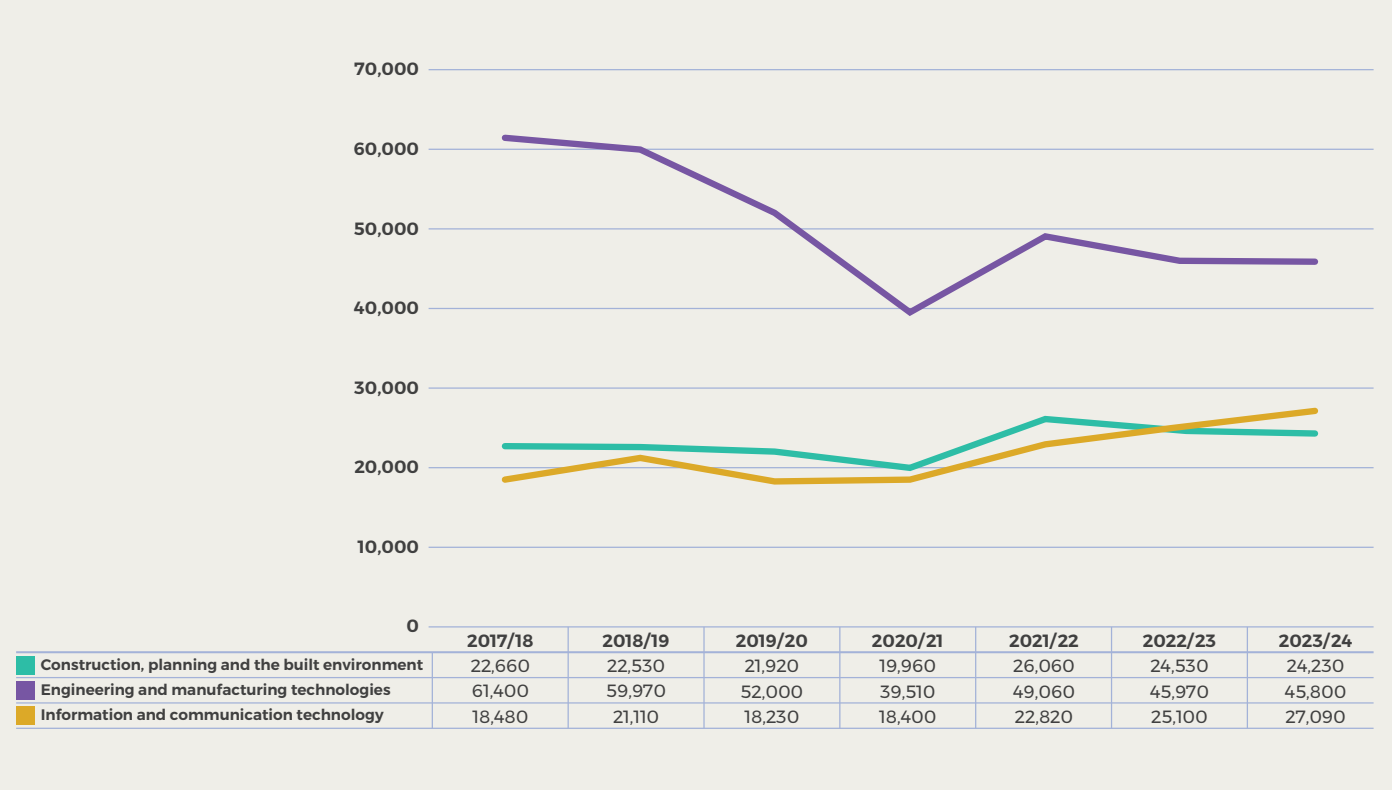
Apprenticeships and technical education

Apprenticeships and technical education are essential to the UK's engineering skills supply system. EngineeringUK data shows that 20% of those in engineering roles have completed an apprenticeship, compared to just 6.4% across the general workforce.[32] Yet uptake remains uneven across regions and demographics, and many employers find the system difficult to navigate.

Skills England has identified engineering as a high-demand industry, calling for expanded access to approved technical and higher technical qualifications.[33] Across the devolved administrations, new strategies are emerging. In Wales, a forthcoming Vocational Education and Training Strategy will focus on so-called green jobs, which are usually technical or engineering jobs, local labour needs and parity of esteem between academic and vocational pathways.[34] Northern Ireland's Green Skills Action Plan provides a framework for workforce development and sustainability related engineering roles.[35] Scotland is pursuing a wider reform package. These efforts are vital to meeting future workforce demands.

However, since the introduction of the Apprenticeship Levy in 2017 (now Growth and Skills Levy), overall apprenticeship numbers in England have declined in engineering and manufacturing technologies (-25%), with only modest growth in construction (7%) but a more substantial increase in ICT (47%) (Figure 3).

Diversity within apprenticeships remains a challenge: women make up just 17% of engineering apprenticeship starts (Figure 4), while minority



	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
Construction, planning and the built environment	22,660	22,530	21,920	19,960	26,060	24,530	24,230
Engineering and manufacturing technologies	61,400	59,970	52,000	39,510	49,060	45,970	45,800
Information and communication technology	18,480	21,110	18,230	18,400	22,820	25,100	27,090

Figure 3 | **apprenticeship starts in engineering and related sector subject areas (2017/18 – 2023/24)**[36]

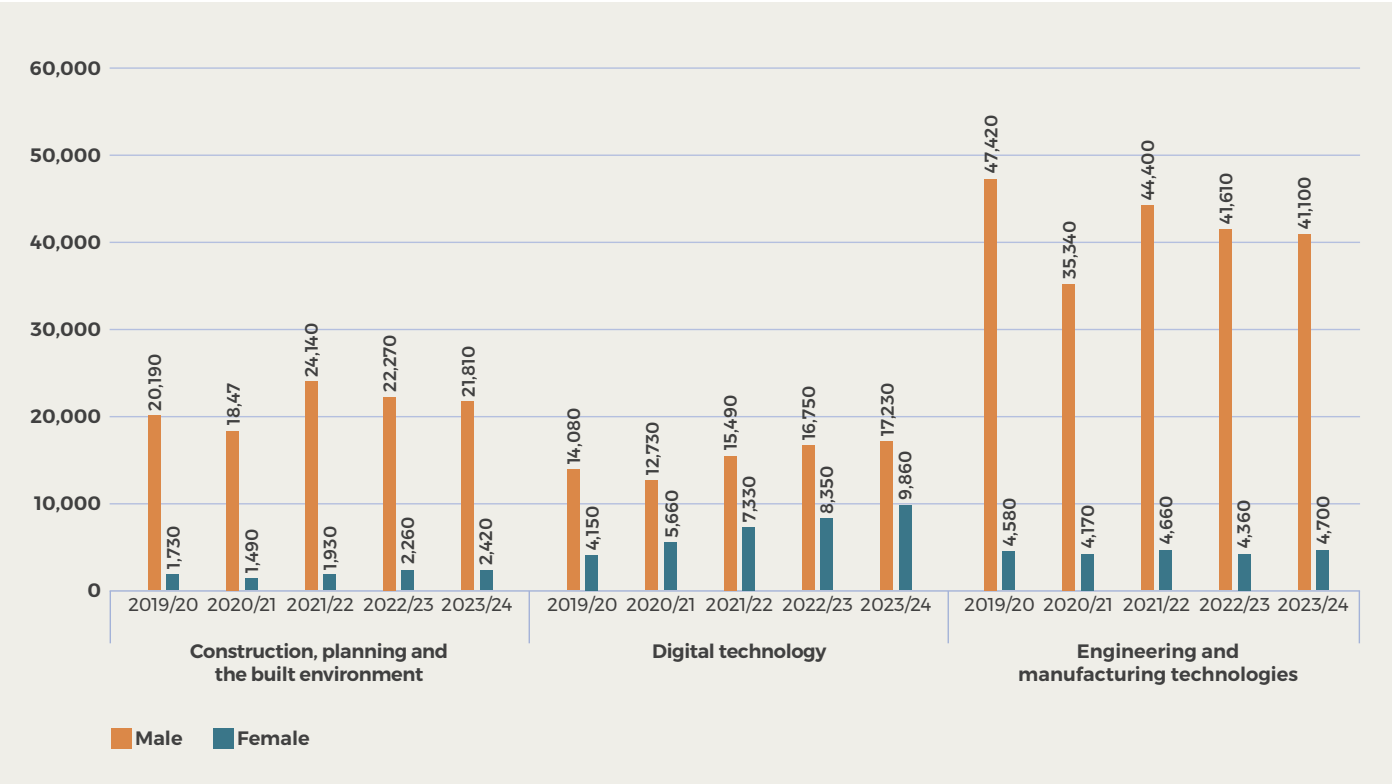


Figure 4 | **apprenticeship starts by gender for engineering and related sector subject areas**[38]

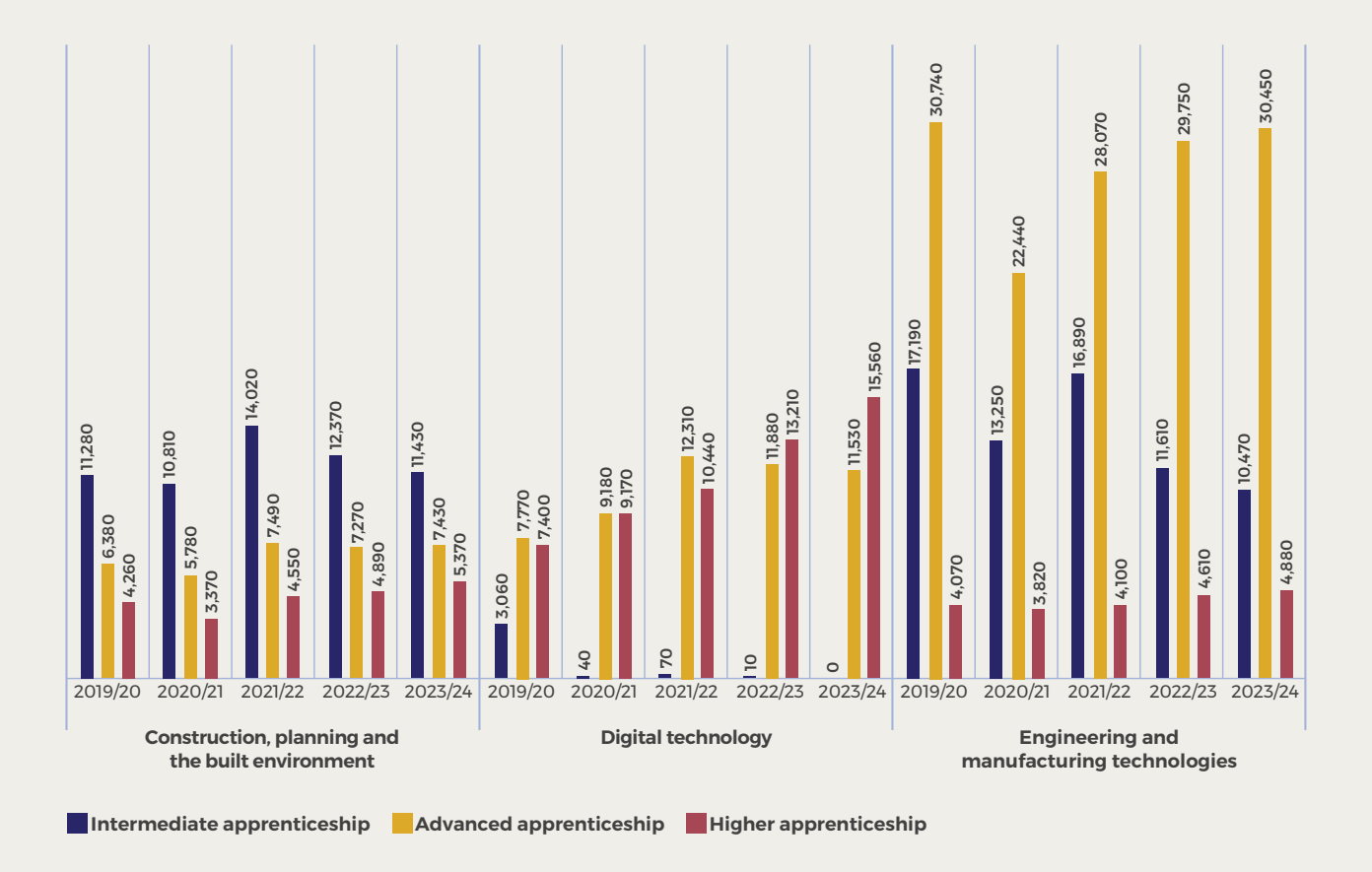


Figure 5 | **apprenticeship starts by level for engineering and related sector subject areas (England only)**[39]

ethnic groups represent 14%.[37] Improving the take-up and retention of underrepresented cohorts within apprenticeships is vital to reaching the number of engineers and technicians needed in the UK.

There has also been a drop in lower-level apprenticeships (Level 2+3, Intermediate), which are key to craft and technician roles (Figure 5).

As in further education, duplication and complexity appear in engineering apprenticeships. Multiple standards often exist for the same discipline. For example, electrical engineering appears across automotive, rail, and maritime sectors. This proliferation stems from early employer enthusiasm and government encouragement via the Institute for Apprenticeships and Technical Education (IfATE), but it has led to fragmentation and over specialisation. Employers designed standards to suit specific business needs, rather than taking a broader, profession-wide view that might also better support apprentices' future career mobility. Professional bodies were slow to engage, further entrenching sectoral silos.

This report calls for a simplification of apprenticeship standards, shifting from sector-specific to discipline-focused apprenticeships. The core principles of electrical engineering, for instance, are consistent across sectors with contextual differences addressed through on-the-job training. This approach aligns with the Engineers 2030 vision of a more adaptable, integrated workforce, able to apply skills flexibly and across industrial sectors.

A discipline-based model would also foster greater collaboration among employers. For many SMEs, the administrative burden of engaging with apprenticeships is too high. Even those who do participate often lose apprentices to competitors offering higher pay after training investments have been made, a symptom of a system lacking cohesion.

A more collaborative model is needed, where groups of employers share responsibility for training. Flexi-Job Apprenticeship Agencies are the latest incarnation of this collaborative approach in England, with models such as Apprenticeship Training Agencies and Group Training Associations (GTAs) being earlier offerings.

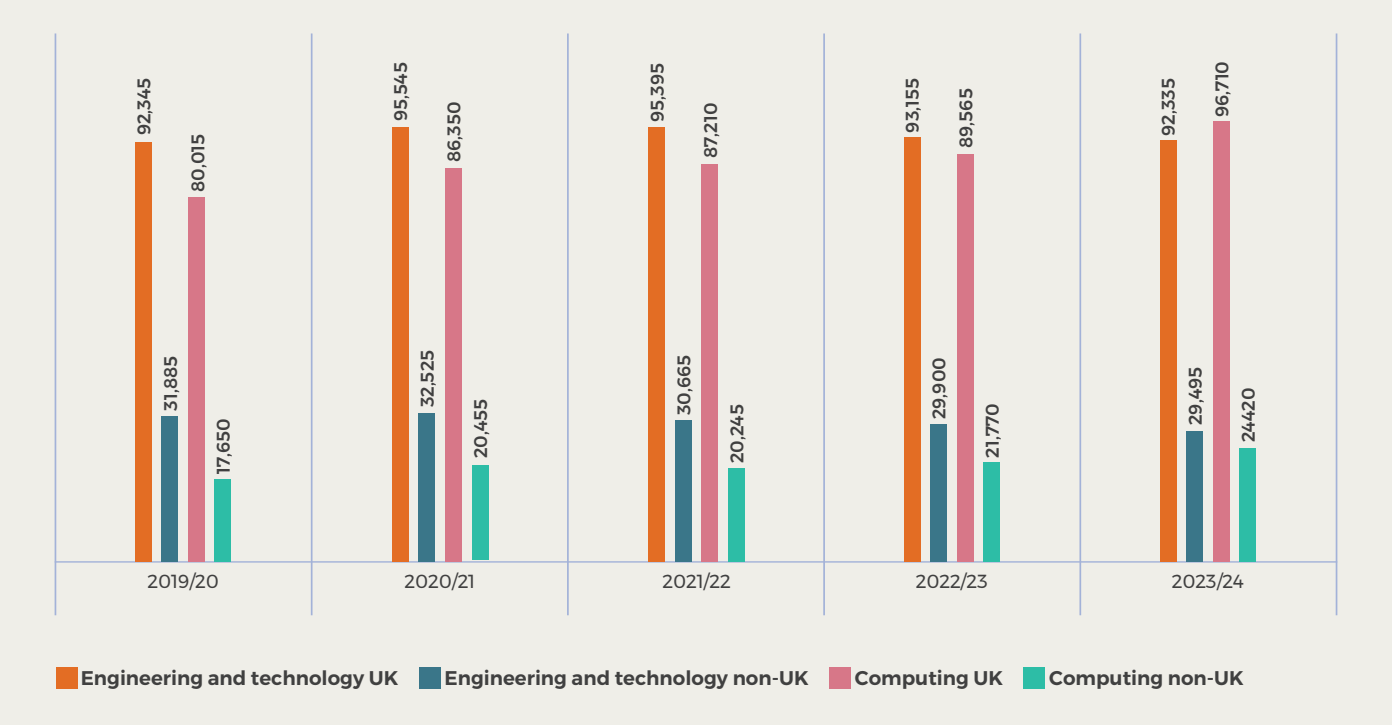


Figure 6 | **first degree starts in undergraduate engineering degrees 2019/20 – 2023/24 (UK and international domicile)**[41]

These models offer a proven solution, supporting SMEs by managing administration, coordinating with providers, and ensuring apprentices gain relevant experience across partner companies. In some cases, further education colleges already play this coordinating role.

To scale this model, government support across all UK administrations is essential. Only with coordinated backing can more employers, particularly SMEs, engage meaningfully in apprenticeship training and help build a resilient, future-ready engineering and technician workforce.

Higher education

Engineering higher education in the UK plays a pivotal role in supporting national innovation, infrastructure development, and economic competitiveness. With a rich tradition of excellence, UK universities have long been global leaders in engineering research and teaching. However, the sector faces a complex mix of systemic challenges and emerging threats to its continued provision across the country.

UK universities continue to enjoy a strong international reputation for engineering education. Many of our higher education institutions are recognised globally for their research excellence and industry engagement. In 2023–24 there were over 120,000 students both UK and international, starting their first degree in engineering and technology and computing (Figure 6).[40] This means that in each year there were approximately one-quarter of students from overseas studying for an engineering or computing degree, highlighting their significant role in sustaining these degree programmes in higher education.

Engineering programmes in the UK span a wide array of disciplines that range from mechanical and civil engineering to emerging fields such as biomedical, environmental, and AI-driven systems engineering. Yet the distribution of students across engineering disciplines varies considerably (Figure 7).

As noted by the Department for Education's Supply of Skills for Jobs in Science and Technology report, while computer science and general engineering have seen growth, areas such as civil, mechanical, and electrical engineering face stagnation or decline.[43] This misalignment between education output and the labour market demand noted in this report is a recurring theme across UK skills policy. In higher education, it is mostly a product of funding incentives largely dictated by student choice rather than balancing choice with the labour market. There is an opportunity to make improvements to this

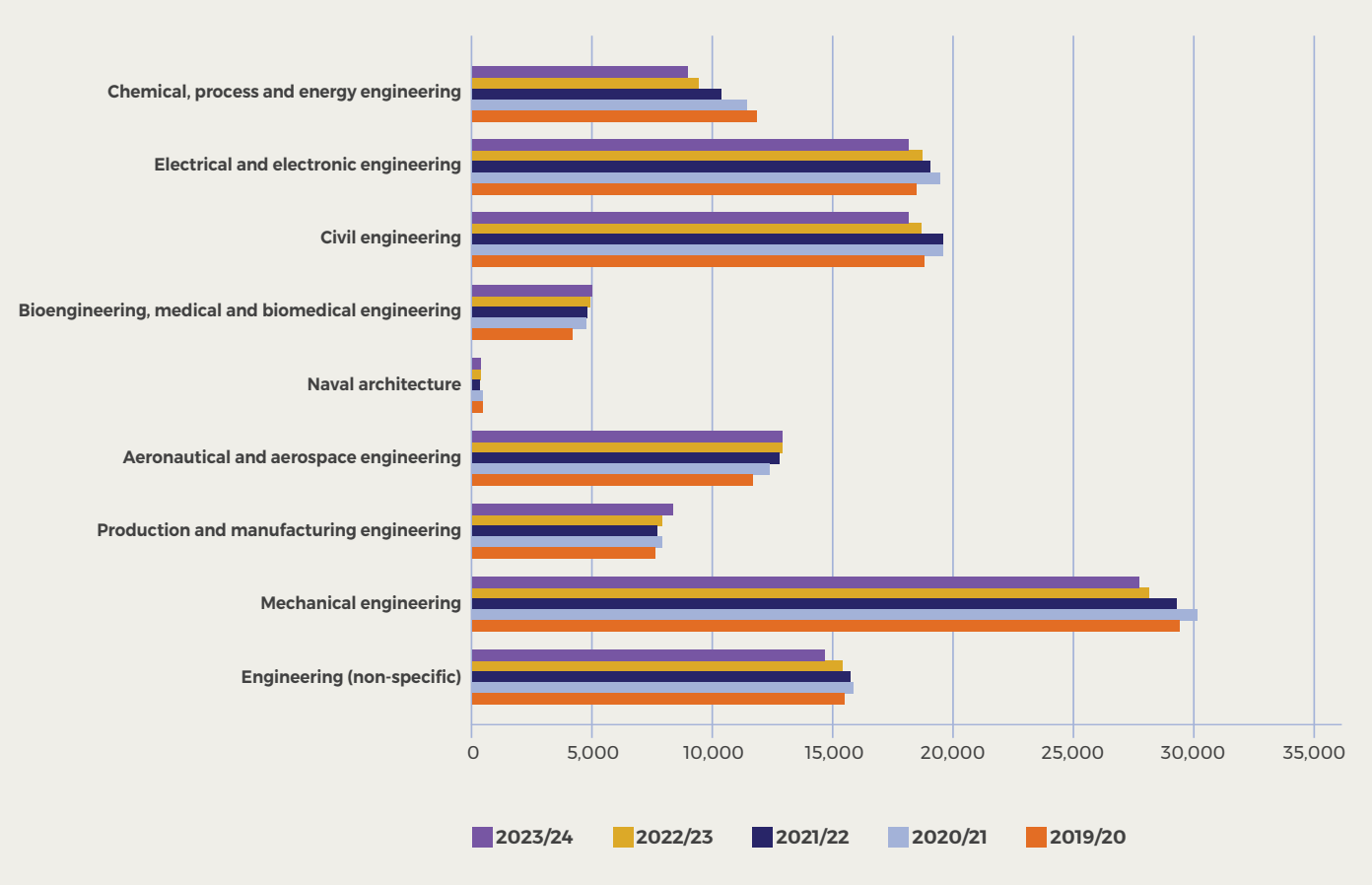


Figure 7 | **undergraduate first-degree starts by discipline**[42]

misalignment by using better and more consistent collection and analysis of data with respect to student interest, education provision, and industry needs. With the emergence of Skills England and its coordination role with similar bodies across the UK, now is the time to put in place mechanisms, with appropriate safeguards to collect the necessary information and make this and subsequent analysis available to all. This will enable better decision-making and lead to a closer alignment of skills needs and provision.

As with the further education and apprenticeship engineering routes, students rely on their course of study integrating with industry. Many engineering degrees include placements, live projects, and modules co-designed with employers, ensuring that graduates are equipped with practical skills and real-world experience. But finding placements with employers and industry remains a challenge for some. Ensuring adequate provision of places for work experience must be a priority for industry and higher education alike so that labour market needs are met and graduate engineer employability remains high.

Moreover, the UK's engineering education system benefits from a robust accreditation framework. The Engineering Council oversees AHEP, which ensures that degree programmes meet the UK Standard for Professional Engineering Competence. Accreditation is carried out by professional engineering institutions. These bodies ensure that graduates are prepared for professional registration and international mobility through accords such as Washington and EUR-ACE.

Yet, at workshops carried out in the nations and regions as part of this Engineers 2030 project, we heard differing views on the impact of these regulatory structures in practice. Some argued that they hindered innovation in course design and delivery while others suggested they simply upheld quality standards and left providers with appropriate flexibility. The fact that so many views were present on how accreditation requirements affect the delivery of higher education engineering programmes (quite separate from what the regulations contain) suggests a need to re-examine

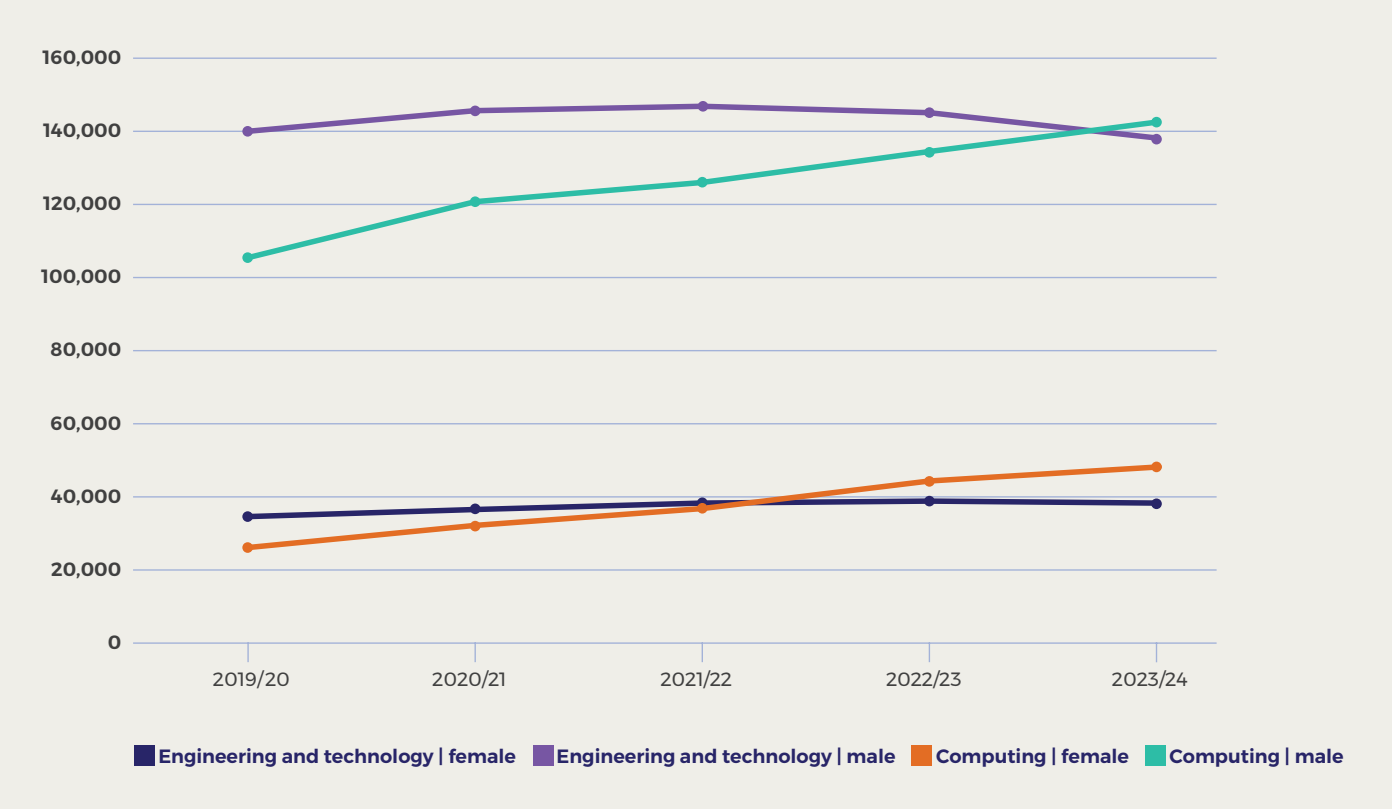


Figure 8 | **undergraduate first-degree starts by sex (UK only)**[44]

how accreditation is functioning in practice – a process that would require the commitment of all those in the chain from regulator to educator.

The sustainability of engineering education in UK universities is under threat from multiple directions. Financial pressures are among the most acute. With domestic tuition fees only recently increasing and inflation rising, many universities are struggling to maintain the viability of resource-intensive programmes like engineering.

Government changes to overseas student visa arrangements have dampened an important source of university income that funds expensive engineering courses. Further, proposed additional policies such as an international student tax on universities will only exacerbate their financial sustainability issues. Laboratories, specialist equipment, and technical staff all require significant investment.

As costs increasingly exceed income in engineering courses, strategic priorities grant funding does not sufficiently correct for the market forces and the. The provision of places on UK undergraduate engineering courses has also not kept pace with rising student demand. Without reform to funding models, or additional support, some institutions may be forced to reduce or even close engineering departments. A better alignment is needed between higher education funding and future labour market needs, beyond simply increasing student fees, and without creating disincentives to study technical disciplines.

Another area for improvement is diversity and inclusion. Engineering remains one of the least diverse disciplines in UK higher education. Women make up only around 20% of undergraduate entrants in engineering and technology but more recently up to 25% of computing undergraduates (Figure 8).[45] While overall there is better representation of ethnic diversity, it varies significantly across institutions and sub-disciplines and improvements could also be made for disabled people (10.5%) and those from lower socio-economic backgrounds (11.2%).[46] Addressing these disparities is essential for building a more representative and innovative engineering workforce that will go on to lead the cultural transformation needed in engineering workplaces.

Conclusion

Labour market data confirms strong and growing demand for engineering talent, particularly in digital, clean energy, and infrastructure-related roles. However, this demand is not matched by a coherent supply system. Fragmented governance, regional disparities, and misalignment between education outputs and industry needs continue to hinder progress. While initiatives such as the Industrial Strategy, Lifelong Learning Entitlement, and devolved skills plans offer promise, they require better coordination and integration to be effective.

The engineering education pathway, from early STEM engagement to tertiary education and apprenticeships remains uneven and, for some, inaccessible. Despite improvements in gender representation, significant barriers persist for underrepresented groups including people from minority ethnic groups and disabled people or neurodivergent people. The lack of parity between academic and vocational routes, coupled with limited awareness and fragmented support, will continue to constrain entry avenues of future engineers and technicians into the discipline.

This underscores the urgent need for a national strategy that aligns education, training, and workforce planning with the evolving demands of the profession. It calls for inclusive, place-based approaches, improved labour market intelligence, and stronger collaboration between government, industry, and educators. Addressing these challenges is essential to ensuring that engineering remains a dynamic, diverse, and future-ready profession capable of delivering on the UK's strategic priorities. Building on the challenges currently facing engineering education and skills, the following chapter explores the future capabilities engineers and technicians must develop to meet national priorities, and indicates the changes needed in the education and skills system and its connection to employment to deliver those capabilities.

> Despite improvements in gender representation and attainment, significant barriers persist for underrepresented groups including people from minority ethnic groups and people with disabilities or neurodivergence

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Chapter 3 | **Future state of the profession**

Introducing the Royal Academy of Engineering Skills Centre

The Skills Centre brings together expert knowledge from industry and education to help the UK engineering community keep up with rapidly evolving skills and technologies. Working in partnership with many skills organisations, professional bodies and research institutes, the Centre will provide support to colleges, universities, training providers and employers to ensure that engineering and technology skills meet employer needs now and in the future.

The Skills Centre is designed to support a wide range of users, including:

- **Employers looking to upskill their workforce**
- **Lecturers and educators searching for teaching resources**
- **Students and engineers eager to keep up to date with the latest technology developments**

It will do so by providing a blend of:

- **Skills research and analysis**
- **Skills development and innovation**
- **Skills transformation programmes**

The UK government is recognising some of these challenges in policy terms. The government's Industrial Strategy,[47] and Assessment of Priority Skills to 2030 led by Skills England, identify engineering as one of the industries with the greatest projected increase in employment demand.[48] These policies call for targeted investment in training and highlight the need for both entry-level and higher-level qualifications to meet future workforce needs. Complementing this is the Royal Academy of Engineering's Skills Centre, which will launch in 2026 and aims to support colleges, universities, and employers in adapting to rapidly evolving technologies and skills requirements.[49]

In its pre-election manifesto, the National Engineering Policy Centre also called for a National Engineering and Technology Workforce Strategy, advocating for a holistic approach to workforce planning that links sector skills plans with STEM education reform. Its policy priorities include improving careers advice, expanding apprenticeships, addressing STEM teacher shortages, and increasing diversity in the engineering workforce.[50]

Together, these government and NEPC policy initiatives reflect a growing recognition that engineering skills are central to the UK's economic resilience, technological leadership, and environmental sustainability. But they also underscore a deeper truth, that the skills and behaviours of the future engineer and technician must evolve in step with the changing demands of industry, society, and environment. Meeting this challenge will require coordinated action across government, education, and employers, not only to strengthen

the talent systems, but also to ensure that engineers and technicians are equipped with the right mix of capabilities to thrive in a fast-changing world.

The following section explores what some of those capabilities are. Drawing on the Engineering 2030 Vision and Principles, it outlines the technical and non-technical skills that will define the future engineer and technician and how we educate, train, and support them throughout their careers.

The skills of the future engineer

The Engineering 2030 Vision and Principles are grounded in wide consultation regarding what skills UK industry and society will need in the coming decades. These skills needs are already becoming apparent in the gaps and pinch points exposed by the demands of today's economy. Looking ahead, engineers and technicians must maintain their bedrock of technical skills but augment them with advanced digital and data, sustainability and decarbonisation skills. In addition, non-technical skills in leadership and communication will need to form part of an engineer and technician's capability set.[51]

Digital and data skills are among the most sought-after across engineering disciplines.[52] As highlighted by the Royal Academy of Engineering, the profession is undergoing a rapid shift toward data-driven and digitally enabled practices.[53] Engineers and technicians are increasingly expected to work with artificial intelligence, machine learning, and advanced simulation tools, yet many employers report a shortage of candidates with these capabilities.[54] Responses to these demands through new mechanisms such as the Royal Academy of Engineering's Skill Centre to support educators and employers in embedding digital fluency into engineering education and professional development pathways, are critical to a future engineer's success.

The effort to decarbonise the economy has also intensified the need for engineers and technicians with environmental, sustainability and circular economy expertise. According to EngineeringUK, engineering roles associated with renewable energy and sustainability have increased by over 50% in the past five years, with job postings requiring 'green skills' rising by nearly 48%.[55] However, many employers struggle to find candidates with systems-thinking approaches and knowledge of low-carbon technologies. The Office for Clean Energy Jobs, established by the UK government, identified engineering as a priority industry for renewable energy skills investment, particularly in relation to retraining and upskilling the existing carbon-intensive energy workforce.[56]

Beyond technical competencies, there is growing recognition of the importance of non-technical skills in the practice of engineering. These skills include such things as leadership, communication, collaboration, ethical reasoning, and entrepreneurial thinking. These skills are essential for engineers and technicians working in multidisciplinary teams, taking interdisciplinary approaches to practice and navigating complex societal challenges.

The need for a systems approach

To deliver these skills and behaviours, the UK must not only define what the future engineer and technician looks like but also review how its education and skills systems deliver an engineering workforce with these skills and behaviours. Just as engineers and technicians are increasingly required to adopt systems thinking in their practice, we can also apply a systems approach to workforce development.

The UK's education and skills system is a complex, interdependent system comprising individuals, schools, colleges, universities, employers, regulators, and professional bodies that must be aligned and responsive to emerging skill demands. Without system reform, including better data intelligence, joined-up planning, and agile qualification pathways, the ambition to equip engineers and technicians with digital fluency, sustainability expertise, and interdisciplinary skills will remain out of reach.

It is critical that there is shared understanding among interested parties of current and future workforce needs for the engineering education and skills system to effectively function. Yet persistent gaps in labour market intelligence continue to hinder effective planning. While the Assessment of Priority Skills to 2030 highlights engineering as an industry with rising demand,[57] it also reveals that existing data points lack the granularity to track emerging roles, hybrid skill profiles, and regional variations. This limits the ability of government, industry, and education providers to design timely and targeted interventions in the education and skills system.

To overcome this, the UK government must invest in more sophisticated data collection and analysis capabilities, including the use of AI to forecast skills demand and map evolving career pathways. Crucially, this intelligence must be shared across the system, across all UK governments, industry, educators and individuals to enable coordinated action.

Our places of education are essential pillars of the UK's education and skills system. Yet laboratory-based and resource-intensive programmes are disproportionately affected by funding shortfalls,

> Universities must be empowered to act as system integrators: collaborating with industry, shaping curricula around emerging technologies, and supporting lifelong learning through flexible pathways

threatening the UK's ability to scale up engineering talent in line with its Industrial Strategy. The financial pressures faced by further education is partially recognised by the government's £800 million funding announcement,[58] while the financial sustainability of engineering in higher education remains under increasing pressure.

Universities must be empowered to act as system integrators collaborating with industry, shaping curricula around emerging technologies, and supporting lifelong learning through flexible pathways. Sustainable funding enables universities to fulfil this role, ensuring that engineering education remains responsive, inclusive, and globally competitive. In a systems approach, universities are not peripheral, they are central nodes in a network of institutions that must work in concert to deliver the engineering skills of the future.

Accessible to all, at every stage

Continuing Professional Development (CPD) already holds an important place in an engineer and technician's professional commitment to maintain and enhance competence in their area of practice. The Engineering Council through Professional Engineering Institutions mandate the recording of CPD for registered engineers and technicians.[59] Despite this structured framework, systemic challenges or barriers and uneven access to CPD across the profession were identified. Engineers and technicians working in small and medium-sized enterprises, in rural and regional areas, or outside traditional professional networks face barriers to upskilling, including cost, time constraints, and limited awareness of available opportunities.[60]

To meet these professional and educational challenges, new, more inclusive approaches to CPD are required. These should include the expansion of micro-credentials and short-form learning that can be stacked into recognised qualifications or skills passports. Such modular formats allow engineers and technicians to build capabilities incrementally, responding to emerging technologies and shifting industry needs. These qualifications should be linked to occupational standards.

This flexibility is particularly valuable for individuals entering the profession later in life, returning after a career break, or transitioning from adjacent industries. For these cohorts, traditional qualification routes may be inaccessible or misaligned with their prior experience. Stackable CPD modules offer a practical and responsive pathway into engineering, enabling learners to demonstrate competence, gain recognition, and progress at their own pace. The government in its Post-16 Education and Skills White Paper now recognises the value in this approach to learning via its commitment to improve learner access to short courses and modular forms of study.

With such a system in place, CPD becomes more than a regulatory requirement, it becomes a strategic enabler of workforce agility. Employers can act quickly on skills gaps at lower cost, individuals can pivot into new roles in new sectors, and the profession as a whole can remain resilient in the face of technological and societal change. The UK's Lifelong Learning Entitlement, which will enable adults to access flexible and modular learning throughout their careers,[61] offers a promising mechanism to support this transformation.[62] By embedding stackable CPD into the wider education and skills system, we can ensure that engineering remains open, inclusive, and future-ready.

Improving equality, diversity and inclusion (EDI) in engineering is not only a matter of fairness, but also a strategic imperative for the profession's future relevance, resilience, and impact. As the Royal Academy of Engineering's Inclusive Cultures in Engineering 2023[63] report highlights, while perceptions of inclusion have improved, underrepresented groups continue to experience engineering as less inclusive, with persistent barriers such as microaggressions, hierarchical cultures, and limited progression opportunities. To build a truly inclusive engineering workforce in 2030, engineering must move beyond representation and focus on creating cultures of belonging, where all individuals feel valued, supported and able to thrive.

This requires coordinated action from us, the engineering community: employees, employers, professional bodies, and educators. At the educational level, EngineeringUK's Gender Pathways into Engineering and Technology initiative has mapped the complex system of influences that shape girls' and young women's journeys into engineering.

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We can accelerate building inclusive engineering workplace cultures, guided by evidence-based frameworks such as the Royal Academy of Engineering's Inclusive Cultures and EDI Engine reports

The initiative finds that girls are not the problem, the system is. Structural inequalities, gendered perceptions of engineering, and limited access to high-quality careers education all contribute to a 'chilly climate' that dissuades even girls interested in engineering. Key leverage points to bring about change include early career-related learning in primary school, whole-school approaches to gender bias, and user-led STEM activities featuring near-peer role models. These interventions have been shown to improve career readiness, challenge stereotypes, and increase uptake of subjects like physics and computing among girls. To build a truly inclusive profession, the education and skills system must embed these insights, ensuring that engineering feels relevant, welcoming and achievable for all learners, regardless of gender or background.[64]

We can accelerate building inclusive engineering workplace cultures, guided by evidence-based frameworks such as the Royal Academy of Engineering's Inclusive Cultures and EDI Engine reports.[65] These show that inclusive teams are more innovative, better at problem-solving, and more reflective of the communities they serve. By embedding inclusive practices into recruitment, career development, leadership, and workplace culture, engineering can unlock the full potential of its workforce. This will not only improve retention and progression for underrepresented groups, but also enhance engineering's ability to design solutions that are equitable, sustainable, and responsive to societal needs.

Looking ahead, engineering must embrace intersectional approaches to inclusion, invest in inclusive leadership, and ensure that EDI is hardwired into how we carry on the business of engineering. Doing so will help the profession attract the next generation of talent, build public trust, and deliver greater economic and social value. Inclusion is not a peripheral issue, it is central to engineering's mission to serve society and shape a better future.

Summary

The skills, behaviours, and systems that underpin the engineering profession must evolve to meet the demands of a rapidly changing world. While technical engineering excellence will remain essential, future success will depend on deepening and broadening competencies in digital fluency, sustainability expertise, systems thinking, and inclusive leadership.

Meeting these demands requires a shift in how the UK develops and supports engineering talent. The education and skills system must become more agile, data-informed, and inclusive. It must enable lifelong learning, simplify access to qualifications, and better connect education with employment. Crucially, it must recognise that engineering is a national capability, one that depends on coordinated action across all UK governments, industry, and places of education.

The recommendations in this chapter are not exhaustive, but they are achievable. They call for practical reforms: modernising curricula, improving data systems, aligning funding with strategic priorities, and embedding inclusive cultures. If delivered, they will help ensure that the UK has the engineering workforce it needs, not just for today's challenges, but for the opportunities ahead.

Chapter 4 | **Engineers 2030: Recommendations**

Engineering curriculum: Vision and Principles

The Engineers 2030 Vision and Principles set out a blueprint for the future engineer and technician. Future curricula must embody those principles, adapted to the level and context in which they are designed. Developing engineers and technicians who model the Engineering 2030 Vision & Principles cannot be achieved by endlessly adding to already complex curricula. In many cases this will involve a move to learning models that enable a combination of foundational breadth of engineering technical and non-technical knowledge and depth within engineering disciplines, sometimes termed T-shaped or Key-shaped models.

Recommendation One

All those with responsibility for designing engineering and technical education in further and higher education must ensure the Engineers 2030 Vision and Principles that set out a blueprint for the future engineer and technician are integrated into their curricula, using models that combine breadth, depth, and cross-cutting capabilities.

Facilitating curriculum change

Efforts to develop new curricula and pedagogy as called for in Recommendation One are often piecemeal and dispersed. The new Royal Academy of Engineering Skills Centre will provide a middle layer of infrastructure, working with Professional Engineering Institutions, skills organisations, professional bodies, research institutes and government, to help the UK engineering community keep up with rapidly evolving skills and technologies.

Recommendation Two

To enable Recommendation one, the Royal Academy of Engineering's Skills Centre together with the Professional Engineering Institutions, should initiate and facilitate the adoption of modernised curricula and teaching methods across engineering education.

University engineering education: accreditation and agility

Accreditation is the process of reviewing an engineering degree programme to judge whether or not it meets the defined standard set by the Engineering Council in the Accreditation of Higher Education Programmes (AHEP) which supports professional registration. Professional Engineering Institutions translate AHEP's principles into discipline-specific guides, along with other inputs including those from industry. One or more Professional Engineering Institution may accredit a degree, particularly where it spans several engineering disciplines. The Council is currently reviewing AHEP's learning outcomes; this is welcome and should align with the Engineers 2030 Vision and Principles.

How AHEP impacts upon the quality and dynamism of higher education engineering courses is a function not only of how AHEP's processes are designed and specified, but also how they are applied in practice. The beliefs and behaviours of all parties involved, including the regulator, Professional Engineering Institutions, universities and their departments, play a role.

We heard widely different views of how this process is functioning in practice. Some credit the system as maintaining standards while others, including university educators, appeal to it as binding their hands and reducing their scope to innovate; the lack of consensus and differing views on responsibility is unhelpful.

> Coherent national planning, building in optimum local subsidiarity, is urgently required if the country's ambitions are to be realised

This is a challenge for the profession as a whole. Beneficial change will require the commitment of all parties involved in accreditation to consider not just the role and design of AHEP but of their role and practice within it.

Recommendation Three

The Engineering Council is reviewing the learning outcomes of the AHEP and should also review the programme recognition process including how AHEP is applied in practice. This review should draw on the support of the Academy and receive the full engagement of the Professional Engineering Institutions, university engineering departments and teaching staff. It should comprise a collective reconsideration of how the design, practices and understanding around accreditation can best promote excellence, both by maintaining high technical standards and by enabling timely adaptation to changing needs.

A systems approach to skills

For too long there has been a fragmentation of skills policies driven by individual sector needs. While there has been a proliferation of initiatives, from STEM engagement in schools to sector-specific skills strategies and recruitment campaigns, a lack of coherence and coordination has led to different initiatives inadvertently competing for, or double counting the same resource, rather than growing and making best possible use of the skills and resources available. In addition, while devolution of skills plans to regional and local administrations has had the benefit of placing local employers in control of skills supply, it does not fully recognise the complex interplay between local and national skills needs, including hotspots created by locally sited national infrastructure. Coherent national planning, building in optimum local subsidiarity, is urgently required if the country's ambitions are to be realised.

Recommendation Four

Government must develop a holistic, long-term plan for all engineering skills across all education stages, addressing growth across all sectors.

Robust skills forecasting for engineering in the UK

Robust, timely data is a prerequisite for a national skills strategy. It has long been challenging for the engineering profession and policymakers alike to access sufficient clear data and intelligence to fully understand future skills needs across all engineering sectors across all parts of the UK. The access to timely, complete, and consistent data on the needs of industry and the capacities of our education and skills systems must be enhanced if we are to meet current and future requirements. Such data cannot be perfect, and forecasts cannot be definitive, so this approach must acknowledge uncertainty and enable planning that is robust across a range of future scenarios.

Recommendation Five

The government should lead a cross-sector mechanism to track and forecast engineering skills supply and demand, working with partners such as within the higher education sector, the Professional Engineering UK Institutions, and the Royal Academy of Engineering. Such data must include a detailed mapping of national and regional needs and must acknowledge uncertainty and while enabling planning that is robust across a range of future scenarios.

> To take higher education alone, engineering is seeing a welcome increase in demand among young people for study at university in the UK

Supporting the delivery of engineering education

Engineering is commonly more costly than many forms of education, requiring more hands-on experience and practical equipment, and yet this is generally not reflected in the way in which education is funded at school, college or university level. Therefore, while delivery of the country's Industrial Strategy requires a sharp uptick in technical skills, the financial incentives for institutions point in the opposite direction. A coherent skills system must correct this.

To take higher education alone, engineering is seeing a welcome increase in demand among young people for study at university in the UK. However, the vast majority of higher education representatives agree that UK student tuition fees do not cover the cost of provision, suggesting that these increases in demand cannot be sustainably met.

Recommendation Six

Government should align its industrial and education policy by reviewing the cost and funding of delivering practical and laboratory-based subjects underpinning its Industrial Strategy ambitions, and must support their financial sustainability at school, further education and higher education level.

Partnership across the skills system

Education is not something that only happens in schools, colleges and universities but is a lifelong journey. For technical subjects such as engineering, exposure to the needs and opportunities in business and industry provide essential context and inspiration. Employers can rightly expect high-quality school and college leavers, and university graduates. They must also recognise that they are more than just consumers of educated and skilled people but are a fundamental part of the skills system with an important role to play in workforce education and skilling. Drawing-in and deepening employer participation in the education and skilling of our engineering and technician workforce, both in the workplace and during initial foundational education, is crucial to its expansion and delivering economic growth in the UK. Yet participation requires capacity and an ability to navigate the complexities and demands of the skills system, which are consistently raised as barriers, particularly by the smaller organisations that comprise the backbone of UK engineering.

Recommendation Seven

Employers must consider themselves a fundamental part of the skills system, both by supporting formal education and by providing excellent ongoing learning in the workplace. Government should reduce barriers and complexity to employers providing employees with the development they need, especially SMEs and micro-businesses. For instance, strategic authorities should drive collaborative approaches to workforce upskilling for smaller employers, such as expanding the presence and remit of group training associations.

Making professional development easier

We should be particularly ambitious for technical and further education, which should be made simpler and easier for workers and employers to engage with, particularly smaller organisations with limited capacity. However, it is consistently reported that the system of apprenticeships and technical qualifications is complex, and hard for individual learners and companies to navigate.

> The Engineer of 2030 draws on a range of perspectives to deliver outcomes that work for all. To achieve an engineering and technician workforce of 2030 that is socially responsible and inclusive, and trusted by the public and communities in which we operate, we must attract and retain people from all parts of our communities

Recommendation Eight

The system of apprenticeships and technical qualifications is complex, and hard for individual learners and companies to navigate. Government should continue its work to:

- **simplify the complex apprenticeship standards by taking a discipline rather than sectoral approach and involve education providers more directly in the development of standards.**
- **institute a more collaborative approach to providing apprenticeships to engage more employers in supporting apprentice training. Governments across the UK should increase support for this collaborative approach through models such as Flexi-job apprenticeship agencies and Group Training Associations.**
- **improve the provision of careers education, information, advice, and guidance in schools and for the wider working public.**

Flexible skills acquisition

Employees and their companies are often much quicker to pivot to new needs than institutions and policies. As technologies are developed increasingly rapidly and time within industry to learn shortens, updating the current CPD methods to short course options which when combined lead to new qualifications, will lead to easier upskilling of the current workforce and accommodate people that need flexibility in their working arrangements. Such system will also facilitate individuals moving between companies and sectors, and to enter the profession from related industries outside engineering. Professional registration as a Chartered Engineer remains the gold standard method for accumulating and demonstrating skills and capabilities within a system that builds trust.

Recommendation Nine

Training and skills acquisition by a practising engineer or technician should be recast into flexible and responsive modules, fundable through the Growth and Skills Levy, which can be stacked into a qualification or skills passport. Such a system will make it easier for individuals to showcase their capabilities, move between companies and sectors, enter or re-enter engineering at different career stages, and map their skills to emerging fields.

Equality, Diversity and Inclusion

The Engineer of 2030 draws on a range of perspectives to deliver outcomes that work for all. To achieve an engineering and technician workforce of 2030 that is socially responsible and inclusive, and trusted by the public and communities in which we operate, we must attract and retain people from all parts of our communities. This includes increasing the number of women, neurodivergent people, people from minority ethnic groups, and people from lower socio-economic backgrounds. The Review of Engineering Education and Skills Programmes and Policies noted that improvements in EDI have been slow but embracing inclusive-learning design and targeted interventions to boost representation in the industry are ways to embed diversity rather than it being implemented as an add on.

Recommendation Ten

The engineer and technician of 2030 must draw on a range of perspectives to deliver outcomes that work for all. To achieve this, employers, educators, and Professional Engineering Institutions must enable and accelerate the growth of a diverse engineering workforce and inclusive cultures across engineering. The Royal Academy of Engineering's Inclusive Cultures in Engineering Report 2023 sets out what employers must do to realise this essential goal, based on wide-ranging research.

Conclusion

The Engineers 2030 project and this final report sets out a bold and necessary vision for the future of engineering and the engineering workforce in the UK. It recognises that the challenges facing society, climate change, digital transformation, infrastructure renewal, and social equity require a workforce of engineers and technicians who are not only technically excellent but also resilient, inclusive and trusted by the public.

Through extensive consultation, evidence gathering, and engagement across the profession, this report identifies the systemic reforms needed to deliver that workforce. It calls for a future-facing education and skills system that is coherent, inclusive and responsive to national and regional needs. It highlights the importance of modular and stackable learning, improved careers guidance, and stronger employer engagement, particularly from SMEs and across diverse communities.

The Vision and Principles articulated in this report redefine engineering as a national capability. Engineers and technicians are not simply implementers of technology, they are leaders, collaborators and custodians of sustainable progress. To realise this vision, the UK must invest in a skills system that supports lifelong learning, enables flexible career pathways, and embeds inclusive cultures and workforce across education and employment.

The recommendations presented are practical and achievable. They are designed to catalyse change, not prescribe every detail. Delivering them will require coordinated action across government, industry, education providers, and the engineering profession itself. The establishment of the Royal Academy of Engineering's Skills Centre provides a vital plat-form to support this transformation, working in partnership with these stakeholders to make it happen.

Realising the Vision and Principles of Engineers 2030 will require more than aspiration. It demands sustained collaboration, investment, and innovation across the entire engineering education and skills system. All members of the engineering sector will play a pivotal role in enabling this transformation, acting as a bridge between policy and practice. By convening partners, supporting implementation, and embedding the Vision and Principles into education and workforce development, it will help ensure that the UK's engineering workforce is fit for the future.

Annex A | The Engineers 2030 policy project

The Engineers 2030 project undertook a series of activities that informed the development of this final report and its recommendations. These included literature reviews, stakeholder workshops, consultations, and regional engagement. Summaries and outputs are available on the Engineers 2030 website.

Literature Review

The project began with a comprehensive literature review identifying transformative shifts in engineering practice driven by digitalisation, sustainability, and data. It highlighted the growing need for systems thinking, adaptability, and ethical leadership, alongside core technical competencies. These insights shaped the Engineers 2030 Vision and Principles and informed this report's recommendations.

Developing the Vision and Principles

Two futures workshops in late 2023 brought together engineers, educators, and policymakers to explore the future role of engineers and technicians. Participants envisioned daily scenarios and identified the values and behaviours needed in 2030. A structured four-stage process of scoping, drafting, reviewing, and finalising led to the Vision and Principles, which were validated through a public consultation in early 2024.

Calibrating Future Curricula

A research collaboration with UCL examined how well UK higher education prepares engineers for modern workplaces. It found gaps in digital fluency, sustainability, and interdisciplinary skills. The report recommended embedding real-world experiences, ethics, and AI tools into curricula, and adopting flexible, student-centred learning pathways.

Nations and Regions Engagement

Roundtables in Newcastle, Belfast, Glasgow, and Liverpool, and interviews in Wales, gathered regional perspectives. Key themes included:

- under-promotion of vocational pathways
- STEM teacher confidence
- transport and digital infrastructure barriers
- localised skills needs.

These insights informed place-based recommendations in the final report.

UK Education and Skills Landscape Review

A national mapping exercise assessed engineering education from primary to professional levels. It identified strengths and gaps, particularly in diversity, curriculum relevance, and teacher capability. Recommendations included:

- embedding inclusive learning design
- reforming curricula to reflect engineering competencies
- expanding university capacity for engineering courses.

The full report was published in September 2025.

Annex B | **Acknowledgements**

The Engineers 2030 project has been carried out under the NEPC and guidance of a working group made up of the following experts.

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Engineers 2030 is both a manifesto for future engineering skills and a wakeup call. It provides a picture of the engineers and technicians the UK will need in future decades, and it sets out the bold changes that will be needed across the skills system to deliver those capabilities

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