



Manufacturing excellence

How can young people acquire the world-class skills the UK needs to become a global leader in advanced manufacturing?

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WORK INSTITUTE



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WorldSkills UK is a four nations partnership between education, industry and UK governments. It is a world-class skills network acting as a catalyst for:

Raising standards: through international benchmarking and professional development.

Championing future skills: through analysis of rapidly changing economic demand.

Empowering young people, from all backgrounds: through competitions-based training and careers advocacy.

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WorldSkills UK foreword

The UK has a huge opportunity to go-for-growth, level up, reach net zero, and attract more inward investment

WorldSkills UK commissioned this report to identify the barriers preventing the UK becoming a global leader in advanced manufacturing, and understand how we can play our full role as part of the solution.

Whilst some challenges identified are not new, the economic stakes have never been higher. By tackling persistent skills gaps, strengthening collaboration between education and industry and building a diverse talent pipeline for the manufacturing sector, the UK has a huge opportunity to go-for-growth, level up, reach net zero, and attract more inward investment.

Whilst there's clearly some work to do, I have witnessed so many young people unlock their full potential and achieve enormous success via WorldSkills UK's national and international programmes for manufacturing. With these successes giving them the foundations to go on and provide the world-class skills that the sector so desperately needs.

Acting on the findings of this report, we need to focus on celebrating the success of these young people in every region, engaging the next generation and turbocharging manufacturers', skills providers', and local economies' ability to access and develop world-class advanced manufacturing skills.

Manufacturing in the UK is operating in a global market, and we need to ensure that we are keeping pace. By capitalising on our unique ability to benchmark UK skills against leading nations, I believe that

This research tells us once again that we need to fundamentally change the narrative about the nature and opportunity available in manufacturing

WorldSkills UK can play a key role in helping our fantastic educators keep pace with the world's best and mirror international best practice in how advanced manufacturing skills are taught.

This research tells us once again that we need to fundamentally change the narrative about the nature and opportunity available in manufacturing. By working with partners to enhance our careers programmes, we will tackle negative perceptions of manufacturing held by too many young people, and help the sector overcome the existential challenge of an ageing workforce.

The high-level skills we need to remain competitive over the next five years are already changing. By championing these future skills now and creating the capacity to develop them in our skills system via competition-based training, we will help ensure the UK manufacturing sector can access the higher technical skills needed to adopt new processes and technologies, raise productivity, and create high-value jobs.

At WorldSkills UK we are committed to do everything we can to make sure that young people are informed and inspired about a potential future in manufacturing and that these firms have the pipeline of high-skilled talent they need. Our research shows that over half of all manufacturers aren't directly engaging with the skills system and we are committed to working with partners from business and education to address this.

I would like to thank Learning and Work Institute for all their work on this report, and also extend my gratitude to all the partners, particularly BAE Systems, that contributed. I will look forward to working with you so the UK can become a world leader in advanced manufacturing, and young people, businesses and the UK economy can reap the rewards.

Ben Blackledge
Interim CEO, WorldSkills UK



BAE Systems foreword

At BAE Systems we often describe our company as a “skills enterprise”. This is because the delivery of the submarines, military aircraft, frigates and cyber systems we design and manufacture is wholly dependent on the highly specialist STEM skills of our employees. We also talk about these skills being “sovereign”, as they provide the UK with an indigenous defence capability and therefore freedom of action in defence terms.

Ensuring our employees, and those in our 6,000-strong supply chain are skilled to deliver is of paramount importance to our customers in the armed forces and security communities. Key to meeting this objective is attracting young people to join our business. This year, in fact, we are recruiting a record 2600 apprentices, graduates and undergraduates.

The need for organisations to recruit and train young people to work successfully in digital and sustainable environments is critical for the UK’s economy and society more widely. And nowhere is this need more pressing now than in the UK’s manufacturing sector. As this important report describes, there are many systemic and historic factors and barriers to address so more young people from a variety of backgrounds can forge careers in the manufacturing sector.

There are however lots of reasons to be positive. With £370 million in new government funding, the Prime Minister and Technology Secretary are committed to cementing the UK’s place as a global science and technology superpower by 2030. Clearly, the manufacturing sector has a key role to play in this.

In addition, as this report describes, manufacturing apprenticeships are a proven route to success. At BAE Systems in 2022, 27 per cent of our apprentice intake in England came from disadvantaged communities. Giving opportunities to young people from a variety of backgrounds has been of enormous benefit to our organisation and our apprentices. We are seeing more young women joining our apprenticeship programmes than ever before. Furthermore, alongside thousands of other organisations across the UK, we are working hard inspiring young people in school about career opportunities in STEM. We see at first hand tremendous enthusiasm from teachers and pupils at the 400 schools we visit every year.

With this in mind and despite the challenges, I believe the UK can build on its proud manufacturing heritage and create a prosperous future for a new generation of manufacturers.

Richard Hamer, MBE

Director, Education & Skills, BAE Systems plc



Executive summary

This report explores how young people can acquire the world-class skills the UK needs to become a global leader in advanced manufacturing. The research provides evidence on the impact of industrial transformation on skills demand and job creation in the manufacturing sector; alignment between industry demand for skills and those developed in post-16 education; and young people's perceptions and motivations around a career in manufacturing. It combines a review of existing evidence and secondary data analysis with new surveys of over 350 manufacturers and 1,000 young people, as well as interviews with employers and educators.

The report finds that persistent skills gaps are preventing the UK becoming a global leader in advanced manufacturing, limiting the sector's potential as an engine for growth, levelling up, inward investment and progress toward 'net zero'. These gaps are at least partly being driven by shortages of young people entering the sector and challenges skills providers experience keeping educators' expertise and training equipment aligned with fast-moving industrial change and the demand for skills it creates. Despite experiencing a shortfall of vital technical and employability skills, too few manufacturers are fully engaging with the education and skills system to help meet industry standards, or empower young people toward manufacturing careers in

sufficient numbers. As a result, many young people, particularly young women, have negative perceptions of the sector, lack inspirational careers support, and are missing out on opportunities for high-value, highly-skilled jobs.

To increase our international competitiveness in advanced manufacturing, the UK needs greater collaboration between education, industry and governments, focused on empowering young people of all backgrounds and equipping both learners and educators with first-rate and up-to-date skills employers need. WorldSkills UK has a vital role to play in supporting this objective, by; championing future skills, raising standards, and empowering young people.

63%
of manufacturers surveyed believe that young people are not coming through the education and skills system with the necessary advanced manufacturing skills

Key findings:

- almost three in five manufacturers surveyed (57%) cite challenges accessing a skilled workforce. Over half (55%) of manufacturers are experiencing shortages in advanced manufacturing skills and even more (61%) in traditional manufacturing skills, such as fabrication, welding and mechanical engineering
- nearly two thirds (63%) of manufacturers believe that advanced manufacturing technologies and processes are currently impacting their skills needs, and more (69%) believe they will in the next five years
- 45% of manufacturers report an increased demand for higher technical qualifications/higher apprenticeships and 38% for degrees/degree apprenticeships. However, demand for qualifications at all levels is expected to increase over the next five years, emphasising the need to increase enrolments
- shortages of traditional and advanced manufacturing skills are driving firms to inflate wages in pursuit of skilled workers, as well as hampering manufacturers' ability to satisfy market demand and increase productivity
- nearly two thirds (63%) of manufacturers surveyed believe that young people are not coming through the education and skills system with the necessary advanced manufacturing skills and 70% believe that they are not coming through with the necessary traditional manufacturing skills
- despite this, roughly half of manufacturers (51%) are not working with education or skills providers to try and ensure their skills needs are met
- skills providers report challenges keeping educators' expertise and training equipment aligned with changes in industry, and the shifting skills demand these changes create
- three in five young people are unlikely to consider a career in manufacturing. Young women are three times less likely than young men (18% vs 54%). This is despite over nine in ten young people believing technical qualifications or an apprenticeship can lead to a highly-skilled, well-paid career

83%

of young people feel they face barriers to pursuing a career in manufacturing

- young people attracted to manufacturing are drawn by the opportunity for 'hands-on' work, and its status as an innovative, high-tech sector providing highly skilled, well-paid work. Many young people who would not consider a career in manufacturing hold negative perceptions about the opportunities the sector can offer, such as physical work, low salaries and limited career progression
- 83% of young people feel they face barriers to pursuing a career in manufacturing and 48% have never received information about a career in manufacturing. In order to pursue a career in manufacturing 88% would find additional information helpful
- young women are significantly more likely to cite facing barriers to pursuing a career in manufacturing due to a lack of knowledge and understanding; including about which qualifications and training they need, what manufacturing jobs are available, what a manufacturing career involves and what skills manufacturing employers require. They are also more likely to report the need for additional information
- two in five employers (41%) are not taking any actions to inspire young people to consider a career in manufacturing. Only 14% are helping educators gain industry knowledge and experience, despite 61% believing this could help attract young people to the sector.

WorldSkills UK will contribute by promoting diverse 'skills champions' to inspire young people of all backgrounds to consider a career in manufacturing

The role of WorldSkills UK

A key reason for commissioning this report was to help inform how WorldSkills UK can best use its programmes to deliver the world-class skills the manufacturing sector needs to be internationally competitive. WorldSkills UK is committing to the following five areas of action:

1. Raising the quality of UK manufacturing skills by aiming for a top ten finish in manufacturing and engineering at WorldSkills Shanghai 2026
2. Promoting diverse 'skills champions' to inspire young people of all backgrounds to consider a career in manufacturing
3. Improving access to Industry 4.0 equipment to offer world-class technical training
4. Partnering with Make UK to share the findings of the research and explore how to inspire the next generation of manufacturing professionals
5. Deepening international partnership agreements fostering advances in technical education and training.

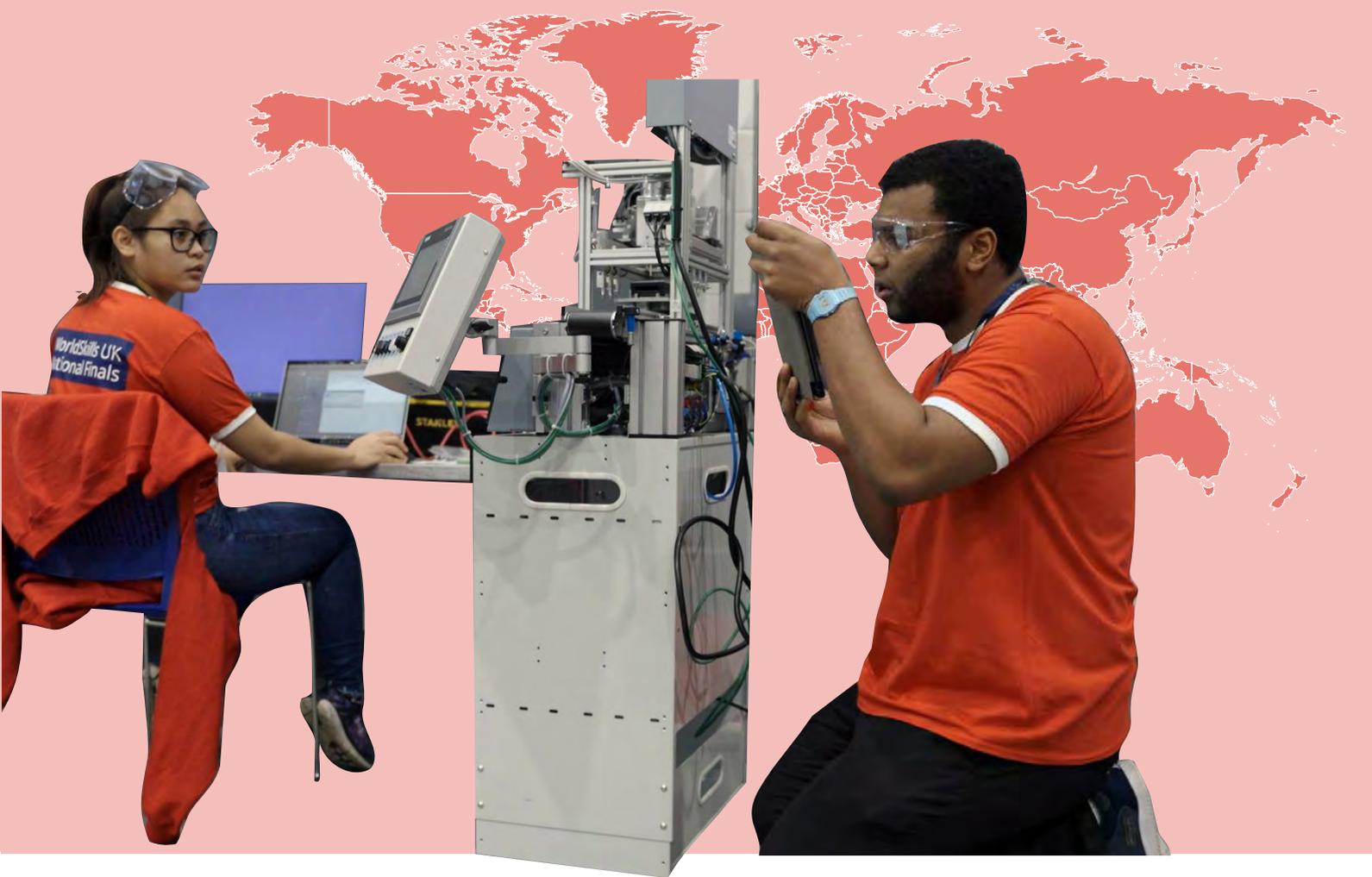
A compelling narrative about modern manufacturing can attract young women and men of all backgrounds to careers in the sector, and challenge the narrow understanding of manufacturing jobs and skills

Additional priorities for action

The findings in this report also highlight broader priorities that will need to be addressed by a range of UK stakeholders in collaboration to help build a more internationally competitive manufacturing sector in the UK. This includes:

- exchanging expertise between employers and skills providers to keep courses and curriculum in lockstep with emerging skills demand
- empowering educators to equip young people with first-rate and up-to-date technical and employability skills required by industry
- boosting higher technical education and training to help manufacturers adopt technologies and processes that will enhance productivity and competitiveness
- increasing enrolment numbers on manufacturing courses at all levels to meet replacement demand and the enduring importance of traditional skills
- developing a compelling narrative about modern manufacturing to attract young women and men of all backgrounds to careers in the sector, challenging the narrow understanding of manufacturing jobs and skills that many currently hold.





1. Introduction

The manufacturing sector has a significant role to play in the UK Government's priorities of reaching net zero and 'levelling up' across the UK's nations and regions. In its recent *Levelling Up the United Kingdom, White Paper*¹, the UK Government highlighted manufacturing as one of five areas key to ensuring that pay, employment and productivity rise in every area of the UK by 2030. The sector plays a vital role in the UK economy, employing 2.7 million people², accounting for 10% of output, 45% of exports, and one fifth of inward investment, as well as providing a range of quality and well-paid jobs across the country³. The UK Government's *Manufacturing Industrial Decarbonisation Strategy*⁴, also outlines the role the manufacturing sector can play in driving the UK's transition to net zero, both through creating the products and infrastructure required in a green economy and reducing its own carbon emissions⁵.

- 1 Department for Levelling Up, Housing and Communities (2022) *Levelling Up the United Kingdom. Levelling Up the United Kingdom White Paper* (publishing.service.gov.uk)
- 2 High Value Manufacturing (HVM) Catapult and Gatsby Foundation (2022) *Manufacturing the Future Workforce: Addressing the UK's Manufacturing Skills Challenge. Manufacturing the Future Workforce: Report | HVM Catapult*
- 3 Holloway, W. and Blagden, J. (2021) *Making a comeback: How a manufacturing renaissance can level up the country. Making-a-comeback.pdf* (ukonward.com)
- 4 Department for Business, Energy and Industrial Strategy (2021a) *Industrial Decarbonisation Strategy. Industrial decarbonisation strategy – GOV.UK* (www.gov.uk)
- 5 The Climate Change Committee (2021) *2021 Progress Report to Parliament. 2021 Progress Report to Parliament - Climate Change Committee* (theccc.org.uk)

Recent reports have highlighted the importance of up-to-date skills to manufacturers' ability to adopt and exploit innovations

The manufacturing sector's ability to decarbonise and help rebalance the UK economy will in part depend on its ability to adopt new and emerging forms of advanced manufacturing, defined as "the use of innovative technologies and methodologies for improved competitiveness"⁶. These transformations can be broadly categorised under electrification, digitisation, and automation. The UK Government recognises advanced manufacturing as a high potential sector for driving investment and growth⁷. However, to adopt these new technologies and processes, the right skills are needed.

Recent reports have highlighted the importance of up-to-date skills to manufacturers' ability to adopt and exploit innovations⁸. To successfully deploy new technologies, the manufacturing workforce will need a higher level of technical skills, alongside the complex cognitive capabilities required to adapt to continuing change⁹. Digital skills are also needed if employers are to adopt advanced manufacturing technologies, yet employers across all sectors, including manufacturing, are experiencing substantial digital skills gaps¹⁰. The UK manufacturing sector is currently one of the slowest digital adopters, and skills shortages are limiting the impact of adopted technologies on productivity when investments in digital are being made¹¹. Previous research by Learning and Work Institute (L&W) and WorldSkills UK has highlighted a strong and growing demand for skills that can help manufacturing drive the UK's progress toward net zero¹², while WorldSkills UK's Skills Taskforce for Global Britain highlighted the importance of world-class skills to increased foreign direct investment (FDI) in advanced manufacturing jobs across the UK's nations and regions¹³.

6 [What is advanced manufacturing? – TWI \(twi-global.com\)](#)

7 [Industry experts appointed to accelerate development of future tech as Chancellor sets out vision for 21st century Silicon Valleys - GOV.UK \(www.gov.uk\)](#)

8 See: High Value Manufacturing (HVM) Catapult and Gatsby Foundation (2022) *Manufacturing the Future Workforce: Addressing the UK's Manufacturing Skills Challenge*. [Manufacturing the Future Workforce: Report | HVM Catapult](#); The Manufacturing Commission (2020) *Level Up Industry: Strengthening Regional Manufacturing*. [Level Up Industry | Policy Connect](#)

9 [Manufacturing the Future Workforce: Report | HVM Catapult](#); The Manufacturing Commission (2020) *Level Up Industry: Strengthening Regional Manufacturing*. [Level Up Industry | Policy Connect](#)

10 Learning and Work Institute and WorldSkills UK (2021) *Disconnected? Exploring the digital skills gap*. [Disconnected-Report-final.pdf \(worldskillsuk.org\)](#)

11 Make UK (2022) *Digital Adoption: The missing link in productivity growth*. [Digital Adoption: The Missing Link in Productivity Growth | Make UK](#)

12 Learning and Work Institute and World Skills UK (2022) *Skills for a net-zero economy: Insights from employers and young people*. [GreenSkillsReport-2022_v3b.pdf \(worldskillsuk.org\)](#)

13 Skills Taskforce for Global Britain (2022) *Wanted: Skills for Inward Investors*. [Wanted: skills for inward investors - WorldSkills UK](#)

The research provides insights to UK skills providers, businesses, and governments on how young people can leave the education system with the skills, information and inspiration to pursue a career in manufacturing

Research aims

WorldSkills UK has commissioned L&W to research the following question: “How can young people acquire the world-class skills the UK needs to become a global leader in advanced manufacturing?” The research provides evidence on:

- the impact of industrial transformation on skills demand and job creation in the manufacturing sector
- alignment between skills developed in post-16 education and training and industry needs
- young people’s perceptions and motivations around a career in manufacturing.

In doing so, the research also provides direction on how WorldSkills UK can align its programmes and activity with the objective of developing the world-class skills the industry needs¹⁴. It also provides insights to UK skills providers, businesses, and governments on how young people can leave the education system with the skills, information and inspiration to pursue a career in manufacturing.

Research method

The research takes a mixed-methods approach, incorporating the following activities:

- a **rapid literature review** and **secondary data analysis** to explore existing evidence on the role of manufacturing in the UK economy, skills needs and gaps, alignment between the education and skills system and industry needs, and the relative international competitiveness of UK skills
- two **roundtable events** with industry stakeholders and training providers to explore manufacturers’ skills needs, the extent to which providers can deliver these, and how the sector can be made attractive to young people from all backgrounds
- **semi-structured interviews** with 11 training providers from WorldSkills UK’s Innovation Network and Centre of Excellence Network, to explore how the skills and roles manufacturers require are changing as a result of advanced manufacturing; alignment between the education and skills system and industry needs; and how to attract more young people to the sector
- **surveys with 352 manufacturing employers and 1,032 young people (aged 16-24)** to explore business priorities and skills needs, and young people’s perceptions around the sector.

A more detailed overview of the methodology is included in Appendix 1.

¹⁴ WorldSkills UK (2022) *Levelling up through skilling up: How developing world-class skills can spread opportunity and boost productivity. LevellingUp_v3.pdf (worldskillsuk.org)*



2. Manufacturing and the UK economy

This chapter presents the findings from secondary data analysis and a review of existing literature. It explores the role of manufacturing in the UK economy, manufacturing skills needs and gaps, and the extent to which skills developed in post-16 education and training are in line with industry needs.

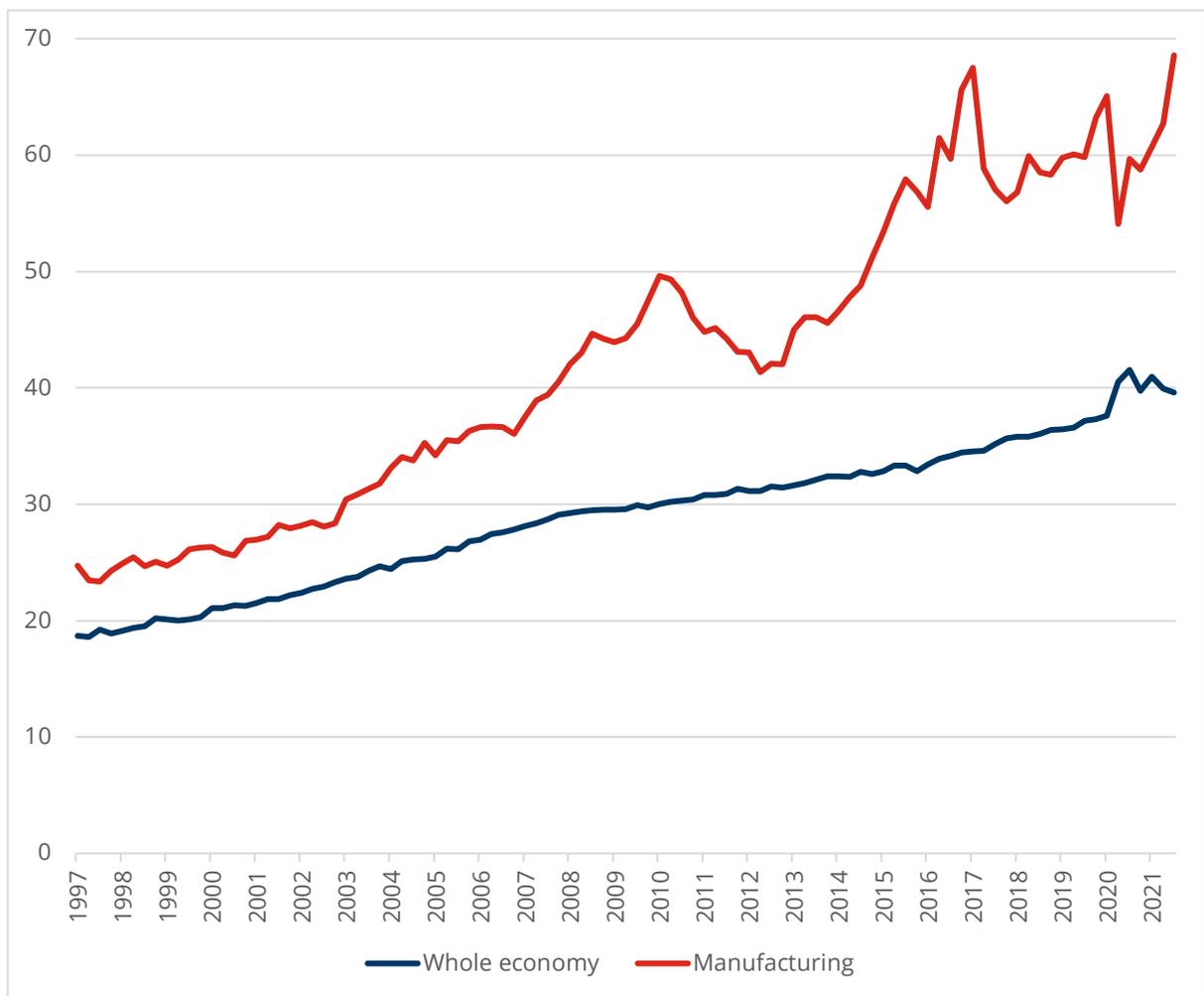
Key chapter findings:

- the manufacturing sector plays a vital role in UK economic output, attracting significant inward investment, and offering a wage and productivity premium in underperforming regions
- the sector is experiencing the largest shortage of skilled workers in 30 years, with unfilled vacancies costing the UK £21m a day in lost GDP
- advances in manufacturing technologies and processes have driven demand for higher level skills, digital skills, and complex cognitive skills
- the low take-up of higher technical qualifications compared to other nations is hampering the supply of skills firms need to adopt new technologies. For example, the UK is one of the slowest digital adopters, with one in three manufacturing businesses reporting a lack of digital skills constraining digital adoption
- manufacturers face difficulties in recruiting and retaining women at higher-paid occupational levels. This is contributing to a substantial gender pay gap and a shortfall of new entrants
- enrolments in manufacturing courses have declined significantly since 2015 and manufacturing and engineering enrolments are dominated by men at lower, intermediate and higher level qualifications
- all four UK governments recognise the importance of the manufacturing sector in supporting wider economic and social aims, and have strategies to develop technical skills to meet the needs of the future workforce.

Contribution of manufacturing to the UK economy

The manufacturing sector is vital to the UK economy, accounting for 10% of the UK's economic output, 45% of exports, and one fifth of inward investment. The sector employs around 2.7 million people¹⁵, and provides a range of quality and well-paid jobs across the country¹⁶. Average productivity in manufacturing has remained above that of the wider economy over the last 20 years, and this gap has widened (Figure 1). However, this is mainly due to two manufacturing industries ie pharmaceuticals and refined petroleum. In other manufacturing industries, growth has remained relatively stagnant over the past two decades. This is consistent with productivity trends in the wider UK economy.

Figure 1: Mean nominal output per hour in manufacturing, UK, current prices (£)



Source: L&W analysis of ONS productivity data (1997-2021)

15 High Value Manufacturing (HVM) Catapult and Gatsby Foundation (2022) *Manufacturing the Future Workforce: Addressing the UK's Manufacturing Skills Challenge*. [Manufacturing the Future Workforce: Report | HVM Catapult](#)

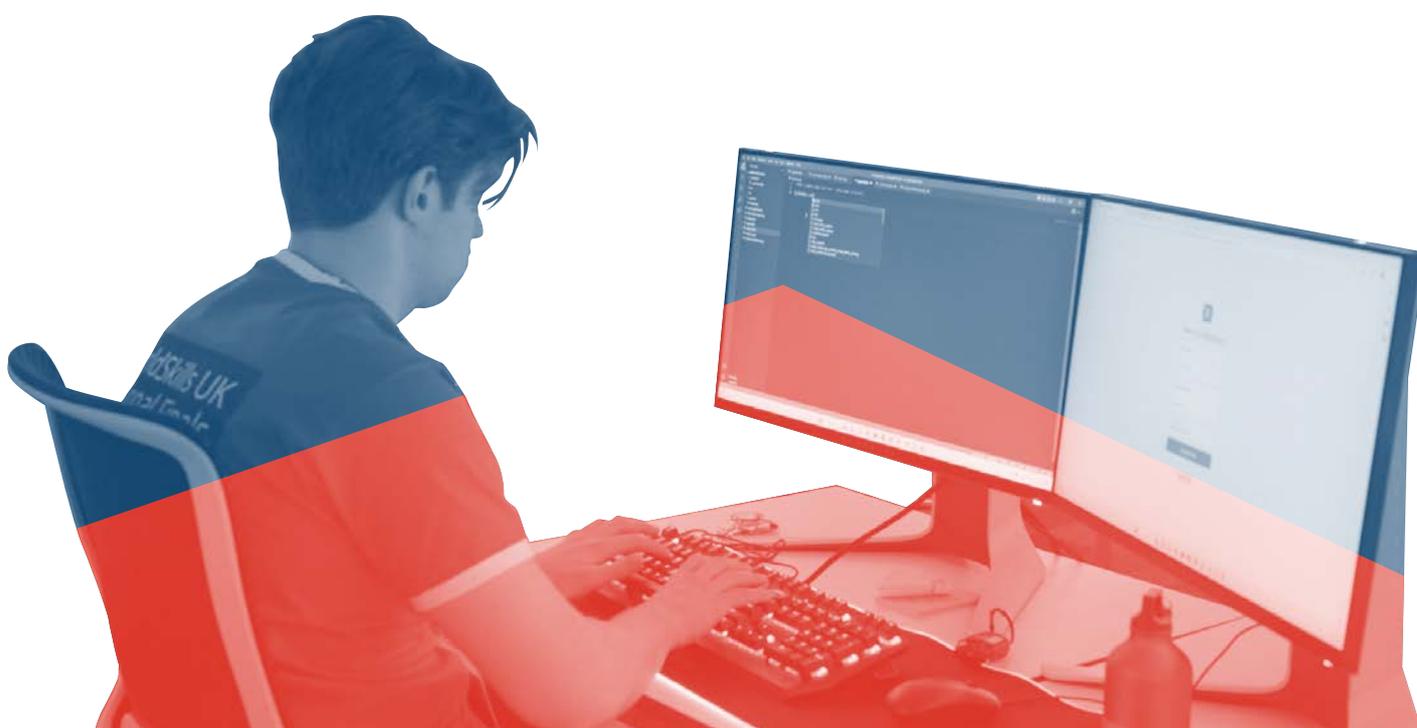
16 Holloway, W. and Blagden, J. (2021) *Making a comeback: How a manufacturing renaissance can level up the country*. [Making-a-comeback.pdf \(ukonward.com\)](#)

In its recent
Levelling Up
White Paper, the
UK Government
highlighted
manufacturing
as one of five
areas key to
ensuring that pay,
employment and
productivity rises
in every area of
the UK by 2030

Manufacturing, and advanced manufacturing in particular, is recognised as a high-skill, high-growth sector, with significant potential to attract foreign direct investment (FDI)¹⁷. Across all sectors, FDI companies account for nearly 40% of UK turnover, and in some parts of the UK represent up to 21% of local business employment¹⁸. Manufacturing attracts a significant amount of our FDI in advanced engineering, automotive and biotechnology, pharmaceuticals, and digital technology. Green industries, such as clean technology, have been highlighted by the government as having potential to attract FDI¹⁹.

For nearly half of UK regions in 2020, the industry with the largest FDI stock was manufacturing²⁰. Regionally, naturally occurring “clusters of excellence” in areas such as Teesside, Humber, Central Scotland, South Wales, and Merseyside make a significant contribution to the wealth, competitiveness, and productivity of local economies. In its recent Levelling Up White Paper²¹, the UK Government highlighted manufacturing as one of five areas key to ensuring that pay, employment and productivity rises in every area of the UK by 2030.

Levels of digital adoption and approaches to sustainability now rank as the two most important factors determining where businesses invest²². Embracing new forms of advanced manufacturing processes therefore has significant potential to make manufacturers more attractive to inward investors.



17 WorldSkills UK (2022) *Promoting technical skills to win foreign investment: Learning from other markets*. [Promoting-technical-skills-to-win-foreign-investment.pdf \(worldskillsuk.org\)](#)

18 Skills Taskforce for Global Britain (2022) *Wanted: Skills for Inward Investors*. [Wanted: skills for inward investors - WorldSkills UK](#)

19 Skills Taskforce for Global Britain (2022) *Wanted: Skills for Inward Investors*. [Wanted: skills for inward investors - WorldSkills UK](#)

20 [Foreign direct investment, experimental UK subnational estimates - Office for National Statistics \(ons.gov.uk\)](#)

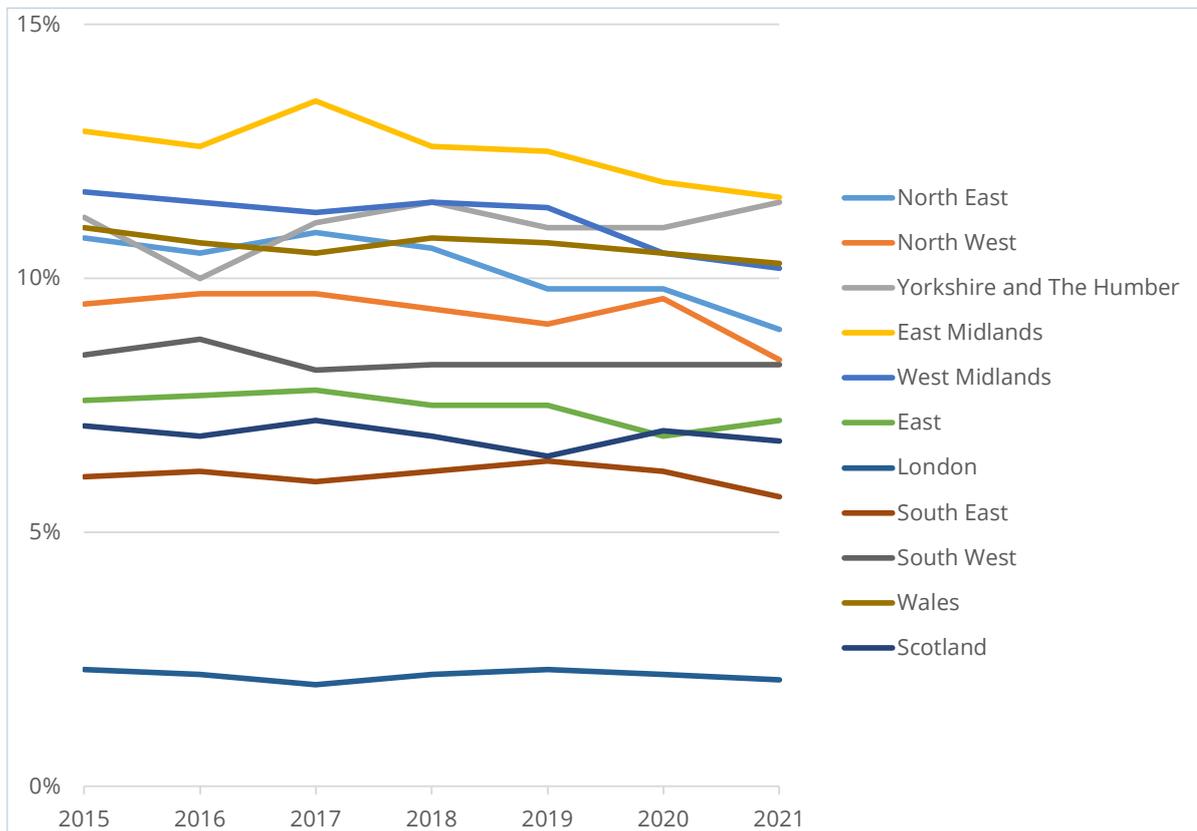
21 Department for Levelling Up, Housing and Communities (2022) *Levelling Up the United Kingdom*. [Levelling Up the United Kingdom White Paper \(publishing.service.gov.uk\)](#)

22 EY attractiveness Survey (May 2022) [ey-attractiveness-survey-europe-may-2022.pdf](#)

Manufacturing employment profile

Following declines from the 1960s onwards²³, employment in the manufacturing sector has been relatively stable in the last decade²⁴. More than 1 in 10 jobs in the Midlands, Yorkshire and Wales are in the manufacturing sector, compared to 1 in 50 in London. Regional employment levels in manufacturing have been relatively stable since 2015 (Figure 2).

Figure 2: Manufacturing employment by region



Source: L&W analysis of Business Register and Employment Survey (2015-2021)

Average pay in manufacturing is higher than the UK average

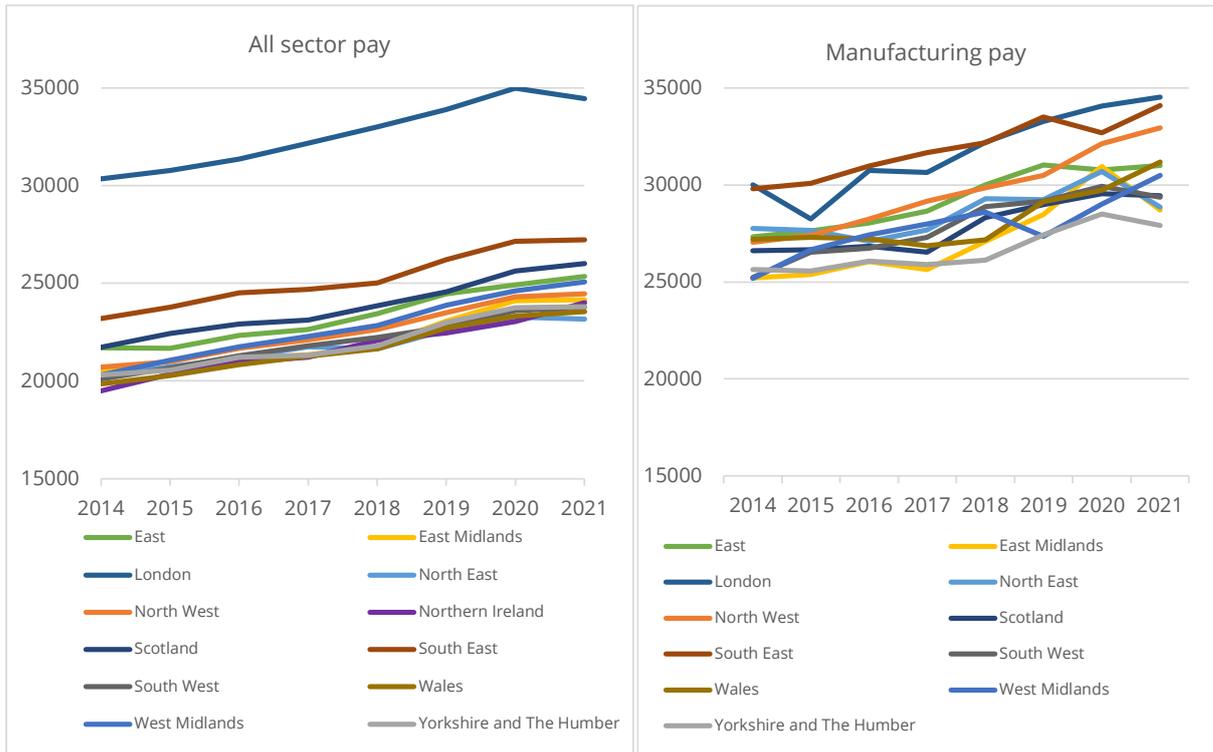
(£30,395 compared with £25,971)²⁵. Manufacturing also offers a wage premium in otherwise economically underperforming regions (Figure 3), standing £8,500 higher than other sectors on average in the North West in 2021. This demonstrates significant potential for the manufacturing sector to contribute to the UK's levelling up agenda by offering highly-paid opportunities across the regions. Still, there are regional pay disparities within the sector, with London (~£34,500 in 2021) and the South East (~£34,000 in 2021) attracting the highest salaries on average, despite holding the lowest share of manufacturing employment. The gap between the highest paid region and lowest paid region has widened from £4,813 in 2014 to £6,032 in 2021. These findings indicate a need to ensure that high-skilled, high-paid opportunities are available outside of London and the South East.

²³ Long-term trends in UK employment: 1861 to 2018 - Office for National Statistics (ons.gov.uk)

²⁴ Business Register and Employment Survey (2021). Between 2015 and 2021, there was a 0.6% decrease in the industry's share of total employment.

²⁵ Annual Survey of Hours and Earnings (2021), derived using gross annual pay which includes pay from overtime and bonuses on top of regular pay.

Figure 3: Median gross annual pay (£) - Manufacturing compared to all sectors



Source: L&W analysis of Annual Survey of Hours and Earnings (2014-2021)

Labour shortages

UK manufacturing is experiencing general labour shortages, and the largest shortage of skilled workers in 30 years²⁶, with 91,000 live vacancies²⁷. Research suggests that the estimated cost of lost productivity due to manufacturing vacancies being left unfulfilled amounts to between £7.7 and £8.3 billion, or approximately £21 million per day in lost output for UK GDP²⁸.

Forecasted trends in employment indicate that, without action to attract more candidates to the sector, these problems are set to continue, with an increased number of employees needed across all manufacturing occupations save process, plant and machine operatives up to 2027 (Figure 4). At the science, research and engineering professional level, this requirement will be driven mostly by demand for new skills, owing to growth in more advanced manufacturing industries such as civil and defence aerospace components, machinery and equipment, and electronic goods²⁹. At the manual occupational

26 Sharp, N (2020) Tackling the UK's manufacturing skills gap – why we must act now. [Tackling the UK's manufacturing skills gap - why we must act now \(esocatec.com\)](https://www.esocatec.com)

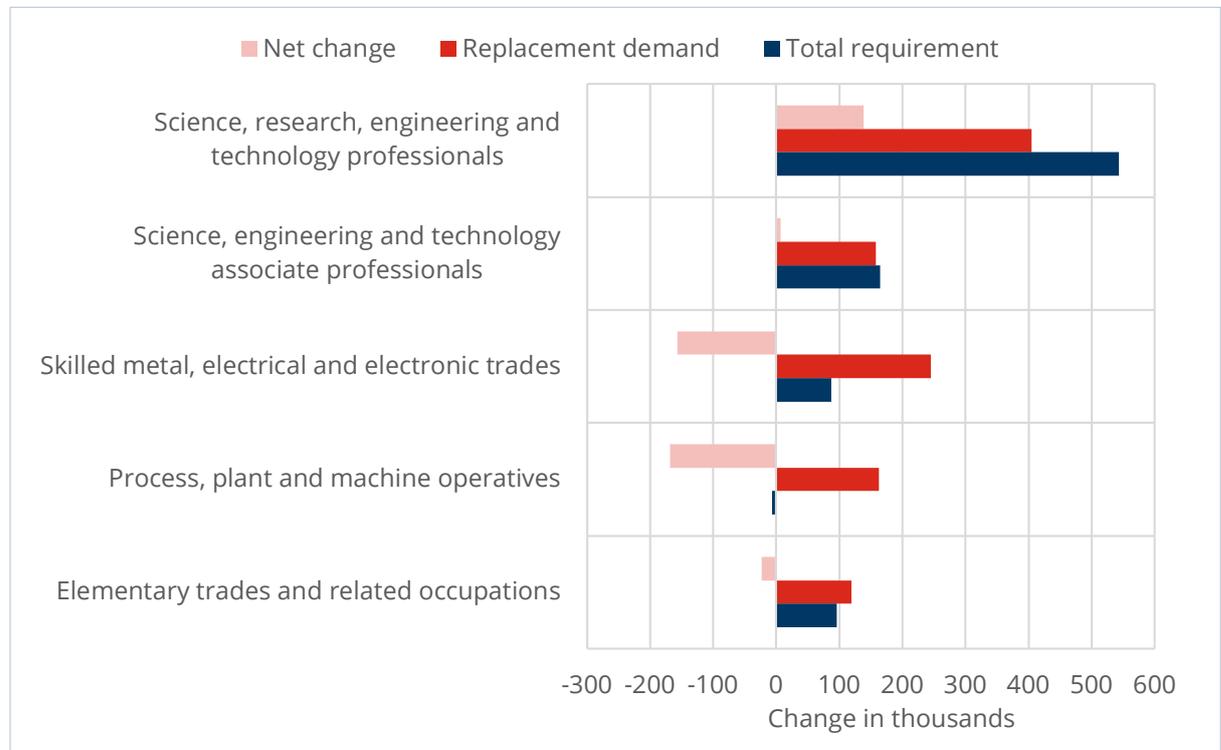
27 ONS (2023) [UK Job Vacancies \(thousands\) – Manufacturing. UK Job Vacancies \(thousands\) - Manufacturing - Office for National Statistics \(ons.gov.uk\)](https://www.ons.gov.uk)

28 Make UK (2022) [Leadership and Management Skills. Leadership and Management Skills | Make UK](https://www.makeuk.com)

29 Department for Education, University of Warwick and Cambridge Econometrics(2020) [Working Futures 2017-2027: Long-run labour market and skills projections for the UK. Working Futures 2017-2027: Long-run labour market and skills projections for the UK - main report \(publishing.service.gov.uk\)](https://www.dfe.gov.uk)

levels, net demand for new jobs is predicted to decline due to increased automation and improved production processes³⁰. However, there is still an overall increased demand for workers due to replacement demand (existing workers retiring and leaving the workforce).

Figure 4: Forecasted change in employment for manufacturing occupations



Source: L&W analysis of Working Futures (2020)

Demand for new roles and replacement demand create the urgent need to attract more young people into the sector. However, the literature points to a lack of interest in the sector from new entrants³¹. Manufacturing is often seen as old-fashioned, monotonous, low-paid, and male-dominated³². Manufacturers face difficulties in recruiting and retaining women, particularly at the higher-paid occupational levels³³. This is contributing to a substantial gender pay gap in the industry³⁴: as shown in Figure 5, the only occupation in which the majority of employees are women are the lowest-paid elementary occupations (55% female). This points to a need to diversify the existing workforce and attract more women into the sector.

30 Ibid.

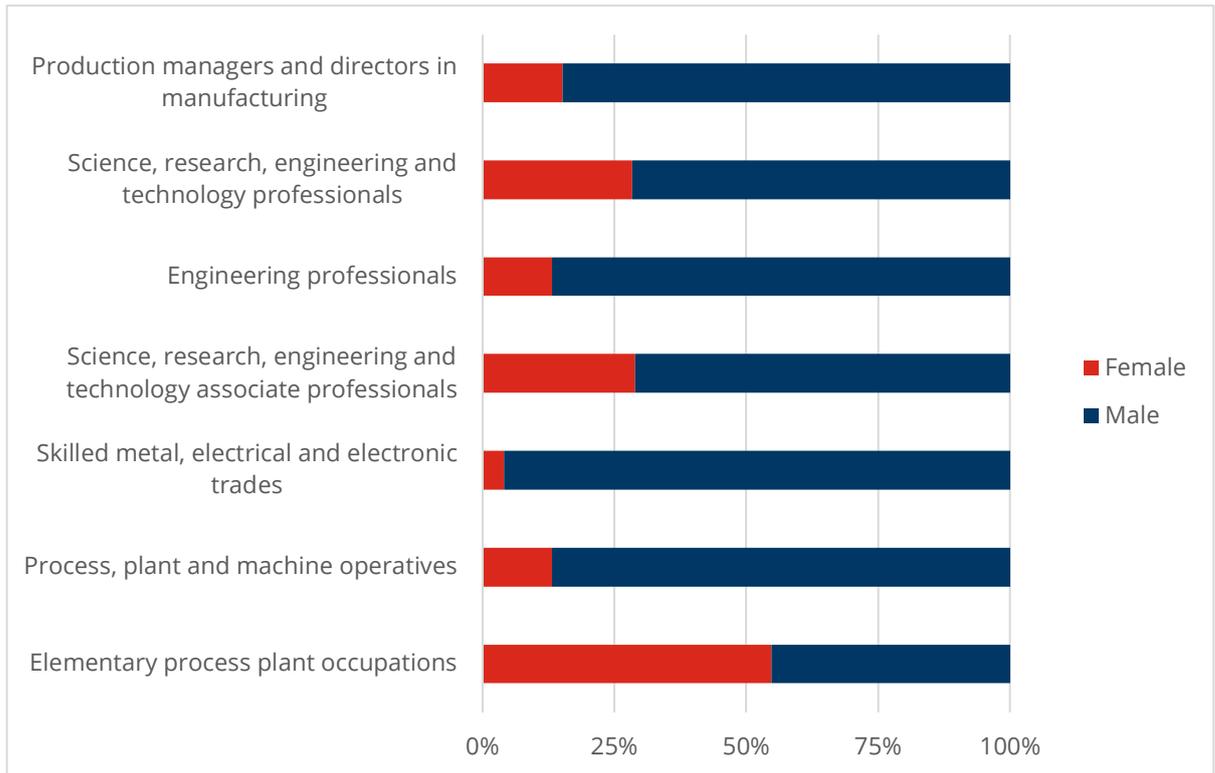
31 Industry Europe (2022) Closing the skills gap in manufacturing and engineering. Guest online post by QMS International. 2 August 2022. <https://industryeurope.com/sectors/politics-economics/closing-the-skills-gap-in-manufacturing-and-engineering/>

32 Sharp, N (2020) *Tackling the UK's manufacturing skills gap - why we must act now*. <https://www.esocatec.com/blog/uk-manufacturing-skills-gap>

33 Make UK (2018) *Making Gender Pay Manufacturers' Business: Gender pay gap benchmarking for manufacturing*. [Making Gender Pay Manufacturers' Business | Make UK](https://www.makeuk.com/making-gender-pay-manufacturers-business)

34 There is a substantial gender pay gap in manufacturing. The median annual pay for men was £32,279 in 2021. For women it was £24,000 (a difference of £8,279). This gender pay gap has decreased from £9,792 in 2014. The gender pay gap in manufacturing is slightly smaller than the overall gender pay gap in the UK (£9,645).

Figure 5: Gender composition of manufacturing occupations



Source: L&W analysis of Quarterly Labour Force Survey (April-June 2022)

Skills gaps

Data from the latest Employer Skills Survey³⁵ shows that one in six manufacturing employers (17%) report skills gaps. Using a 13-sector³⁶ breakdown, manufacturing ranks as the 4th highest in terms of reported skills gaps (the average for all sectors is 13%). Just over one in 12 manufacturing employers (8%) reported skills shortage vacancies, the second highest reported among 13 sectors and higher than the overall average (5.5%).

Rapidly changing skills requirements are exacerbating these issues. Industrial digitalisation (Industry 4.0) and rapid technological change in the sector is driving demand for new skills, as well as the need for higher level technical skills to harness more complex and changing technologies³⁷.

35 Department for Education (2019) *Employer Skills Survey 2019: Summary report*. [Employer Skills Survey 2019: Summary report \(publishing.service.gov.uk\)](https://publishing.service.gov.uk)

36 Using a 13-sector classification of Information & Communications, Construction, Primary Sector & Utilities, Business Services, Art & Other Services, Transport & Storage, Wholesale & Retail, Health & Social Work, Financial Services, Manufacturing, Education, Hotel & Restaurants, and Public Administration.

37 High Value Manufacturing (HVM) Catapult and Gatsby Foundation (2022) *Manufacturing the Future Workforce: Addressing the UK's Manufacturing Skills Challenge*. [Manufacturing the Future Workforce: Report | HVM Catapult](#)

Technician roles are vital for manufacturers' capacity to drive and absorb innovations, including through working to install, commission, operate and maintain new technologies; and improving methods of production

Technical skills

Findings from the wider literature point to a gap in intermediate and higher-level technical skills³⁸. A survey of engineering and technology employers³⁹ found that almost three-quarters (71%) of those experiencing internal skills gaps have gaps in engineering and technical skills, with 44% reporting skills gaps at a technician or skilled level, 41% reporting skills gaps at a professional level, and 36% reporting gaps at operative or semi-skilled levels. Fewer than half (48%) of these employers think that young people have the right technical skills their sectors need, while almost half (49%) reported that young people lack the specialist skills and knowledge needed in their role. These skills gaps will also impede manufacturers' ability to adopt newer forms of advanced manufacturing processes, since Industry 4.0 and changes brought about by digitalisation will demand higher levels of technical ability⁴⁰.

These skills shortages can be attributed at least partly to a low take up of higher technical qualifications. Take up of Level 4 and 5 qualifications is low when compared to both other countries, and other levels of qualification⁴¹. Apprenticeship uptake is also low when compared to other Northern European countries, and is increasingly skewed towards older and incumbent workers⁴². This is already having an impact on the manufacturing sector, with a particular shortage in relation to technician roles requiring intermediate (Level 3-5) skills in STEM subjects⁴³. Technician roles are vital for manufacturers' capacity to drive and absorb innovations, including through working to install, commission, operate and maintain new technologies; and improving methods of production.

Going forward, an increased demand for higher-level job roles in the manufacturing sector will in turn create demand for more highly qualified candidates (Level 5 and above), as demonstrated in the Working Futures Projections (Figure 6). It is therefore vital that the 'missing middle'⁴⁴ in higher technical qualifications is addressed if young people are to be prepared to fill the roles that manufacturers need.

38 See: ReWAGE (2023) *Evidence Paper: How to address skills shortages at the intermediate skills level*. [intermediate_level_skill_shortages - ev_publish.pdf \(warwick.ac.uk\)](#); Blackman, T. (2020) *Lifelong Learning: Time to Fix the Problem*. [The-Training-We-Need-Now.pdf \(policyexchange.org.uk\)](#)

39 The Institute of Engineering and Technology (2021) *IET skills and demand in industry 2021 survey*. [IET 2021 skills survey \(theiet.org\)](#)

40 High Value Manufacturing (HVM) Catapult and Gatsby Foundation (2022) *Manufacturing the Future Workforce: Addressing the UK's Manufacturing Skills Challenge*. [Manufacturing the Future Workforce: Report | HVM Catapult](#)

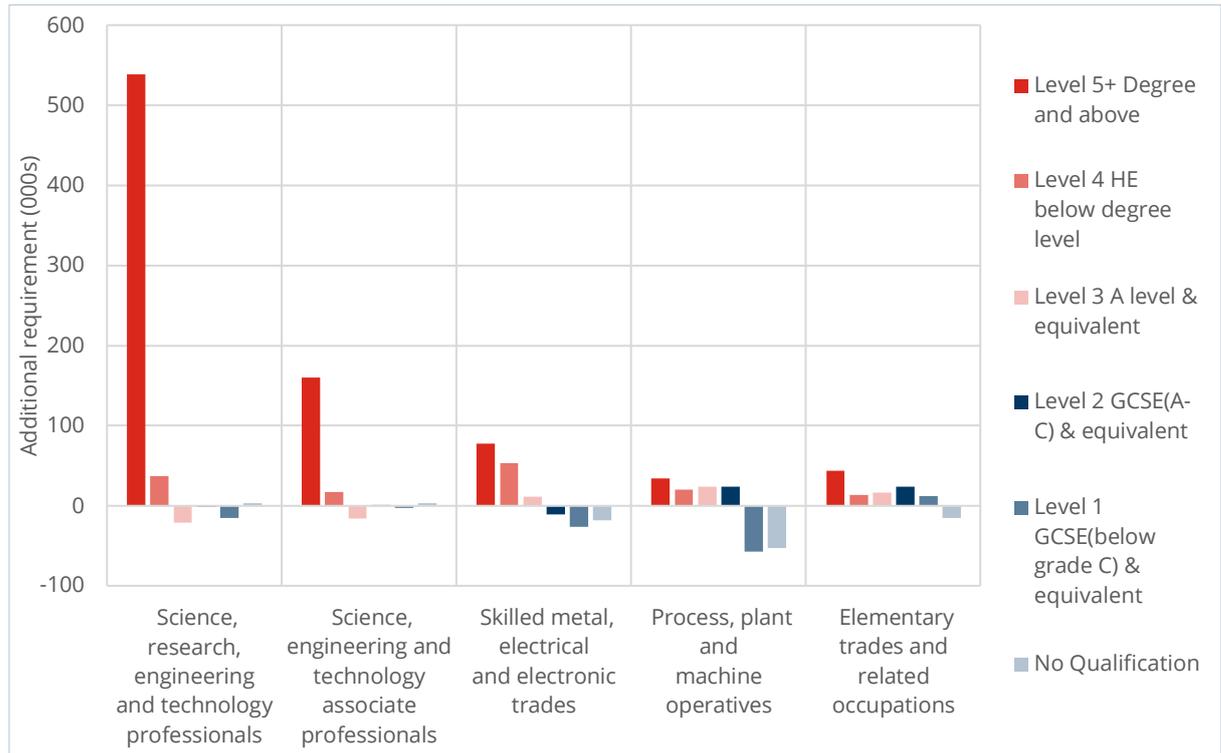
41 House of Commons (2019) *Research briefing: Level 4 and 5 education*. [Level 4 and 5 education - House of Commons Library \(parliament.uk\)](#). In England, around 10% of adults aged 18-65 hold a Level 4-5 qualification as their highest, compared to around 20% in Germany and 34% in Canada. Around 4% of 25-year-olds in England hold a Level 4 or 5 qualification as their highest qualification, compared to nearly 30% for both Level 3 and Level 6.

42 Vedral, B. (2020) *Lessons from Germany?* In Policy Exchange (2020) *The Training We Need Now. Essays on technical training, lifelong learning and apprenticeships*. <https://policyexchange.org.uk/wp-content/uploads/The-Training-We-Need-Now.pdf> [The-Training-We-Need-Now.pdf \(policyexchange.org.uk\)](#)

43 Lewis, P. (2020) *The Missing Middle: Technicians, Innovation and Advanced Manufacturing*. In Policy Exchange (2020) *The Training We Need Now. Essays on technical training, lifelong learning and apprenticeships*. [The-Training-We-Need-Now.pdf \(policyexchange.org.uk\)](#)

44 Learning and Work institute (2021) *Making a market for the missing middle: Higher technical education*

Figure 6: Forecasted additional employees required by occupation and qualification level, 2017-2027



Source: L&W analysis of Working Futures (2020)

Digital skills

A recent survey by Make UK⁴⁵ found that almost half (45%) of businesses are introducing new digital tools and manufacturing infrastructure. This is resulting in a need for higher-level skills; almost half (49%) of employers said that they needed a higher skilled pool of labour and 40% said they needed more mid-level skills. The survey also found that 70% of manufacturers are prioritising digital skills for investment, with IT and software management, cyber security and data analysis identified as areas where demand is expected to increase between now and 2030. Further studies⁴⁶ have identified digital skills such as software development, data processing, systems development and robotics, programming, artificial intelligence (AI), cloud computing, human-machine interfaces, cyber security, and digital reality as being increasingly important to the sector. However, the UK is one of the slowest digital adopters⁴⁷. One of the biggest barriers constraining digital adoption is a lack of digital skills⁴⁸, with one in three manufacturing businesses reporting this⁴⁹. Furthermore, even when new technologies are adopted, skills shortages are affecting manufacturers' abilities to optimise these investments and increase productivity⁵⁰.

45 Make UK (2022) *Digital Adoption: The missing link in productivity growth*. [Digital Adoption: The Missing Link in Productivity Growth | Make UK](#)

46 See: BEIS (2017) *Made Smarter*. [Made Smarter Review - GOV.UK \(www.gov.uk\)](#); Stanton and Spence (2020) *A Review of the Digital Skills Gaps in the Advanced Manufacturing Industries*. [ioc_industry_reports_advanced-manufacturing-industries_final_online.pdf \(coventry.ac.uk\)](#)

47 Make UK (2022) *Digital Adoption: The missing link in productivity growth*. [Digital Adoption: The Missing Link in Productivity Growth | Make UK](#)

48 CBI (2022) *Made in the UK How manufacturing holds the key to our growth story*. [cbi-made-in-the-uk.pdf](#)

49 Make UK (2022) *Digital Adoption: The missing link in productivity growth*. [Digital Adoption: The Missing Link in Productivity Growth | Make UK](#)

50 Ibid.

The manufacturing sector has a unique role in creating the products and infrastructure needed in a net zero economy

Demand for **complex cognitive skills** is also predicted to increase, to support greater innovation and use of more digital and tech-enabled production methods⁵¹. With technological change moving fast, manufacturing employees will need to be flexible, adaptable, open to change, and committed to continued interdisciplinary learning⁵².

Green skills

As the UK strives to meet its net zero targets, **green skills**⁵³ are becoming increasingly vital to the manufacturing sector. As one of the UK's most polluting sectors⁵⁴, manufacturing needs to substantially reduce its own emissions if the UK is to meet its net zero targets. To do this, the right skills are needed.

A survey by the Institute of Engineering and Technology found that just over half (51%) of employers had a sustainability strategy and of these, 81% believed that additional skills would be needed to deliver it, including innovative thinking to create new technologies, management or strategic skills to implement new processes, and agility to adapt to new technologies⁵⁵.

Increasing adoption of digital technologies, underpinned by digital skills, will also be crucial for decarbonisation in manufacturing. It is predicted that large scale adoption of digital technologies in industry will reduce CO2 emissions by 4.5%⁵⁶. The manufacturing sector also has a unique role in creating the products and infrastructure needed in a net zero economy, for example, in areas such as electric vehicles and clean energy⁵⁷. Previous research between WorldSkills UK and L&W found these areas to be where green skills are currently most in demand⁵⁸.

Impact on business competitiveness and regional growth

In a recent survey of engineering and technology employers⁵⁹, two in five experiencing skills gaps (40%) cited a negative impact on productivity as a result, while 31% said that skills shortages had impacted business growth. Analysis of the Employer Skills Survey⁶⁰ shows that 65% of manufacturing employers report that skills gaps impact commercial performance.

By reducing productivity, increasing operational costs and frustrating businesses' ability to meet consumer demand, skills shortages are weakening the competitiveness of the UK manufacturing sector in

51 Make UK (2022) *Digital Adoption: The missing link in productivity growth*. [Digital Adoption: The Missing Link in Productivity Growth | Make UK](#)

52 IBSA (2018) *Preparing for Industry 4.0 – Will Digital Skills be Enough?* [IBSA-Manufacturing-Preparing-for-Industry-4-will-digital-skills-be-enough.pdf](#)

53 Green skills can be broadly defined the knowledge, abilities, values and attitudes needed to live in, develop and support a sustainable and resource-efficient society. These can include technical skills relating to engineering or manufacturing, and more general skills such as project management, change management, leadership, education management and communication skills.

54 The Climate Change Committee (2021) *2021 Progress Report to Parliament*. [2021 Progress Report to Parliament - Climate Change Committee \(theccc.org.uk\)](#)

55 The Institute of Engineering and Technology (2021) *IET skills and demand in industry 2021 survey*. [IET 2021 skills survey \(theiet.org\)](#)

56 CBI (2022) *Made in the UK How manufacturing holds the key to our growth story*. [cbi-made-in-the-uk.pdf](#)

57 The Climate Change Committee (2021) *2021 Progress Report to Parliament*. [2021 Progress Report to Parliament - Climate Change Committee \(theccc.org.uk\)](#)

58 Learning and Work Institute and World Skills UK (2022) *Skills for a net-zero economy: Insights from employers and young people*. [GreenSkillsReport-2022_v3b.pdf \(worldskillsuk.org\)](#)

59 The Institute of Engineering and Technology (2021) *IET skills and demand in industry 2021 survey*. [IET 2021 skills survey \(theiet.org\)](#)

60 Department for Education (2019) *Employer Skills Survey 2019: Summary report*. [Employer Skills Survey 2019: Summary report \(publishing.service.gov.uk\)](#)

The UK is at risk of falling behind leading countries in the sharpness, speed and quality of young people's technical skills in manufacturing and engineering

the international market. Make UK and PWC⁶¹ found that over half of manufacturing employers cited access to domestic skills and labour as their biggest barrier to competitiveness.

Research by WorldSkills UK and OCO Global⁶² moreover reveals that skills gaps, and misalignment between the UK skills system and the needs of international firms, may be enough to deter foreign direct investment into the UK manufacturing base. Conclusions from WorldSkills UK's Skills Taskforce for Global Britain supports this analysis, highlighting the importance of an internationally competitive and effectively marketed skills offer for internationally mobile firms in high-growth industries, such as advanced manufacturing and clean tech.

WorldSkills UK's recent International Benchmarking and Insights report also showed that the UK is at risk of falling behind leading countries in the sharpness, speed and quality of young people's technical skills in manufacturing and engineering⁶³.

Skills shortages in manufacturing may also impact the UK's ability to deliver on the levelling up agenda. Manufacturing employers are primarily based outside London and the South East, and could play a key role in rebalancing regional productivity and investment with the right skills needed to embrace advanced manufacturing. However, new evidence suggests that 'new economy' firms, such as those involved in software and robotics, are being attracted to base themselves in the South East, in part due to greater access to skilled workforces⁶⁴. Advanced manufacturing employers operating elsewhere are also experiencing significant skills shortages. For example, 41% of advanced manufacturing employers in the West Midlands report that skills shortages and difficulties accessing talent are constraining productivity⁶⁵.



61 PWC and Make UK (2023) *Executive Survey 2023: Cost, competitiveness and confidence*. [Executive Survey 2023: Cost, Competitiveness and Confidence | Make UK](#)

62 WorldSkills UK (2022) *Promoting technical skills to win foreign investment: Learning from other markets*. [Promoting-technical-skills-to-win-foreign-investment.pdf \(worldskillsuk.org\)](#)

63 WorldSkills UK (2023) *International benchmarking and insights: bringing world-class skills to the UK*. <https://www.worldskillsuk.org/insights/international-benchmarking-and-insights-bringing-world-class-skills-to-the-uk/>

64 [At the frontier: The geography of the UK's new economy | Centre for Cities](#)

65 Billing, C., Xorrilla, M., Collison, S., Green, A., an, F. (2020) *Regional Productivity Differences, Skills and Inclusive Growth: Survey Findings*. [Regional Productivity Differences, Skills and Inclusive Growth: Survey Findings \(birmingham.ac.uk\)](#)

Sensata Technologies are collaborating with local skills providers to bring high-value manufacturing jobs to Northern Ireland

Skills are a key driver of Sensata Technologies' business. The global sensor company specialises in providing solutions for the automotive, industrial, marine, and heavy and offroad vehicle sectors, with manufacturing and engineering sites in the US, Northern Ireland, Bulgaria, China and Mexico. Developing solutions for a more sustainable and electrified world is top of Sensata's agenda with customers transitioning from traditional internal combustion engines to electric vehicle platforms.

Working with customers to offer cutting-edge solutions, and bring them to market, requires design, quality, process and increasingly software engineering skills. Sensata's manufacturing plants are becoming increasingly automated, with AI also transforming the working lives of colleagues and reducing the need for repetitive quality checks.

Bringing those skills into the business is critical and the company has built strong collaborative relationships with FE and HE providers to ensure they can access the skills required. Sensata Technologies has worked with WorldSkills UK to maximise the quality of workforce skills and benefit from world-leading standards of training, employing a member of Team UK who competed at WorldSkills Special Education 2022 in robot systems integration.

Trevor Grimsley, Managing Director Operations at Sensata Antrim, said, "Like all manufacturing businesses in the UK, we are constantly challenging ourselves to develop leaner, more efficient processes which deliver high quality products for our customers. Having a skilled pipeline of potential employees with good industry knowledge and best practice techniques, would be a valuable asset to all manufacturers in the UK."

Alignment between training provision and industry needs

In the UK, there are a range of post-16 education and training options available with direct relevance to manufacturing. Yet, more than eight in ten manufacturing businesses (84%) say the government must do more to deliver skills for manufacturing digitalisation and more than three quarters (78%) believe that the education system is failing to deliver the right STEM skills for the future⁶⁶.

Despite this, a recent survey of engineering and technology employers⁶⁷ found that employer engagement with education and skills providers has declined over the last two years, and over one quarter (26%) of employers report no direct engagement with schools, colleges or universities. Employer Pulse Survey data⁶⁸ shows that only 11% of manufacturing employers reported currently offering apprenticeships, the joint second lowest value of the industries surveyed, with around two-thirds (65%) reporting structural barriers to doing so.

66 BDO Digital Transformation Report (2019) *A new era of manufacturing: Embracing a future of digitalisation*. https://www.bdo.co.uk/BDO_UK/media/bdo/PDF/Industries/Manufacturing/BDO-Digital-Transformation-Report-2019.pdf

67 The Institute of Engineering and Technology (2021) *IET skills and demand in industry 2021 survey*. [IET 2021 skills survey \(theiet.org\)](https://www.theiet.org)

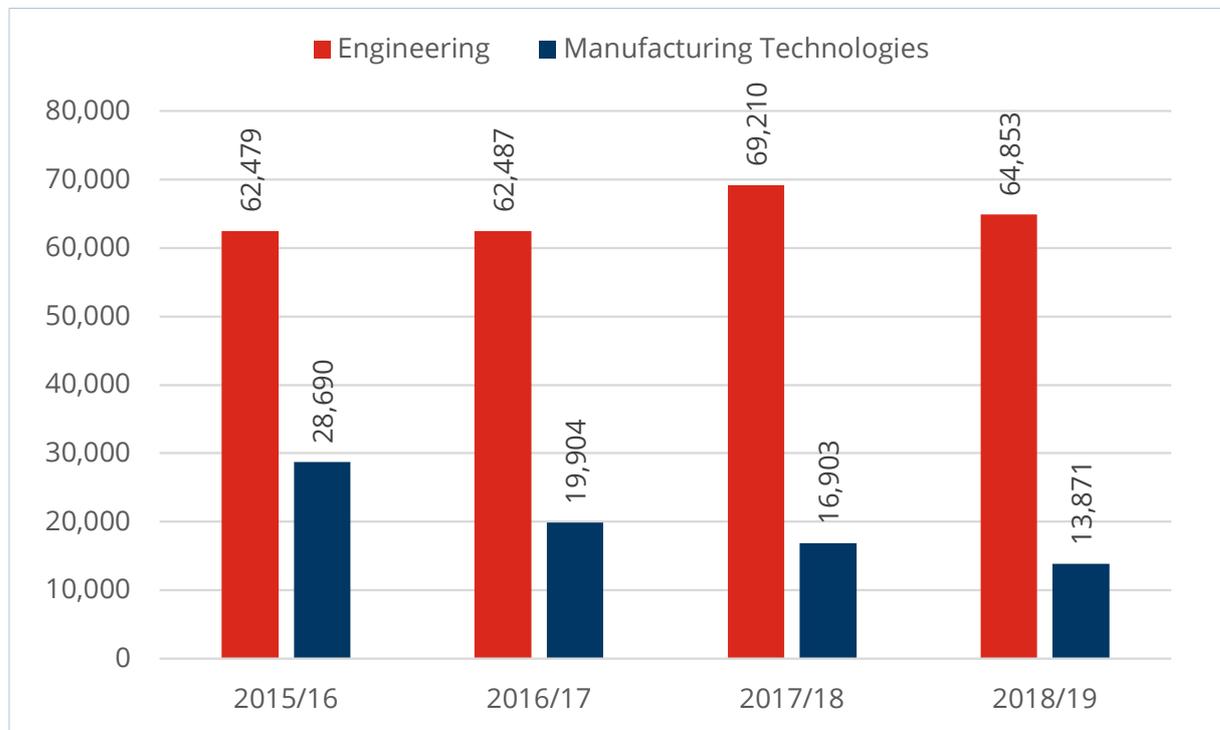
68 Employer Pulse Survey (2021)

Current attainment rates

The achievement rate for engineering and manufacturing qualifications (Level 1-3 qualifications) is 87.6%, placing it slightly above the overall achievement rate (86.5%)⁶⁹. However, while the number of enrolments in engineering have remained fairly consistent, the number of enrolments in manufacturing has declined substantially (-52%) between 2015/2016 and 2018/2019 (Figure 7). This is concerning, with the need for new enrolments remaining strong owing to replacement demand. Level 3 qualifications can also provide support progression to higher levels skills where demand is increasing.

There were almost 53,000 qualification achievements at Level 4 and above in engineering and technology subjects in the 2019/20 academic year⁷⁰. According to the Working Futures projections explored earlier in this chapter, we will need an additional 9,398 employees qualified at Level 4 and above by 2027 to meet the skills demands of the sector.

Figure 7: Education and training participation by subject area (Entry Level to Level 3, FE)



Source: L&W analysis of Individualised Learner Record (2019)

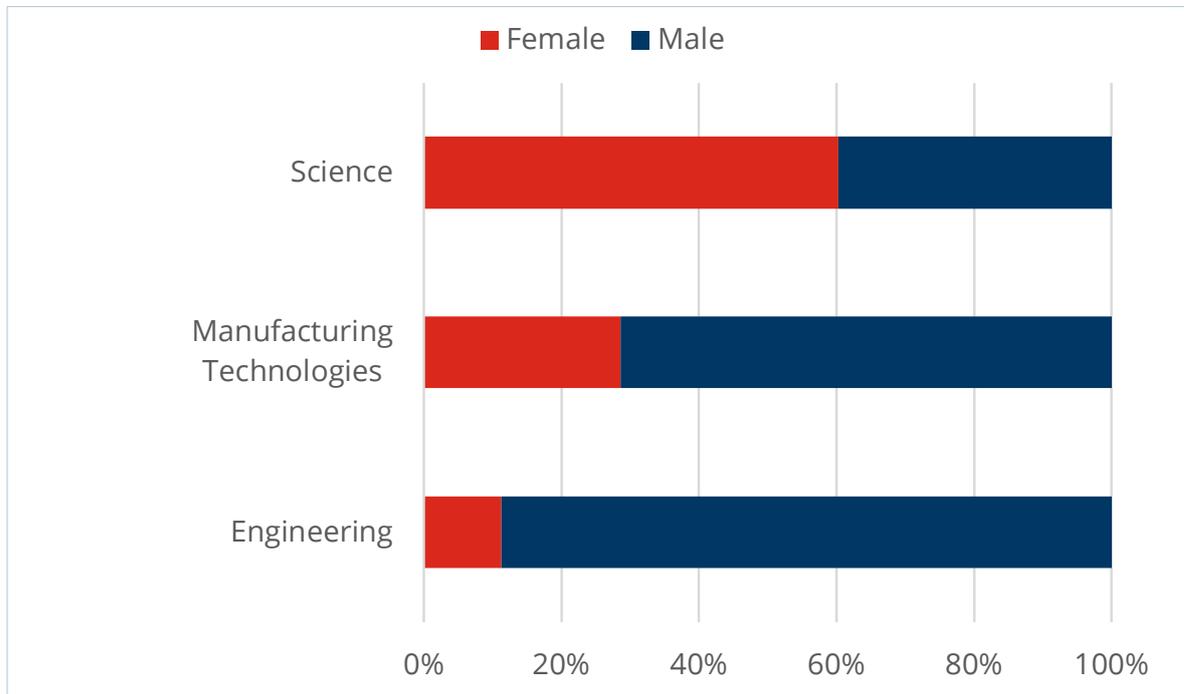
⁶⁹ National Achievement Rates (2019). The NART data does not include under 19 year-olds based in schools or sixth forms, meaning the data is incomplete for individuals aged under 19 years of age. We have chosen to include under 19 year-olds in the analysis as they fall within our age range of interest. The achievement rate for over 19's only is higher, at 92.4%, placing it slightly above the mean achievement rate in education and skills for over 19 years of age (88%).

⁷⁰ Higher Education Statistics Agency (2019)

Participation by gender

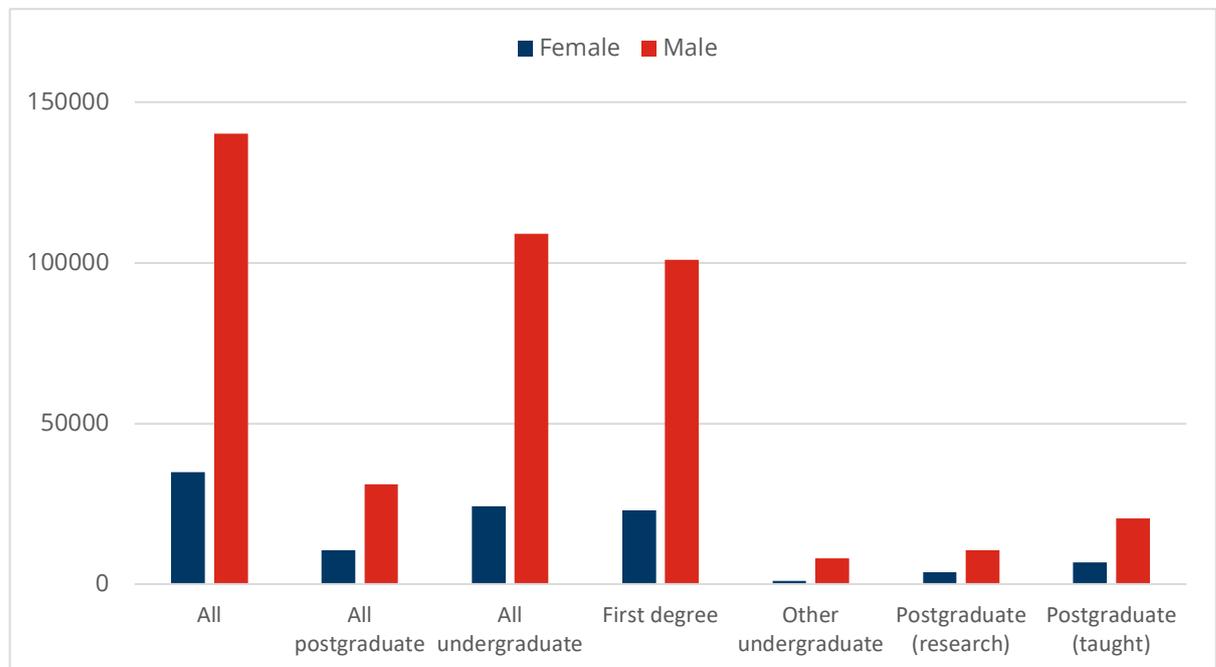
Manufacturing and engineering enrolments are dominated by men at lower intermediate and higher-level qualifications (Figure 8)⁷¹ (Figure 9).

Figure 8: Education and training participation by gender (Entry Level to Level 3, FE)



Source: L&W analysis of Individualised Learner Record (2019)

Figure 9: Engineering and technology higher education students by gender



Source: L&W analysis of Higher Education Statistics Agency data (2019)

71 Individualised Learner Record (2019)

WorldSkills UK is benchmarking UK manufacturing skills against global competitors to identify international best practice and help raise standards

By benchmarking the quality of UK skills against international occupational standards, WorldSkills UK has identified how global competitors such as Japan and Switzerland are outperforming the UK in the standard of skills needed by the manufacturing and engineering sector. Several Asian and European economies are leveraging the input of multinational employers to ensure training remains in lockstep with fast-moving technological change cross-fertilising expertise between business, FE and HE. This is opening doors for these countries to capture increased foreign direct investment, accelerate their transition to net zero, and propel productivity, pay and growth. Learning from these lessons will be key to improving UK competitiveness in future years. Through its Centre of Excellence workforce development programme, WorldSkills UK is helping to embed global best practice in classrooms and workshops nationwide, helping educators innovate and enhance the way they teach technical and employability skills young people, businesses and the local economies need to succeed.

Response of UK Government and four nations governments to supporting sectoral growth

The importance of the manufacturing sector to the UK economy is recognised by the UK Government and the governments in Scotland, Wales and Northern Ireland in recent policy. The Levelling Up the United Kingdom White Paper⁷² commits strategic investments to support sectoral growth and outlines the importance of collaboration between industry and academia to help manufacturing transition to net zero. The Industrial Decarbonisation Strategy⁷³ commits the UK Government to establishing four low-carbon industrial clusters by 2030 and one net zero industrial cluster by 2040, while the Innovation Strategy⁷⁴ also prioritises advanced materials and manufacturing as an area for investment.

A wave of recent initiatives have been announced to accelerate innovation and attract investment in the manufacturing sector. Most recently, the Chancellor announced 'Investment Zones' to catalyse 12 growth clusters in five priority sectors including advanced manufacturing⁷⁵. The UK Government has also invested in three 'Innovation Accelerator' pilots on advanced manufacturing⁷⁶; funded the 'Made Smarter Programme'⁷⁷; and launched High Potential Opportunities (HPO) programmes aimed at attracting FDI to the UK's regions and nations⁷⁸.

72 Department for Levelling Up, Housing and Communities (2022a) *Levelling Up the United Kingdom*. [Levelling Up the United Kingdom White Paper \(publishing.service.gov.uk\)](https://www.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/104444/levelling-up-the-united-kingdom-white-paper)

73 Department for Business, Energy and Industrial Strategy (2021a) *Industrial Decarbonisation Strategy*. [Industrial decarbonisation strategy - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/97444/industrial-decarbonisation-strategy)

74 Department for Business, Energy and Industrial Strategy (2021b) *UK Innovation Strategy: Leading the future by creating it* [UK innovation strategy \(publishing.service.gov.uk\)](https://www.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/97444/uk-innovation-strategy)

75 HM Treasury (2023) *Spring Budget 2023* <https://www.gov.uk/government/publications/spring-budget-2023/spring-budget-2023-html>

76 Department for Levelling Up, Housing and Communities (2022) *Levelling Up the United Kingdom*. [Levelling Up the United Kingdom White Paper \(publishing.service.gov.uk\)](https://www.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/104444/levelling-up-the-united-kingdom-white-paper)

77 [Made Smarter backs 250th manufacturer with tech investment on fourth anniversary | Made Smarter](https://www.gov.uk/government/news/made-smarter-backs-250th-manufacturer-with-tech-investment-on-fourth-anniversary)

78 [Regional investment projects announced to boost local economies - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/news/regional-investment-projects-announced-to-boost-local-economies)

Developing the technical skills needed by our economy has been prioritised in recent education and skills policy across the UK

The Scottish Government recently published an action plan to identify new markets and export opportunities for the advanced manufacturing sector⁷⁹, and has launched several advanced manufacturing initiatives, including a 'National Robotarium' at Heriot-Watt University⁸⁰ and a £25 million Low Carbon Manufacturing Challenge Fund⁸¹. Through its Enterprise Zone initiative, the Welsh Government has established an Advanced Manufacturing Research Centre in Deeside⁸².

The right skills will be vital to ensuring that these initiatives succeed. Developing the technical skills needed by our economy has been prioritised in recent education and skills policy across the UK. In England, the Skills for Jobs White Paper⁸³, and subsequent Skills and Post-16 Education Act 2022⁸⁴ prioritised the need for investment in higher technical skills and raising awareness of technical education routes amongst school age children. The roll-out of Local Skills Improvement Plans and expansion of Institutes of Technology also aim to improve the responsiveness of the English skills system to employer need and strengthen partnership between industry, further education and higher education for sectors reliant on technical skills such as advanced manufacturing. IoTs and Skills Bootcamps specialising in manufacturing, advanced manufacturing, and engineering are already operating in a number of regions across England⁸⁵.

In Wales, Regional Skills Partnerships have been established to drive investment in skills, including through the development of Regional Employment and Skills Plans⁸⁶. Advanced manufacturing is identified as a key sector in the plans for both the Cardiff Capital Region and North Wales⁸⁷.

In Scotland, the National Strategy for Economic Transformation⁸⁸ establishes a Skilled Workforce Programme, and commits to investing £75 million in a National Manufacturing Institute to: "equip current and future workforces with the skills they and the manufacturing and engineering community need."⁸⁹

79 Scottish Government (2022) *A Trading Nation – An Export Plan for Scotland's Technology Sector*. [A Trading Nation – An Export Plan for Scotland's Technology Sector \(www.gov.scot\)](https://www.gov.scot)

80 [Levelling up reaches new heights in Scotland - GOV.UK \(www.gov.uk\)](https://www.gov.uk)

81 Scottish Government (2022) *Scotland's National Strategy for Economic Transformation: Delivery Plans*. [Delivering Economic Prosperity - Delivery Plans \(www.gov.scot\)](https://www.gov.scot)

82 [Written Statement: Update on the Enterprise Zone Programme in Wales \(2 March 2022\) | GOV.WALES](https://www.gov.wales)

83 Department for Education (2021) *Skills for jobs: lifelong learning for opportunity and growth* [Skills for Jobs: Lifelong Learning for Opportunity and Growth \(publishing.service.gov.uk\)](https://www.publishing.service.gov.uk)

84 [Skills Bill becomes law - GOV.UK \(www.gov.uk\)](https://www.gov.uk)

85 See: [Institutes of Technology - GOV.UK \(www.gov.uk\)](https://www.gov.uk); [Skills Bootcamps - Skills for Life](https://www.gov.uk)

86 [Regional Skills Partnerships | Business Wales Skills Gateway \(gov.wales\)](https://www.gov.wales)

87 See: Cardiff Capital Region Skills Partnership (2020) *Employment and Skills Plan 2019-2022* [2020_02_005 CCR Regional Skills Plan.indd \(gov.wales\)](https://www.gov.wales); [Ambition North Wales \(2021\) Annual Report 2021-2022](https://www.gov.wales) [Ambition North Wales - Annual Report 2021-22](https://www.gov.wales)

88 Scottish Government (2022) *Scotland's National Strategy for Economic Transformation: Delivery Plans* [Delivering Economic Prosperity - Delivery Plans \(www.gov.scot\)](https://www.gov.scot)

89 Ibid, p.20

The Northern Ireland Skills for a 10X Economy Strategy⁹⁰ acknowledges a need to increase the number of people undertaking professional and technical qualifications at the mid-levels. Advanced manufacturing/engineering is identified as one of five key strategic clusters where bespoke skills action plans will be developed. The government has established employer-led sectoral partnerships in the food manufacturing and advanced manufacturing sectors, to ensure that apprenticeships meet the current and future needs of industry⁹¹.

Delivering technical skills to support the success of the UK manufacturing sector is high on the agenda of governments across the UK. The remainder of this report will set out our findings on which skills are needed, how far providers can deliver these, and young people's awareness and motivation to develop them.



90 Department for the Economy (2021) *Skills Strategy for Northern Ireland: Skills for a 10X economy* [Skills Strategy for Northern Ireland. Skills for a 10X Economy. \(economy-ni.gov.uk\)](#)

91 Department for the Economy (2021) *Skills Strategy for Northern Ireland: Skills for a 10X economy* [Skills Strategy for Northern Ireland. Skills for a 10X Economy. \(economy-ni.gov.uk\)](#) p.56



3. Employer skills needs

This chapter reports findings from a survey of manufacturers on their skills needs. It also explores reflections from interviews with employers, training providers and industry stakeholders who participated in roundtables and interviews.

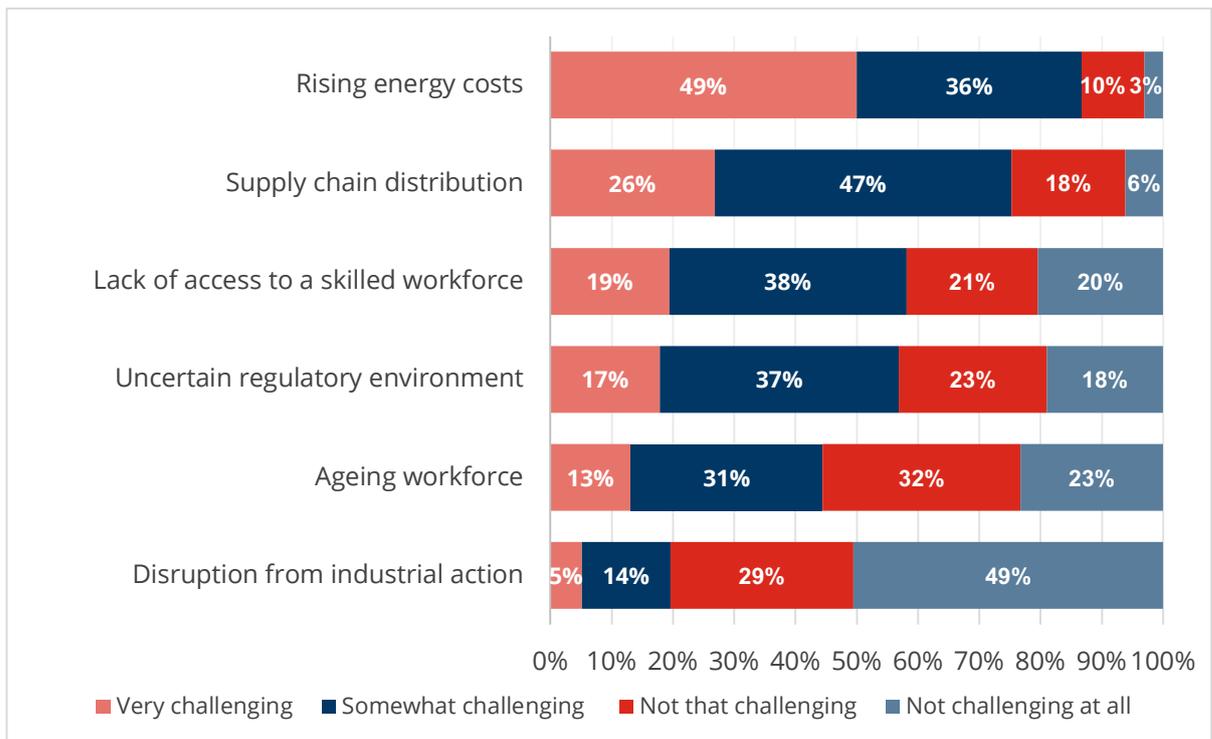
Key chapter findings:

- almost three in five manufacturers surveyed (57%) cite challenges accessing a skilled workforce. Over half (55%) of manufacturers are experiencing shortages in advanced manufacturing skills and even more (61%) in traditional manufacturing skills
- nearly two thirds (63%) of manufacturers believe that advanced manufacturing technologies and processes are currently impacting their skills needs, and more (69%) believe they will in the next five years
- 45% report an increased demand for higher technical qualifications/higher apprenticeships and 38% for degrees/degree apprenticeships
- demand for qualifications at all levels is expected to increase over the next five years, emphasising the need to increase enrolments, rather than just reprofile existing workforce numbers to higher qualification levels
- over half of manufacturers reported an increased demand for advanced digital skills (55%) and employability skills (54%), and 37% for basic digital skills. Demand for these skills is expected to increase over the next five years
- most manufacturers recognise that advanced manufacturing skills can bring benefits to their organisation, including increased productivity (48%), competitiveness (37%) and profitability (36%)
- shortages of traditional and advanced manufacturing skills are driving firms to inflate wages in pursuit of skilled workers, as well as hampering manufacturers' abilities to satisfy market demand and increase productivity.

Challenges faced by employers

Almost three in five manufacturers surveyed (57%) cite challenges accessing a skilled workforce. This is the third most reported challenge behind rising energy costs (85%) and supply chain distribution (74%) (Figure 10). Additionally, around two in five (43%) cite an ageing workforce as a challenge. These findings complement existing evidence highlighting substantial skills and labour shortages within the sector.

Figure 10: Extent to which issues faced by employers are challenging for their organisation currently



Source: Manufacturers Survey. Base: All respondents (352).⁹²

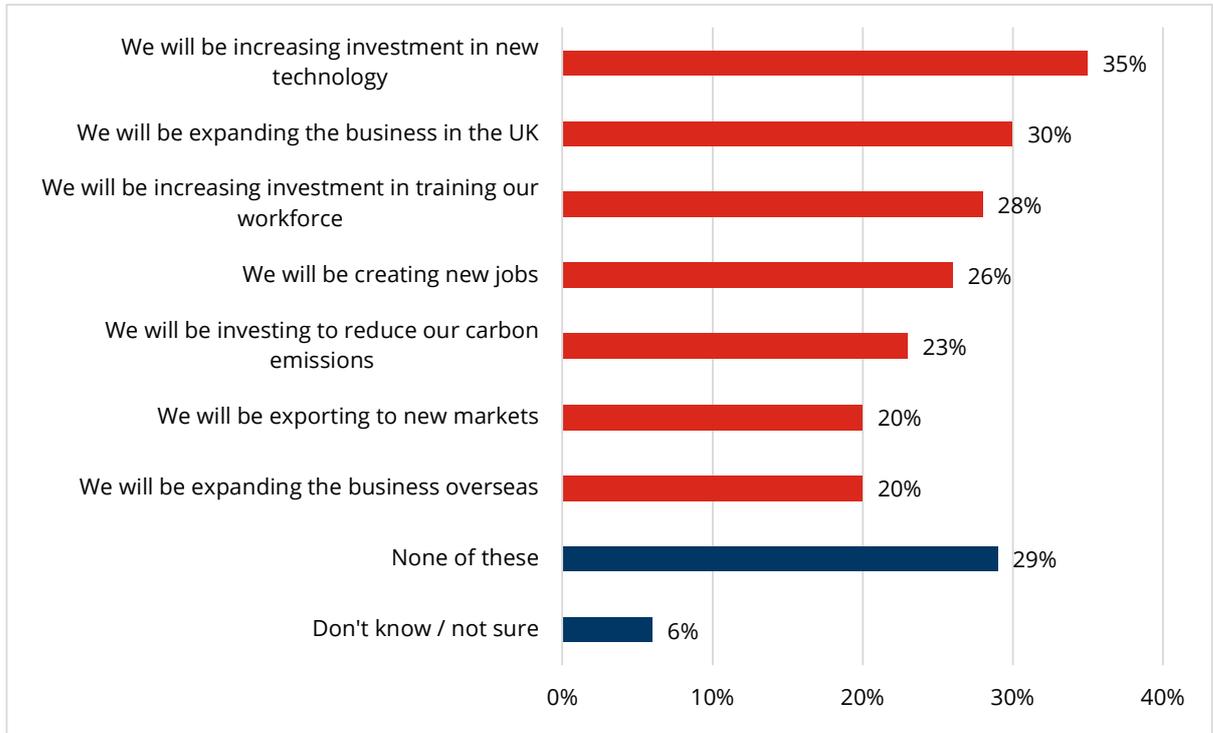


⁹² 'Don't know' responses are excluded due to low sample sizes (between 2% and 5% per question)

Plans to resolve challenges

Manufacturers surveyed are taking steps to resolve these challenges, including increasing investment in new technology (35%) and training (28%). While 30% plan to expand in the UK, one fifth (20%) plan to expand overseas (Figure 11).

Figure 11: Manufacturing organisations' plans over the next 12 months (ie up to January 2024)



Source: Manufacturers Survey. Base: All respondents (352)



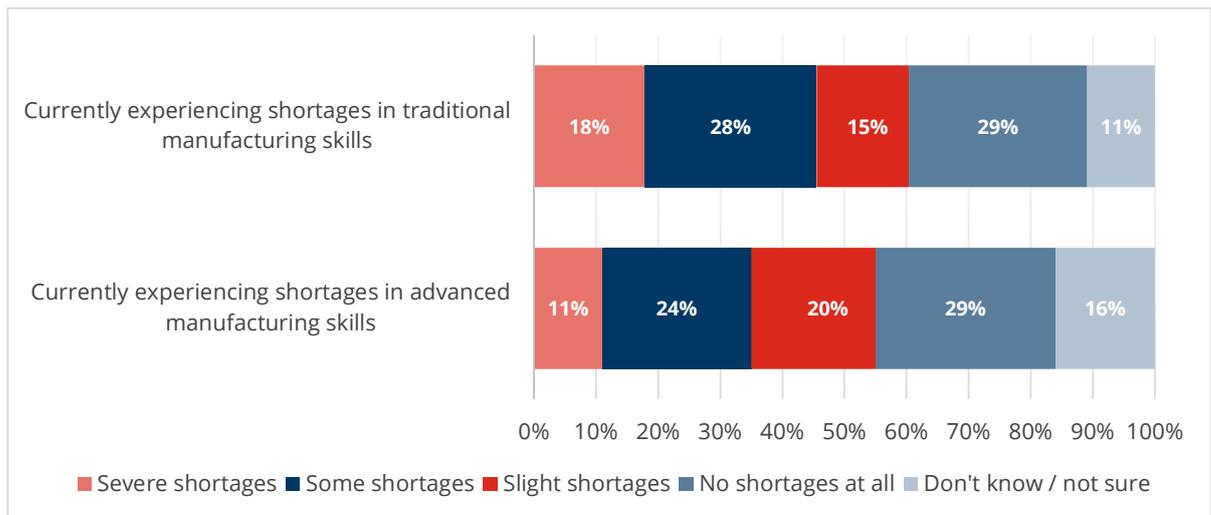
Skills shortages

Over half (55%) of manufacturers are experiencing shortages in advanced manufacturing skills and even more (61%) in traditional manufacturing skills, such as fabrication, welding and mechanical engineering (Figure 12). Almost one in five manufacturers (18%) say that they are experiencing severe shortages in traditional manufacturing skills.

Almost two fifths (38%) of manufacturers expect skills shortages in advanced manufacturing to increase over the next five years, while 43% expect traditional skill shortages to increase. Large businesses are more likely to expect both traditional and advanced manufacturing skills shortages to increase over the next five years.

There are also regional variations in the types of skills shortages manufacturers experience and anticipate. For example, manufacturers in the Midlands are significantly more likely to experience severe shortages in traditional skills (24%) than manufacturers in the North and the South (11% in each region), and are significantly more likely to expect traditional manufacturing skills shortages to increase significantly in the next five years (26%, compared to 16% of the total sample).

Figure 12: Extent to which manufacturers are experiencing skills shortages

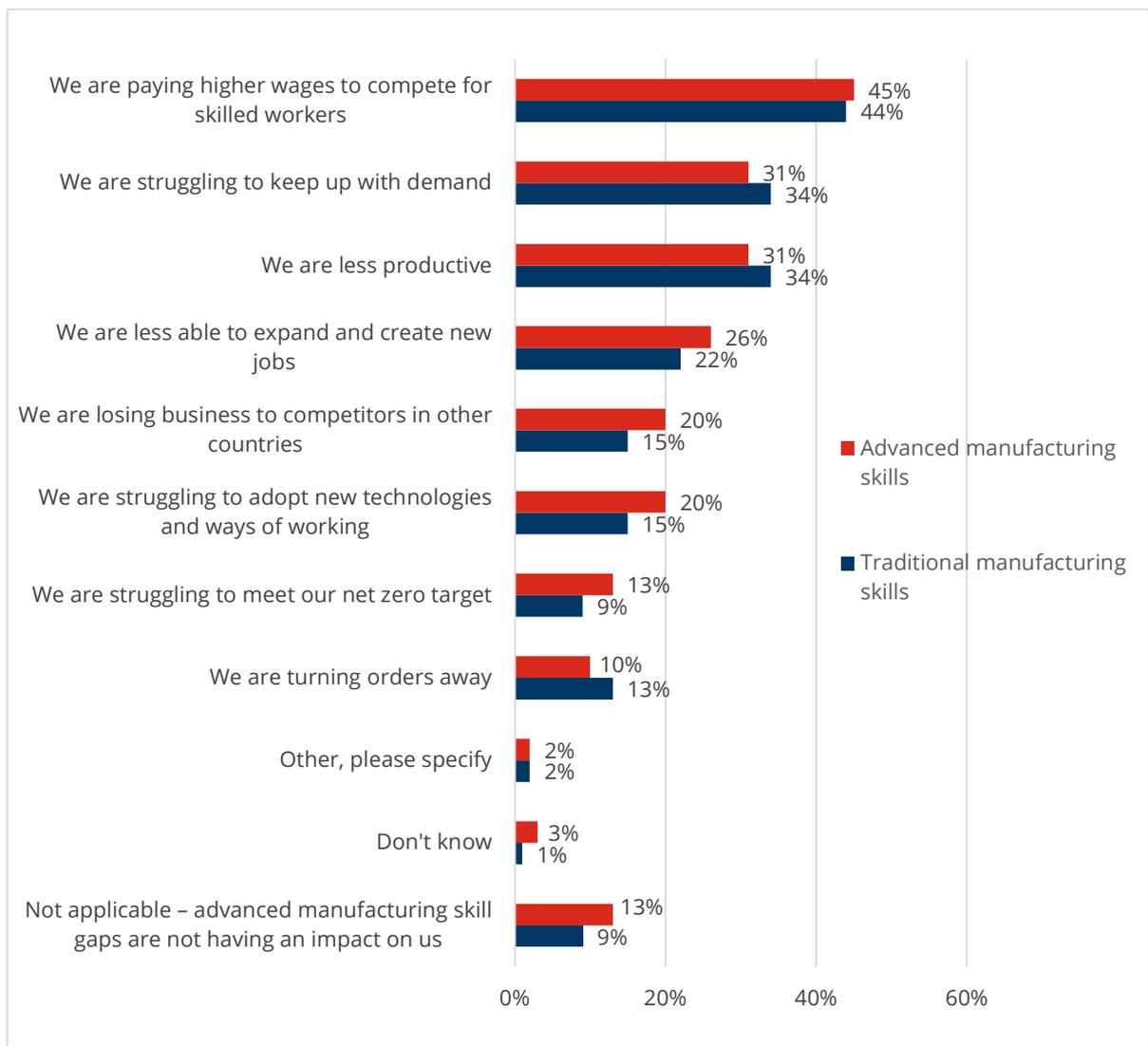


Source: Manufacturers survey. Base: All respondents (352)

Impact of skills shortages

Advanced manufacturing skills gaps, as well as traditional manufacturing skills gaps, were reported to have several impacts on manufacturers (Figure 13). The most common impacts include organisations paying higher wages to compete for skilled workers (45% advanced, 44% traditional), being less productive (31% advanced, 34% traditional), struggling to keep up with demand (31% advanced, 34% traditional) and being less able to expand and create new jobs (26% advanced, 22% traditional). Some manufacturers report struggles to adopt new technologies and ways of working (20% advanced, 15% traditional), losing business to competitors in other countries (20% advanced, 15% traditional), and struggling to meet net zero targets (13% advanced, 9% traditional).

Figure 13: Impacts of advanced and traditional manufacturing skills gaps on manufacturers



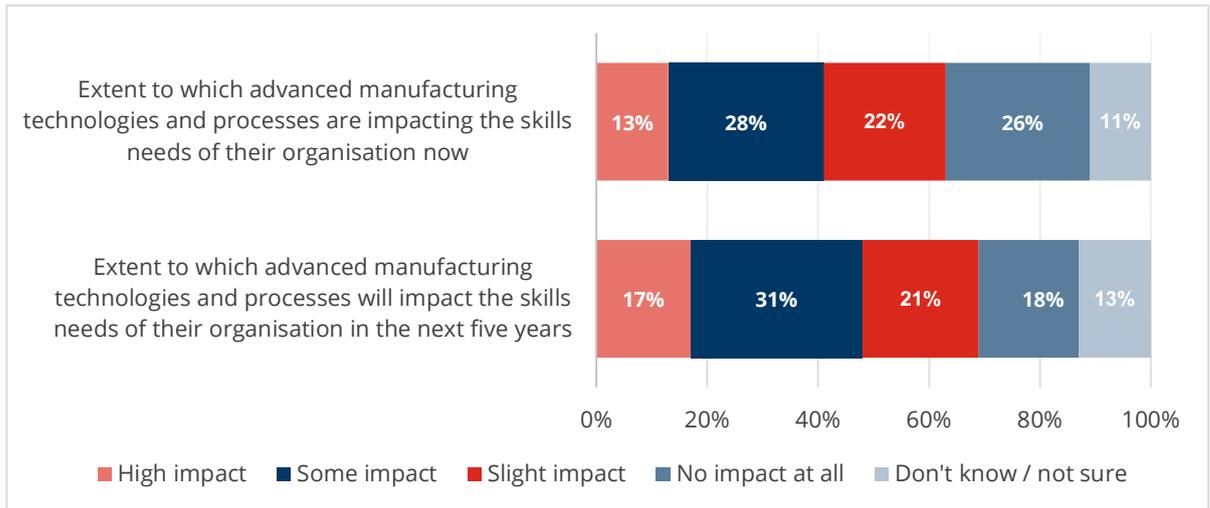
Source: Manufacturers Survey, Base: all who are experiencing shortages in advanced manufacturing skills (194) and traditional manufacturing skills (214)

Impact of industrial transformation

Impact of advanced manufacturing on skills needs

Nearly two thirds (63%) of manufacturers believe that advanced manufacturing technologies and processes are currently impacting their skills needs, and more (69%) believe they will in the next five years (Figure 14).

Figure 14: Impact of advance manufacturing technologies and processes on demand for skills now and in the future



Source: Manufacturers Survey. Base: All respondents (352)

Demand for specific skills and qualifications

Reflecting existing evidence, employers demonstrate a clear demand for higher technical qualifications: 45% report an increased demand for higher technical qualifications/higher apprenticeships and 38% for degrees/degree apprenticeships (Table 1).

However, demand for qualifications at all levels is expected to increase over the next five years, emphasising the need to increase enrolments, rather than just reprofile existing workforce numbers to higher qualification levels. Over half of manufacturers reported an increased demand for advanced digital skills (55%) and employability skills (54%), and 37% for basic digital skills. Again, demand for these skills is expected to increase over the next five years.

Table 1: Impact of advanced manufacturing on demand for skills and qualifications

Skill / Qualification	Current demand			Future demand		
	Increased	Decreased	No impact	Increased	Decreased	No impact
Degree or degree apprenticeship	38%	6%	44%	40%	8%	42%
Higher technical qualification/higher apprenticeship	45%	4%	40%	43%	4%	43%
T Level, A Level, Level 3 NVQ/SVQ, Advanced Apprenticeship	26%	5%	53%	31%	7%	48%
GCSE, Level 2 NVQ/SVQ, intermediate apprenticeship	20%	6%	58%	23%	7%	58%
Basic digital skills (e.g. basic word processing/Excel skills, using email and messaging apps, internet browsing)	37%	5%	49%	34%	7%	46%
Advanced digital skills (e.g. advanced software skills, programming skills, digital design)	55%	5%	29%	56%	3%	31%
Employability skills (e.g. critical thinking, problem solving, communication)	54%	4%	32%	50%	4%	36%

Source: Manufacturers Survey. Base: all who say advanced manufacturing is impacting their skills needs now (220) and will in the next five years (242)

There is a continued need for traditional skills such as welding in advanced manufacturing futures

Interview and roundtable participants also reported an increased demand for technical skills, and at a higher level, as a result of industrial transformation. Respondents noted a particular demand for digital skills, which they attributed to digitisation and the rise of additive manufacturing⁹³. Specific skills reported to be in demand included digital planning, transformation, data analysis, robotics, IT skills, computer aided design/manufacturing (CAD/CAM), control mechanisation, electronics, creative media software skills, 3D printing, proof of concept (POC), and coding.

Nevertheless, participants in roundtables and interviews also reported the continued need for traditional skills (such as welding) in advanced manufacturing futures, including for the creation and maintenance of infrastructure to support sustainability.

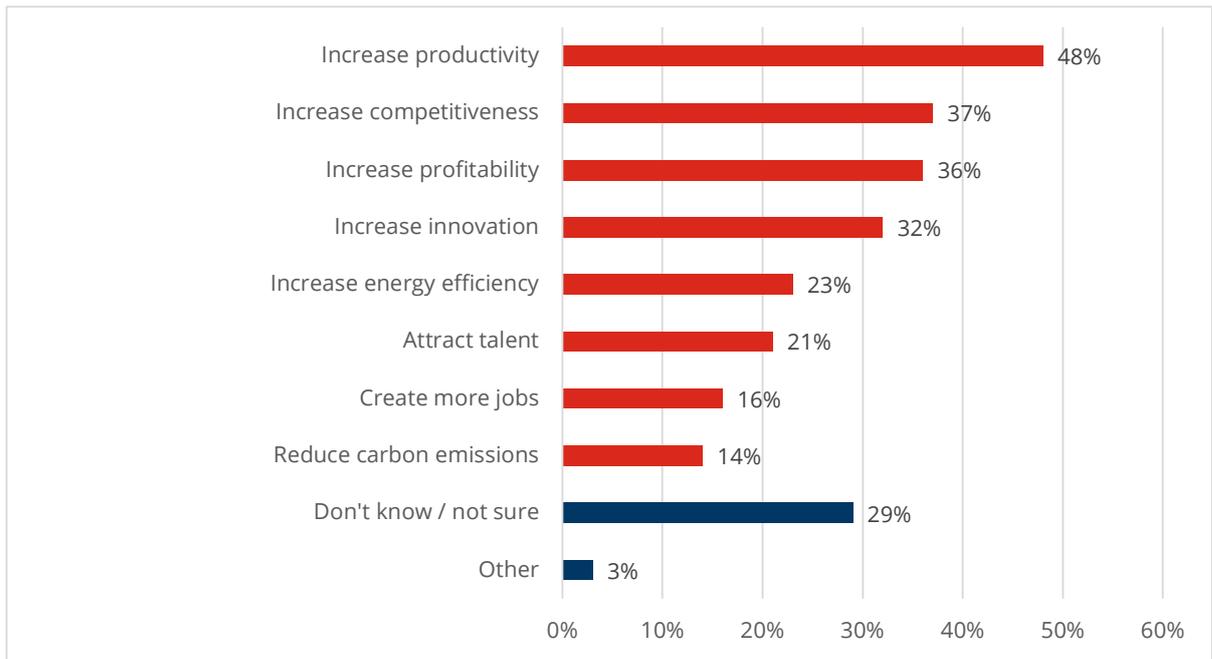
Most interview and roundtable participants considered employability skills, such as problem-solving and critical thinking, to be of equal importance as technical skills. In line with findings from the manufacturers survey and evidence review, participants generally felt that demand for these skills has increased. Also raised were 'meta skills', such as curiosity, intuition, innovation, empathy and critical thinking, viewed as important for young people to adapt to ongoing advances in technology.

⁹³ Additive manufacturing, also known as 3D printing, is the construction of a three-dimensional object from a CAD model or a digital 3D model.

Benefits of employing advanced manufacturing skills

Most manufacturers recognise that advanced manufacturing skills can bring benefits to their organisation, most notably in terms of increased productivity (48%), competitiveness (37%) and profitability (36%) (Figure 15). Around one third (32%) believe that advanced manufacturing skills can increase innovation. Other perceived benefits include increased energy efficiency (23%), attracting talent (21%), creating jobs (16%) and reducing carbon emissions (14%).

Figure 15: Perceived benefits of successfully employing advanced manufacturing skills



Source: Manufacturers Survey. Base: All respondents (352)



The Advanced Manufacturing Skills Academy is closing skills gaps and boosting competitiveness in Welsh manufacturing

The Advanced Manufacturing Skills Academy (AMSA) at University of Wales Trinity St David (UWTSD) harnesses state-of-the-art facilities and equipment to develop and maintain 'first-rate' and up-to-date skills required by manufacturing apprentices and employers.

With backing from the Welsh Government and Higher Education Funding Council for Wales, AMSA works in partnership with leading companies Sandvik, Mazak, and Renishaw to diffuse digital skills and deepen technology adoption within firms. This is contributing to the competitiveness of the Welsh manufacturing sector and keeping its businesses in lockstep with technological changes within the industry worldwide.

AMSA offers a range of degree apprenticeships with UWTSD, as well as short bespoke training packages to local companies for the purpose of workforce upskilling. Individuals enrolled in these programmes are encouraged to further progress the raising of skill levels across their organisation through peer-to-peer learning and support.

AMSA works with WorldSkills UK on the competition programme for Computer-Aided Design, helping to ensure young people from all four nations can develop world-class digital skills both they and UK manufacturers need to thrive.





4. Manufacturing training provision

This chapter explores reflections from employers, training providers and industry stakeholders who participated in roundtables and interviews regarding alignment between current provision and industry needs. It also includes findings from the survey of manufacturers on how firms are working with skills providers, as well as findings from the survey of young people on their views toward training options.

Key chapter findings:

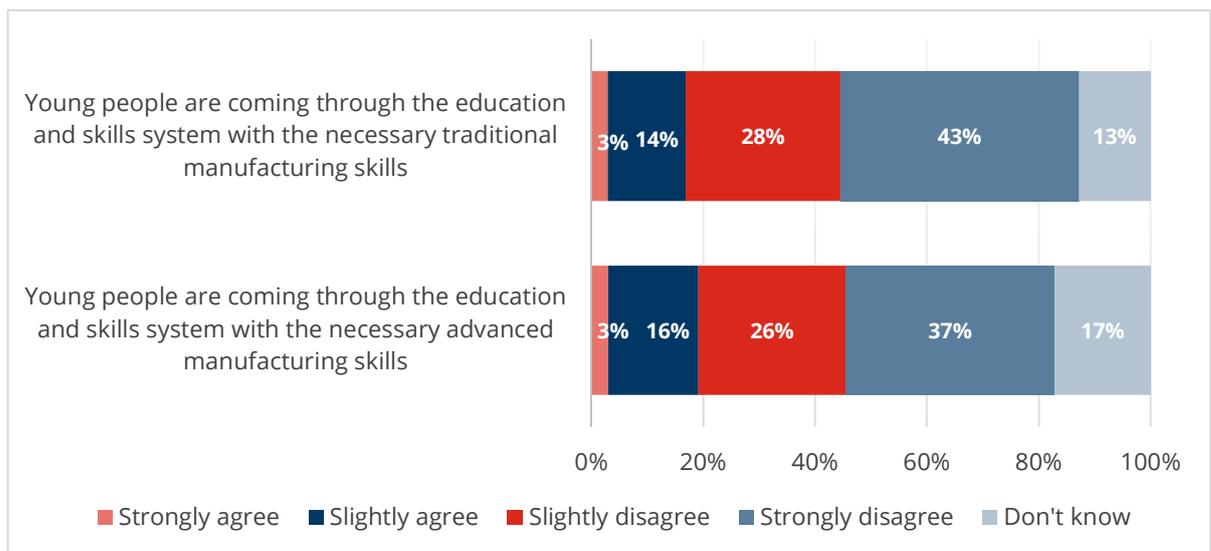
- nearly two thirds (63%) of manufacturers polled believe that young people are not coming through the education and skills system with the necessary advanced manufacturing skills and 70% believe that they are not coming through with the necessary traditional manufacturing skills
- despite this, roughly half of manufacturers (51%) are not working with education or skills providers in order to have their skills needs met
- skills providers report challenges keeping educators' expertise and training equipment aligned with changes in industry, and the shift in skills demand these changes create
- most skills providers identified continuing professional development and training as important for making sure educators can prepare young people for roles in industry
- over nine in ten young people believe that technical qualifications (93%) can lead to highly skilled, well-paid careers. The same is true for apprenticeships (92%)
- despite this, only 51% of young women and 74% of young men have confidence in the UK education system's ability to equip them with the skills needed for a career in manufacturing specifically.

Confidence in the UK skills system

Manufacturers

Both the manufacturers survey and stakeholder interviews identified a lack of confidence in the UK skills system to deliver the skills that industry needs. Nearly two thirds (63%) of manufacturers polled believe that young people are not coming through the education and skills system with the necessary advanced manufacturing skills and 70% believe that they are not coming through with the necessary traditional manufacturing skills (Figure 16).

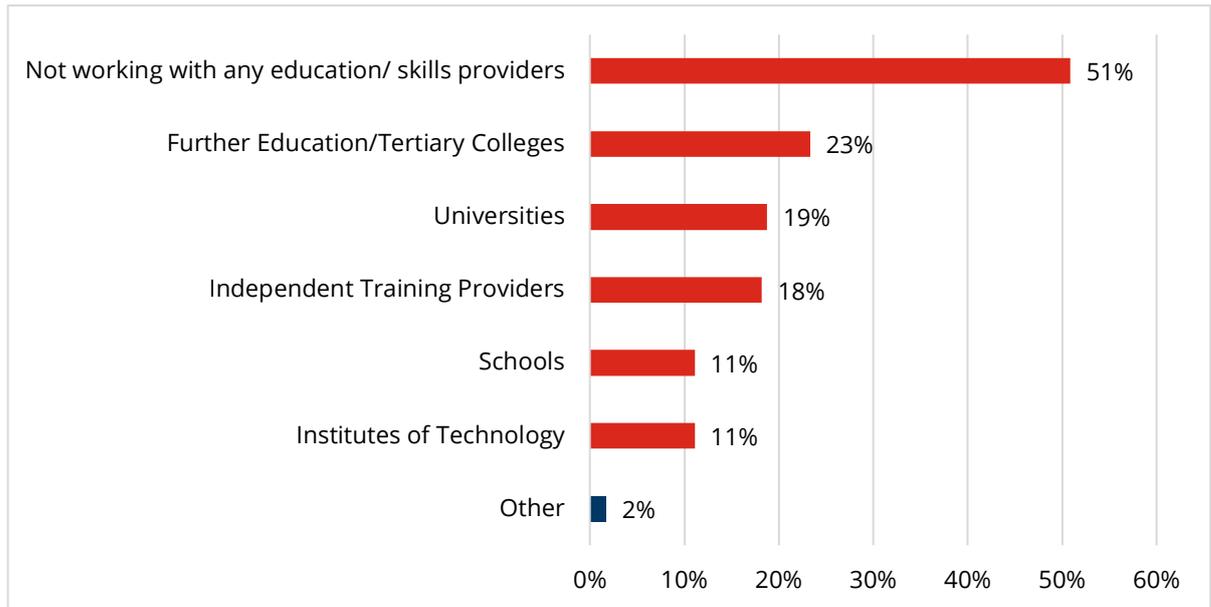
Figure 16: Agreement with the statements around young people gaining the necessary advanced and technical manufacturing skills



Source: Young persons survey. Base: All respondents (1032)

Despite this, **roughly half of manufacturers (51%) are not working with education or skills providers to help them address industry skills needs**, for example, through curriculum design, work placements or careers advice. Nearly one quarter are working with further education/tertiary colleges (23%), whilst nearly one fifth are working with universities (19%) or independent training providers (18%). Large and medium sized businesses are significantly more likely to work with providers compared with small businesses. 79% of large firms are working with education and skills providers, compared with 54% of medium sized firms, and 26% of smaller firms. This supports evidence from WorldSkills UK suggesting the UK is behind world-leading economies in leveraging systemic partnership between education and industry to fire up skills excellence.

Figure 17: Proportion of manufacturers working with education and skills providers



Source: Manufacturers Survey. Base: All respondents (352)

Skills providers

Most skills providers interviewed agreed that many other advanced economies place greater emphasis on technical and vocational education and training to deliver up-to-date skills required by industry. The introduction of vocational subjects at an earlier age and higher value placed on technical qualifications was also considered to be a key factor in the success of the manufacturing industries in countries such as Germany.

Young people do understand the value of technical and vocational qualifications and training pathways

Young people

Despite these concerns, young people surveyed demonstrated a strong interest in technical and vocational education. Over nine in ten young people agree that studying a technical qualification (93%) or an apprenticeship (92%) can lead to a highly-skilled well-paid career (Table 2).

These findings indicate that young people do understand the value of technical and vocational qualifications and training pathways, and do not think these routes lack prestige or quality. However, progress is clearly required on translating these positive impressions into increased enrolments in manufacturing courses, with existing evidence showing falling numbers in recent years.

Table 2: Agreement with the statements around vocational education

Statement around vocational education	Degree to which young people agree/disagree				
	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree	Don't know
Gaining a technical/vocational qualification can lead to highly-skilled, well-paid career	44%	49%	5%	1%	1%
I plan to study/am studying/have studied a technical/vocational qualification	26%	24%	17%	24%	9%
Doing an apprenticeship can lead to highly-skilled, well-paid career	48%	44%	6%	<1%	2%
I plan to do/am doing/have done an apprenticeship	15%	13%	21%	44%	6%

Source: Young persons survey. Base: All respondents (1032)

Gender and ethnicity

Our polling also shows that there are variations in young people's perceptions of, and participation in, technical and vocational education and training.

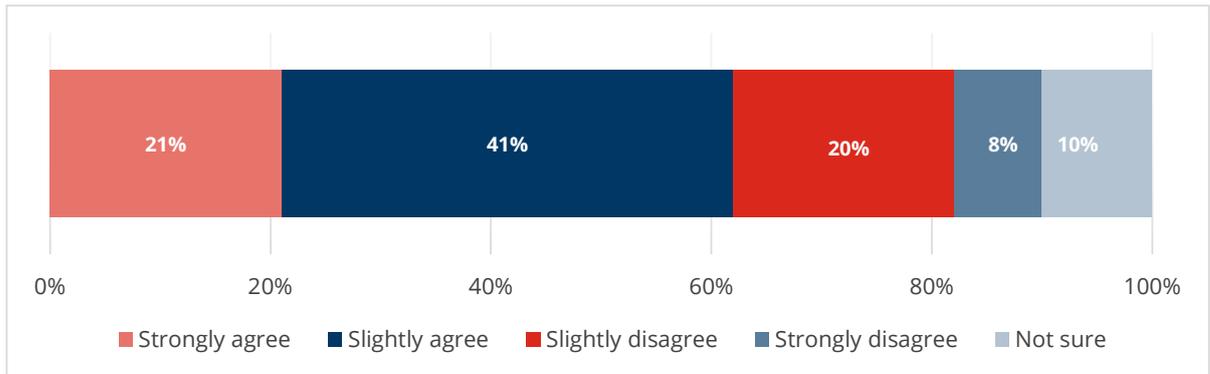
- **Women** are significantly less likely than men to have engaged, or be holding intentions to engage, with technical/vocational qualifications (40% compared to 59%) and apprenticeships (17% compared to 41%). Despite this, women are more likely to agree that an apprenticeship can lead to a highly-skilled, well-paid career (94%, compared to 90% of men). This indicates that young women are not fully empowered to pursue technical and vocational education and training routes, as well as the jobs they support.
- **White respondents** are more likely to agree that gaining a technical qualification leads to a highly-skilled, well-paid career (94%, compared to 89% of respondents from ethnic minority backgrounds)⁹⁴. They are also significantly more likely to strongly agree that doing an apprenticeship leads to a highly skilled well-paid career (49%, compared to 38% of respondents from ethnic minority backgrounds). This suggests that improving young people's perceptions of technical qualifications and apprenticeships might help to increase diversity in the manufacturing sector.

High numbers of young people (62%) have confidence in the UK education system's ability to equip them with the skills needed for a career in manufacturing (Figure 18). However, men are significantly more likely to agree with this statement than women (74% compared to 51%), and respondents from ethnic minority backgrounds are significantly more likely to disagree with this statement (35%, compared to 27% of white respondents).

⁹⁴ Respondents from Black, Asian, mixed and other minority ethnic groups have been grouped under 'respondents from ethnic minority backgrounds' due to low base sizes. However, it should be noted that this use of this subgroup potentially masks differences between individual ethnic groups.

This lack of confidence presents a further barrier to underrepresented groups entering the sector. Addressing this will be important, not just on the basis of improving equality and diversity, but also in meeting replacement demand for jobs and skills.

Figure 18: Agreement with the following statement: “I’m confident the education and skills system can equip me with the skills I need for a career in manufacturing”



Source: Young persons survey. Base: All respondents (1032)

The Black Country and Marshes Institute of Technology is helping unlock the potential of the region's young people, manufacturing sector and economy.

Institutes of Technology are focused on leveraging collaboration between further education, higher education and industry to deliver world-class technical education and training, particularly at Levels 4 and 5.

The Black Country and Marshes Institute of Technology (BCMIoT) is delivering a range of advanced manufacturing and engineering apprenticeships, as well as higher technical qualifications in mechanical and electrical engineering. Co-investment, co-design and co-delivery of courses is ensuring students and apprentices are equipped with the skills needed to thrive in an exciting new era for the region's manufacturing sector.

Clear and continuous pathways from intermediate to higher technical skills are helping businesses to seize the possibilities presented by automation and AI, invest in their talent pipeline, and unlock high-value jobs. This is transforming the career prospects of young people in the local economy, and can contribute to a narrowing of the productivity gap between the West Midlands and London and the South East.

BCMIoT is also innovating to attract young people to the sector and help those in engineering and manufacturing roles to upskill. This includes providing short introductory courses in 3D modelling and robotics.

Many colleges either don't provide training in skills they can't afford the equipment for, or create generalised courses that aim to cover a broad range of skills, without providing specialist training

"The CPD for staff is incredibly important because if we don't keep up to date, we're going to end up teaching redundant technology, which is what has happened in education for many, many years."

(FE college lecturer)

Challenges and barriers for training providers

In interviews and roundtables, skills providers identified a lack of flexibility in curriculum design resulting in poor alignment with industry needs. Several interviewees felt that course content and teaching resources are relying on outdated information. Some providers also reported difficulties in delivering an adequate level of hands-on training in hours funded.

Some participants also pointed to a lack of preparation for manufacturing/engineering – based courses in secondary school curricula, limiting the capacity of further education to meet industry demand.

Industry standard materials, equipment and machinery are expensive, requiring adequate funding from private and public sources. Even providers with larger budgets are finding it difficult to keep their machinery and equipment up-to-date with industry standards as technology is evolving at a rapid rate. As a result, many colleges either don't provide training in skills they can't afford the equipment for, or create generalised courses that aim to cover a broad range of skills, without providing specialist training.

Most providers identified difficulties in accessing qualified staff as a challenge. A common theme raised in the interviews and roundtables was that the education sector is struggling to recruit staff who not only have the academic and teaching ability, but also have previous experience in manufacturing/engineering roles. This challenge was largely attributed to low pay in teaching roles, as well as perceptions of these roles as demanding and lacking in variety. One workshop participant described a "brain drain" from colleges to higher education or industry, where both pay and status tend to be higher.

Providers pointed out that hiring and upskilling staff is both time-consuming and highly costly, while current demand for contracted teachers is increasingly competitive, driving costs up. Equally, most lecturers reported that they don't have the time to invest in CPD or to keep up with industry standards, leaving them to rely on outdated resources and course structures.

There is a lack of collaboration between training providers and employers. Some felt that providers are not always aware of current skills gaps and demand due to a disconnect between colleges and employers regarding what each party needs from the other. One college lecturer pointed out that, although his college collaborates with industry to conduct placements and work experience, they rarely worked together to determine how skills are taught on their courses.

Providers also identified the need to ensure that provision is flexible to meet industry needs, and highlighted the benefits of project-based learning.

A minority are spending extra time upskilling young people who have a specialist skill they wish to develop which isn't included, or isn't covered in-depth, as part of the curriculum. One provider described spending "hours" out of class with a group of students, training them in CNC

skills because, while these students wanted to be CNC machinists, he considered the current level of provision for these skills in the curriculum to be inadequate if they wanted to get a job in industry.

Continuing professional development (CPD) and training were also raised as important for helping staff to develop their skills. Most participants agreed that if educators aren't equipped with the skills the manufacturing sector needs, then they can't pass these on to prepare young people for roles in industry:

The CPD delivered by WorldSkills UK, through the Centre of Excellence programme and Learning Lab, was seen as particularly helpful for teaching staff.

Electrification Skills Delivery Community are enabling today's trainers to deliver the skills of the future.

The Electrification Skills Delivery Community began as a Gatsby Charitable Foundation supported pilot project in May 2022, in collaboration with Institutes of Technology, manufacturers, colleges, training providers and employers previously initiated by the Department for Education's Emerging Skills Programme (ESP). The aim was to define and establish a mechanism to support trainers in emerging skills for automotive electrification.

To date, the project has been successful in establishing and continually growing a community of practitioners and leaders in the world of electrification training.

The community provides a regular forum for support and meets monthly to discuss common challenges and successes throughout the network. Community members can access the experience of others to share ideas and, commonly, request support from those who may have had similar experiences. This can range from recommendations for training equipment suppliers to how to meet the needs of employer training requests.

Ongoing upskilling is a key objective of the community and, to date, multiple 'masterclass' sessions have been delivered at no cost to community members. Masterclasses have covered a range of technical topics relating to vehicle battery management and propulsion systems, as well as sessions such as 'Don't Miss Digital' which looked at how to improve learner engagement through various educational technology techniques.

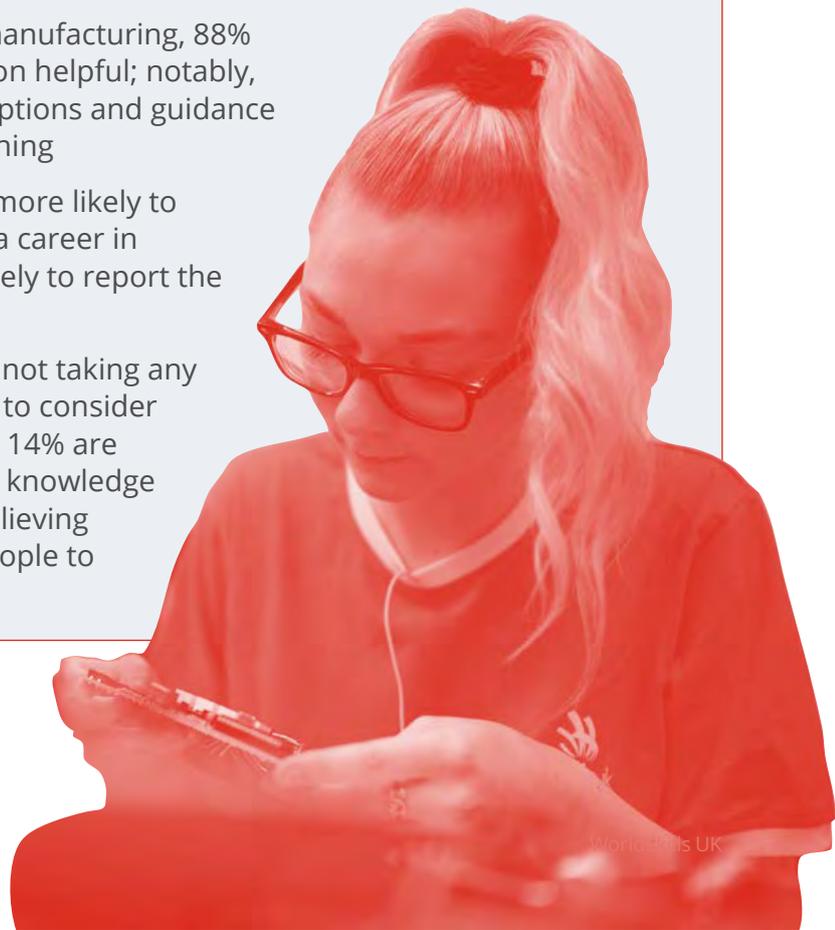
The community have also completed industry insight days at the likes of the UK Battery Industrialisation Centre in Coventry.

5. Attracting young people to the sector

This chapter reports findings from the survey of young people regarding their views of the manufacturing sector and appetite for careers. It also includes the reflections of employers, training providers and industry stakeholders on how to attract young people to the sector.

Key chapter findings:

- three in five young people are unlikely to consider a career in manufacturing. Young women are three times less likely than young men (18% vs 54%)
- young people attracted to manufacturing are drawn by the opportunity for 'hands-on' work, and its status as an innovative, high-tech sector providing highly-skilled, well-paid work. Many young people who would not consider a career in manufacturing hold negative perceptions about the opportunities the sector can offer, such as physical work, low salaries and limited career progression
- however, when provided with a range of in-demand job roles related to manufacturing, only 22% of young people reported not finding any appealing. Most popular options involve AI, design, and data, while traditional manufacturing options are less appealing
- 83% of young people feel they face barriers to pursuing a career in manufacturing. The most common barriers relate to a lack of knowledge and understanding around the sector. Approximately half (48%) have never received information about a career in manufacturing
- in order to pursue a career in manufacturing, 88% would find additional information helpful; notably, around manufacturing career options and guidance on the right qualification or training
- young women are significantly more likely to cite facing barriers to pursuing a career in manufacturing and are more likely to report the need for additional information
- two in five employers (41%) are not taking any actions to inspire young people to consider a career in manufacturing. Only 14% are helping educators gain industry knowledge and experience, despite 61% believing this could help attract young people to the sector.



Young people's perceptions of a career in manufacturing

Young people were asked to provide five words that they associate with a career in manufacturing. Thirty common words and themes were identified in their responses and displayed in the word cloud (Figure 19) below where size is reflective of frequency. Results show that young people have diverse and sometimes opposing impressions of the manufacturing sector and the opportunities it can offer. Some are positive (eg skilled, creative, interesting, good), while others are negative (eg hard, boring, tiring, repetitive). Although high-pay is reported (36 respondents), low-pay (59 respondents) is more frequent. Perceptions of the sector as male-dominated were identified (24 respondents) with this likely to act as a significant barrier to young women considering a career in manufacturing.

Figure 19: Words young people associate with manufacturing



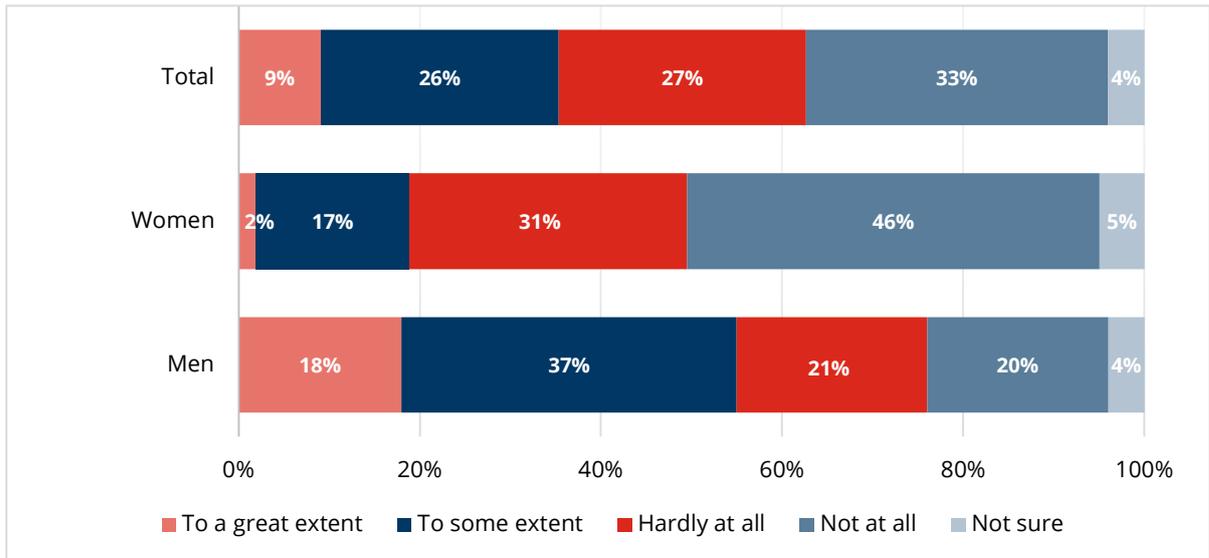
Source: Young persons survey. Base: All respondents (1032)

Motivation to work in manufacturing

The majority (60%) of young people surveyed said that they would not consider working in manufacturing. Just over one third (36%) would consider it, with 26% surveyed responding that they would strongly consider working in manufacturing (Figure 20).

Men are three times more likely to consider working in manufacturing than women (54% compared to 18%), with almost half (46%) of women responding that they would not at all consider working in manufacturing. Most interview participants also agreed that it remains difficult to attract women to the sector as careers advice isn't inspiring young women, and perceptions of a male-dominated sector often discourage women.

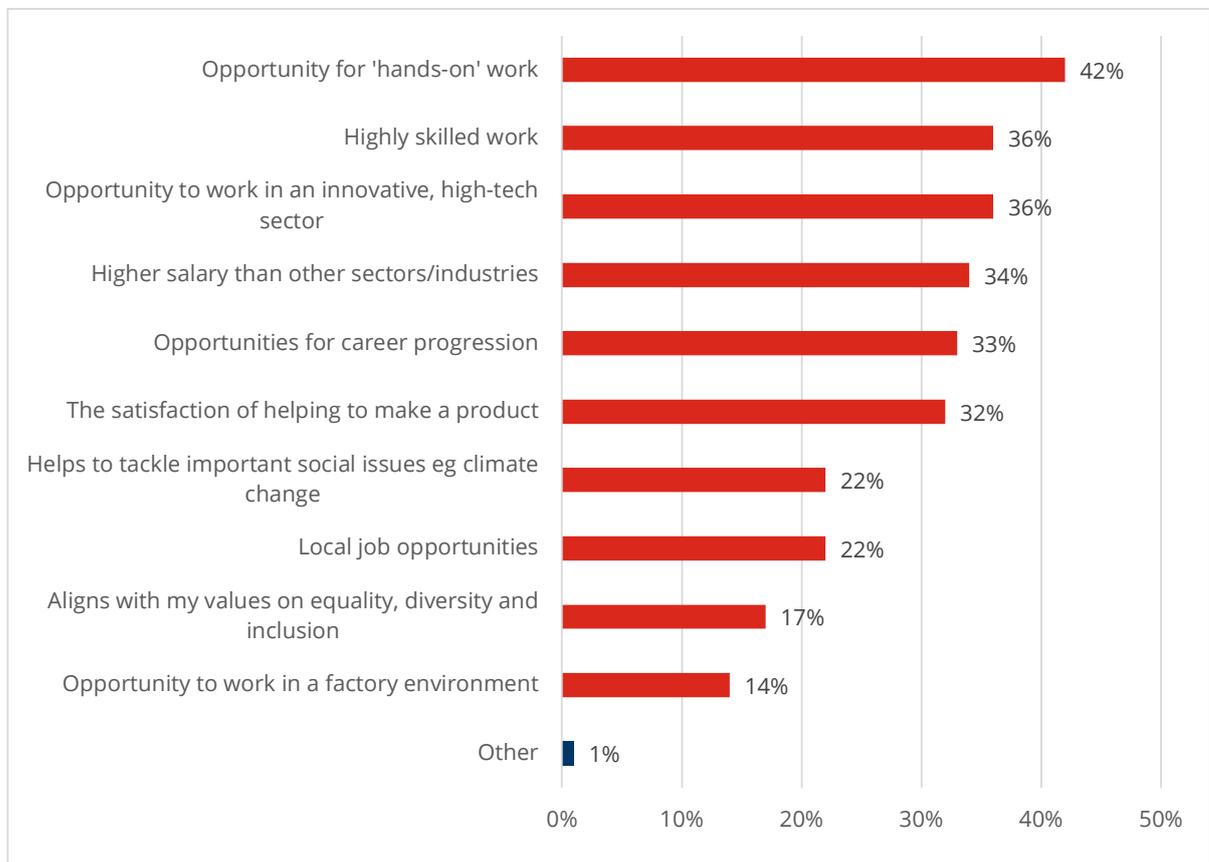
Figure 20: Extent to which young people would consider working in manufacturing



Source: Young persons survey. Base: All respondents (1032); Women (unweighted 540, weighted 520); Men (unweighted 479, weighted 499)

Young people who would consider working in manufacturing are most commonly attracted to the opportunity for ‘hands-on’ work (42%), followed by the opportunity to work in an innovative, high-tech sector (36%), engage in highly-skilled work (36%), and earn a higher salary than in other sectors/industries (Figure 21).

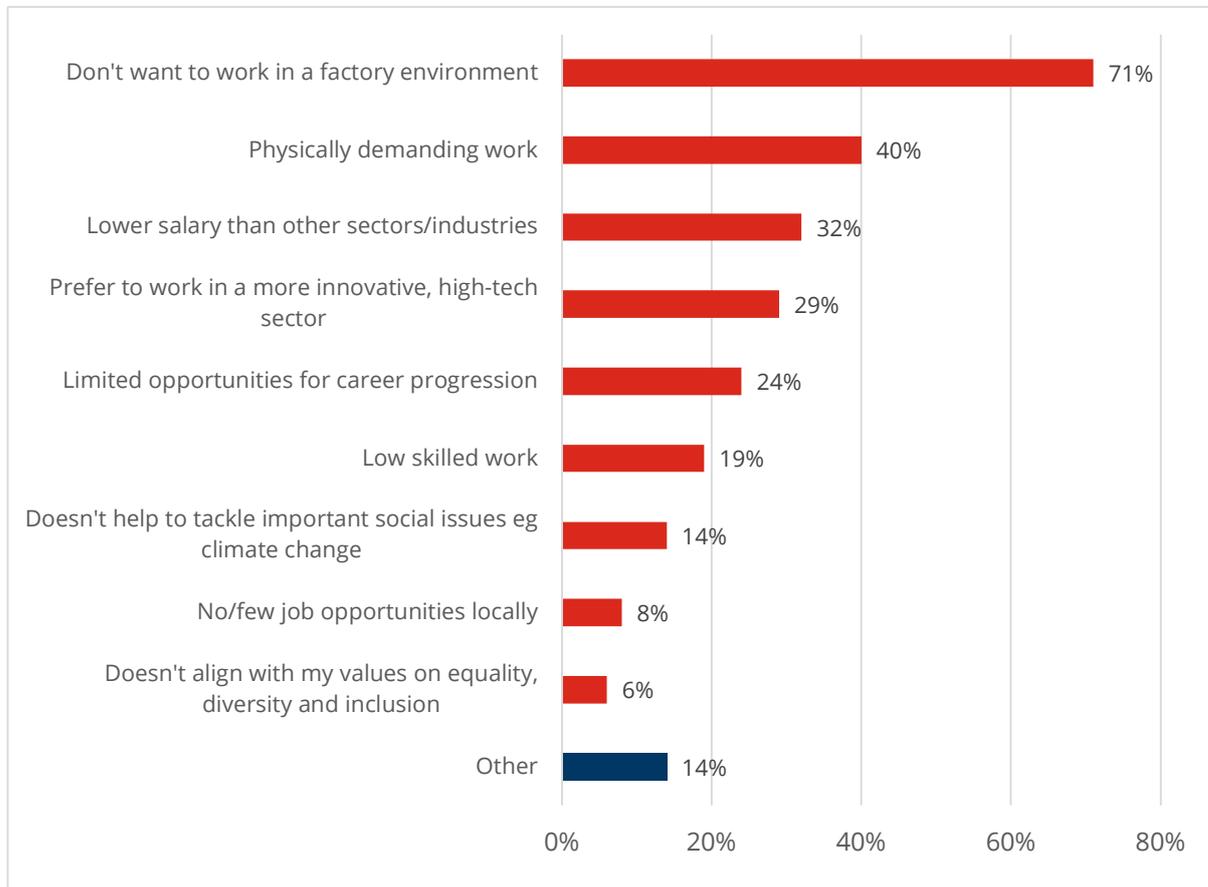
Figure 21: What attracts young people to working in manufacturing



Source: Young persons survey. Base: All respondents who would consider a career in manufacturing (unweighted 361, weighted 369)

For young people unlikely to consider working in manufacturing, the most common reason offered was not wanting to work in a factory environment (71%) (Figure 22). This is followed by the physically demanding work (40%), lower salary returns than other sectors (32%), and a preference to work in a more innovative, high-tech sector (29%).

Figure 22: Reasons why young people would not consider working in manufacturing



Source: Young persons survey. Base: All respondents who would not consider a career in manufacturing (unweighted 623, weighted 618)

These findings indicate that significant misconceptions about roles in the manufacturing sector may be denying young people opportunities to move into higher-value well-paid jobs the UK urgently needs. Young people's misgivings around the sector's ability to provide highly-skilled, well-paid careers was also raised in interviews and roundtables with skills providers, who pointed to other sectors with academically challenging courses that hold higher status in young people's minds.

Roundtable participants also highlighted that young people require clarity on the nature of qualifications and training pathways, and the balance between practical and theory-based work. This is vital with survey findings showing that the opportunity for hands-on work is the most common factor attracting young people to manufacturing careers.

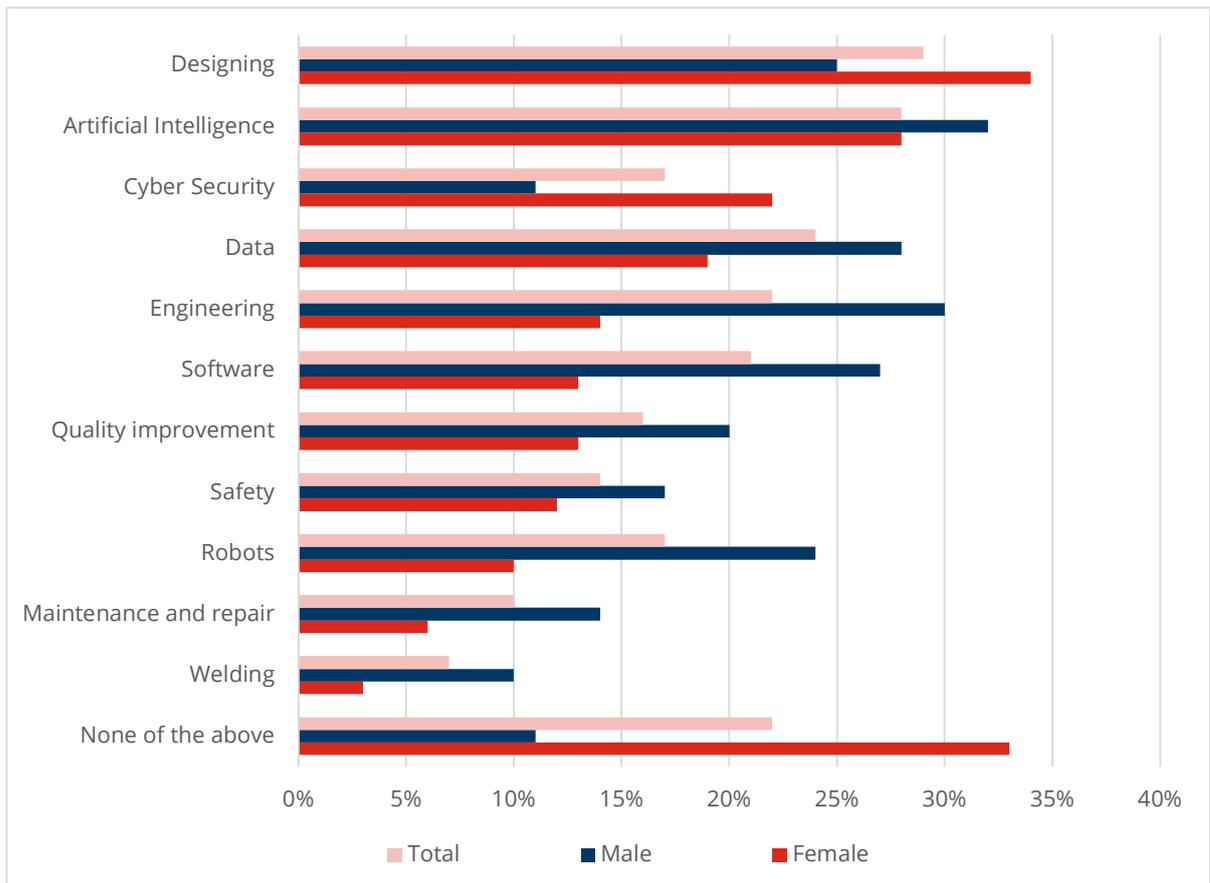
Appealing job roles

In another survey question, young people were provided with a range of job roles related to manufacturing and asked to select what might be of interest (Figure 23), including the option of 'none of the above'.

These options were based on existing evidence on demand for jobs and skills cited in the evidence review.

Interestingly, despite 60% of young people previously stating that they would not consider a career in manufacturing, only 22% were not interested by any of the manufacturing job roles in high demand. This points to a lack of understanding around the job opportunities available in the sector, which, if addressed, could help to encourage new entrants.

Figure 23: Appealing job roles amongst young people



Source: Young persons survey. Base: All respondents (1032)

Respondents most commonly reported that jobs involving designing (29%) and AI (28%) are appealing, followed by those involving data (24%), engineering (22%), and software (21%). Emphasising the availability of these job roles may therefore help to attract more young people to the sector. A smaller proportion of respondents find jobs involving safety (14%), maintenance and repair (10%) and welding (7%) appealing, suggesting less preference for more traditional roles. This is concerning, given the evidence that traditional roles are still in high demand, and will continue to be so owing to replacement demand.

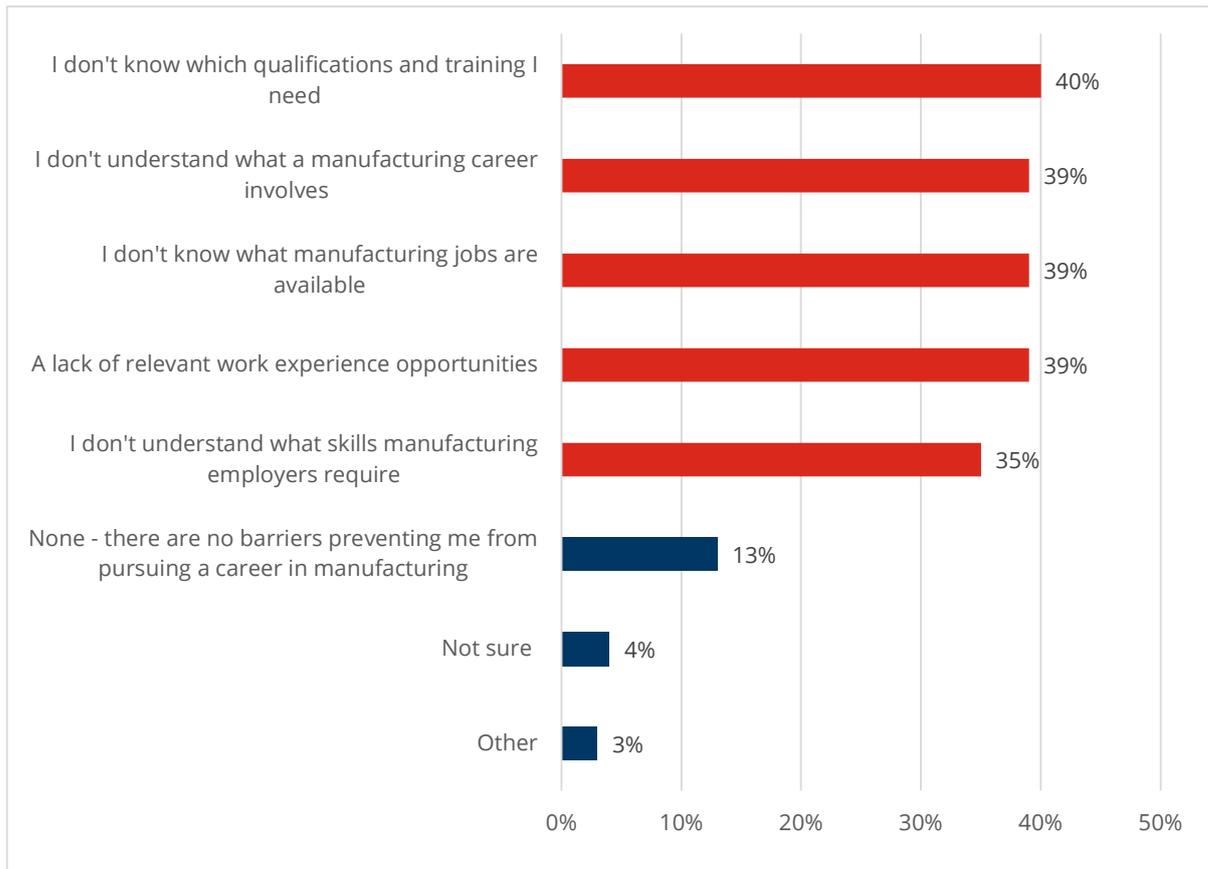
Further analysis shows that:

- men are significantly more likely to find all the listed manufacturing job roles appealing compared to women, with the exception of 'design'
- respondents from ethnic minority backgrounds find jobs involving AI (40%), engineering (32%) and cyber security (25%) more appealing than white respondents (26%, 20% and 16% respectively).

Barriers to a career in manufacturing

A large majority (83%) of young people feel they face barriers to pursuing a career in manufacturing (Figure 24), most commonly, a lack of understanding around what training they need (40%), relevant work experience opportunities (39%), knowledge around what manufacturing jobs are available (39%) and understanding of what a manufacturing career involves (39%). These findings suggest that clear, accurate and inspiring careers education, information advice and guidance is a key part of confronting skills shortages faced by manufacturers.

Figure 24: Barriers to pursuing a career in manufacturing



Source: Young persons survey. Base: All respondents (1032)

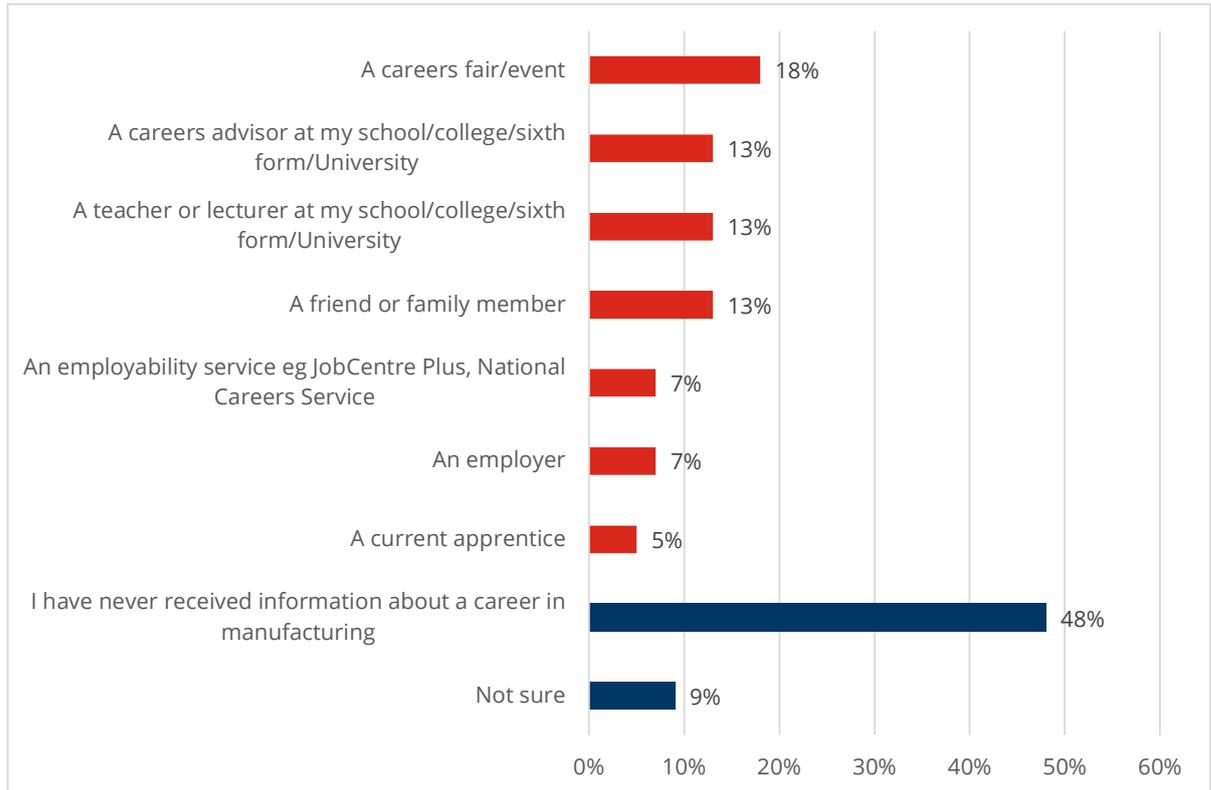
Further analysis shows that:

- women are more likely than men to report barriers around a lack of knowledge and understanding, including: a lack of knowledge about which qualifications and training they need (45% compared to 35%), lack of awareness around what manufacturing jobs are available (43% compared to 36%), lack of understanding about what a manufacturing career involves (46% compared to 32%), and a lack of understanding of what skills manufacturing employers require (39% compared to 32%)
- respondents from ethnic minority backgrounds were significantly more likely to cite a lack of relevant work experience opportunities as a barrier (50% compared to 38%).

Information about a career in manufacturing

Almost half (48%) of young people have never received information about a career in manufacturing. For those who have, most received this through a careers fair/event (18%), followed by a careers advisor at an education institution (13%), a friend or family member (13%) or a teacher or lecturer at an education institution (13%) (Figure 25). Most young women have never received information about manufacturing careers (58%, compared with 37% of men).

Figure 25: Information received about manufacturing careers through the following sources



Source: Young persons survey. Base: All respondents (1032)

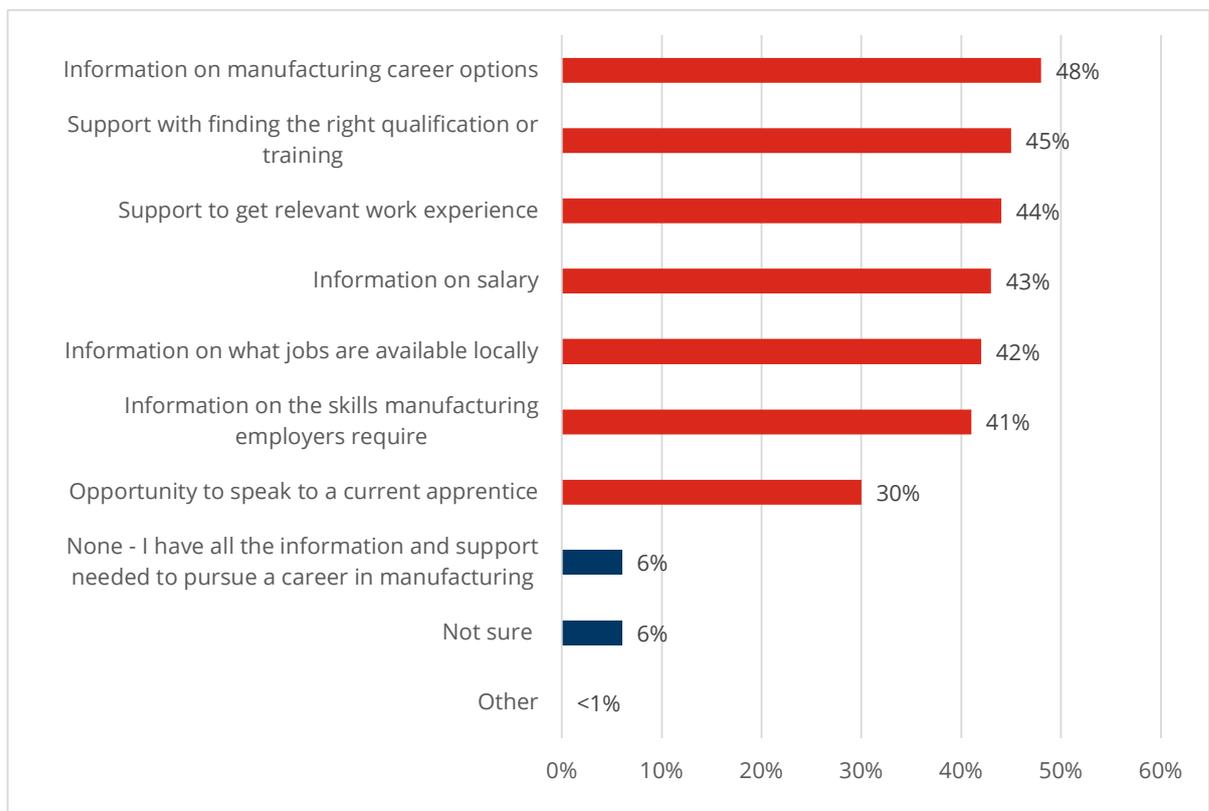
Supporting these findings, interview and roundtable participants believed that careers advice services are neglecting to advertise the benefits of manufacturing careers to secondary school students, or even highlight this as a potential career path. This means that young people don't always understand the variety of manufacturing or engineering jobs available to them, what these roles involve, and the skills they need.

Most interviewees suggested that careers advice should take place from an earlier age, with the challenge of changing perceptions too large for either schools or colleges to tackle alone.

Additional information young people require

In order to pursue a career in manufacturing, the majority of young people (88%) would find additional information helpful (Figure 26). The most commonly cited types of information or support that young people would find helpful are information on manufacturing career options (48%) and guidance on the right qualification or training (45%). Just 6% of young people felt they had all the information and support they needed to pursue a career in manufacturing. This suggests that a dearth of information, advice and guidance is leaving young people under-informed about manufacturing careers and contributing to misconceptions.

Figure 26: Information or support that would be helpful for pursuing a career in manufacturing



Source: Young persons survey. Base: All respondents (1032)

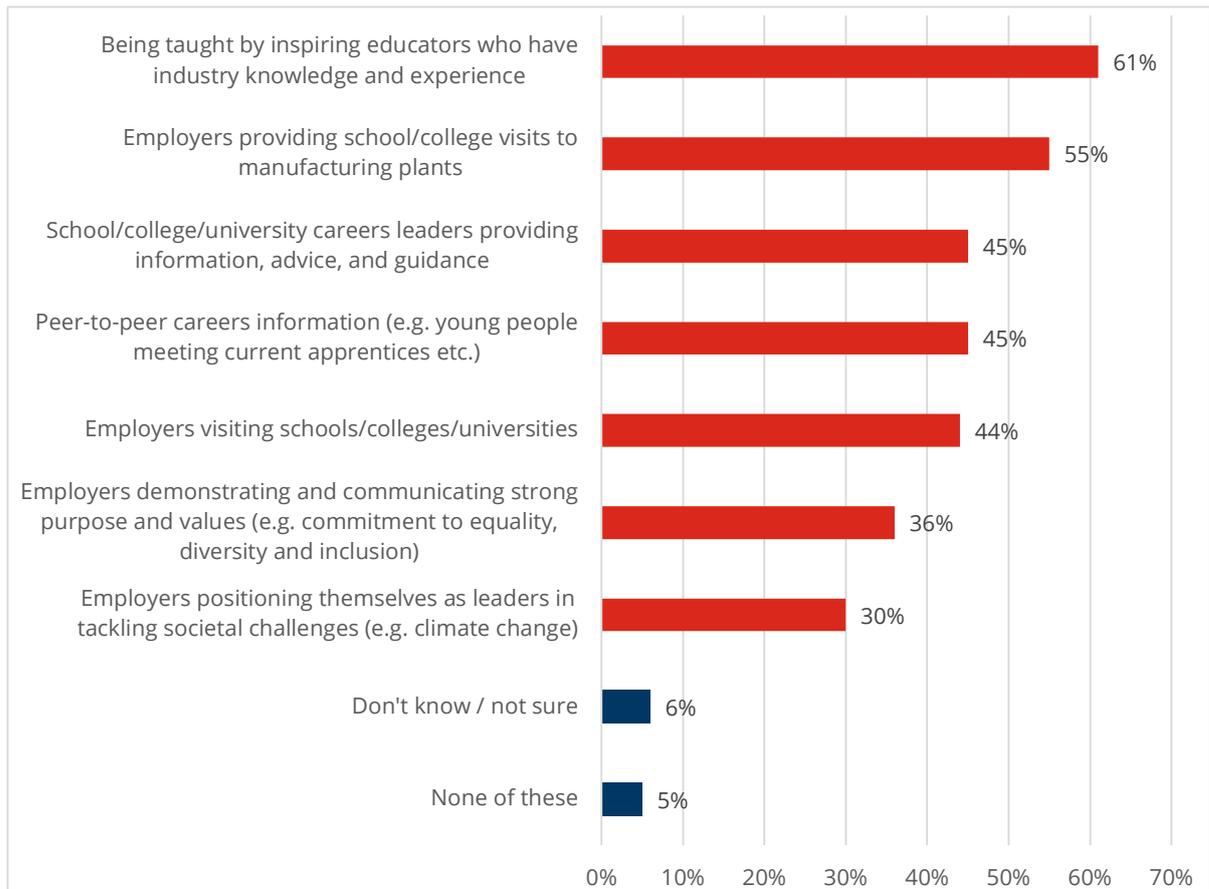
Further analysis shows that:

- women are more likely than men to indicate a need for all the different types of additional information and support
- respondents from ethnic minority backgrounds were significantly more likely to note the benefit in gaining support for relevant work experience (53% compared to 43%).

Employers' role in attracting young people to sector

Employers and educators who engaged with this research recognised the important role of industry in attracting young people to the manufacturing sector. The majority of employers surveyed (61%) thought that 'being taught by inspiring educators with industry experience' would help attract young people, and over half (55%) felt that providing opportunities for young people to visit manufacturing plants would help.

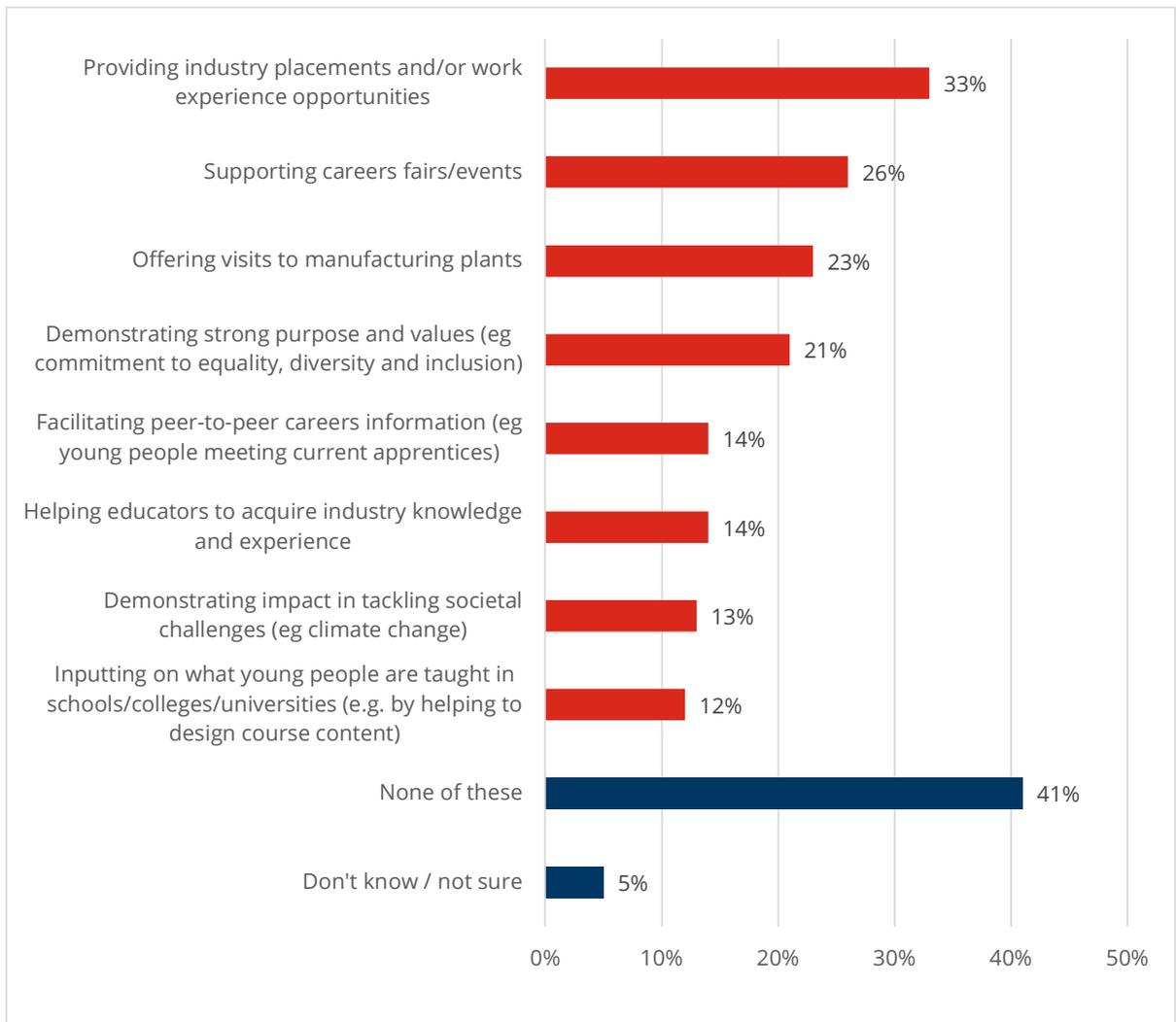
Figure 27: Actions and information that would help attract young people to the sector



Source: Manufacturers Survey. Base: All respondents (352)

Despite this, more than two in five employers (41%) are not currently taking any actions to inspire young people to consider the sector (Figure 28). Notably, only 14% are helping educators acquire industry knowledge and experience, despite 61% reporting this would attract young people to the sector. This suggests that greater industry-active measures to inspire young people towards manufacturing careers will be vital to increasing young people's interest and understanding.

Figure 28: Actions manufacturers are taking to inspire young people to consider a career in manufacturing



Source: Manufacturers Survey. Base: All respondents (352)





6. Conclusion

Persistent skills gaps are preventing the UK becoming a global leader in advanced manufacturing, limiting the sector's potential as an engine for growth. Skills shortages are biting manufacturers now, thwarting job creation and firms' ability to satisfy demand in the market, with lost business often going overseas. Shortages also risk hampering the competitiveness of UK manufacturing in the longer term, and its ability to help the UK confront structural challenges such as low productivity and slow technology adoption, climate change and regional inequality.

Industrial transformation is increasing employer demand for advanced manufacturing skills, with the majority of manufacturers recognising the benefits these skills can bring to their organisation. However, only half of manufacturers are working with providers to meet their skills needs, despite many expressing concern that the education and skills system is not equipping young people with the skills required. Only a small number of manufacturing firms are helping educators acquire industry knowledge and experience, despite the clear majority believing this could help attract young people to the sector. Skills providers are also reporting challenges keeping educators' expertise and training equipment in line with fast-moving industry demand for advanced manufacturing skills.

With the gap in manufacturing skills widening every year it is concerning that most young people would not currently consider a career in manufacturing

Rising demand for qualifications at all levels and a profound shortage of traditional skills reflects the scale of replacement demand in the manufacturing sector, as well as the enduring importance of roles such as welding in advanced manufacturing futures. Falling enrolments in manufacturing courses are exacerbating challenges of an ageing workforce and lack of diversity.

With the gap in manufacturing skills widening every year it is concerning that most young people would not currently consider a career in manufacturing. Perceptions about physically demanding work and poor pay are common and particularly pervasive amongst young women, who are three times less likely to consider a manufacturing career than young men. These perceptions are persisting in an environment where nearly half of young people haven't received any information about manufacturing careers, and too few manufacturing employers are taking active measures to inspire young people. Despite the urgent need to expand and diversify the manufacturing talent pipeline, young people don't feel informed on the jobs available or the training they need, and are missing out on high-value jobs as a result.





7. The role of WorldSkills UK

A key reason WorldSkills UK commissioned this report was to understand how the organisation can play its full role in enabling the UK to become a global leader in advanced manufacturing.

Engineering and manufacturing have for a long time been a key plank of WorldSkills UK's programmes to inspire young people and develop world-class skills in the UK, working with partners that include BAE Systems, Autodesk, Toyota Manufacturing UK, Festo, Lincoln Electric, Fanuc and Air Products who all invest in making sure young people are attracted to careers in manufacturing and have amazing opportunities to develop their skills in this sector.

In the past year WorldSkills UK has already prioritised the development of world-class manufacturing skills by introducing a new competition programme in additive manufacturing with Shining 3D and Ultimaker, fielding a team of young professionals to compete in the Industry 4.0 WorldSkills competition for the first time, and by passing on world-class pedagogical techniques to educators in manufacturing and engineering through our Centre of Excellence programme. WorldSkills UK also has several hours of engaging content on careers in advanced manufacturing provided by partners such as BAE Systems and Autodesk on its online Learning Lab for schools, colleges and career hubs to access which will also help tackle some of the challenges revealed in this report.

WorldSkills UK is also committing to a new set of actions to help inspire and develop a new cohort of young professionals to join the manufacturing sector:

1. Raising the quality of UK manufacturing skills by aiming for a top ten finish in manufacturing and engineering at WorldSkills Shanghai 2026

With no global league table for vocational and technical education, WorldSkills international skills competitions provide a valuable mechanism for benchmarking the quality of skills developed in the UK against those in other major economies. With Team UK finishing 14th in international Engineering and Manufacturing skills competitions at WorldSkills Special Edition 2022, WorldSkills UK is focused on raising the standards of skills the UK manufacturing sector needs to attract FDI and compete internationally targeting a top 10 place in Engineering and Manufacturing skills competitions at WorldSkills Shanghai in 2026.

2. Promoting diverse 'skills champions' to inspire young people of all backgrounds to consider a career in manufacturing

Skills Champions are former WorldSkills competitors, who play a vital role in inspiring young people to follow in their footsteps and gain the skills to succeed. By showing their peers and the next generation of young people that technical pathways can lead to successful and prestigious careers, skills champions are powerful role models who help break down barriers and show that high quality skills are for everyone. Current skills champions include those who competed in manufacturing and engineering competitions at WorldSkills Special Edition – such as in Industry 4.0 where the UK achieved a bronze medal. To tackle the findings in this report showing that young people aren't attracted to a career in manufacturing we will work with our Skills Champions to show that manufacturing careers can be stimulating and rewarding and can be for everyone.

3. Improving access to Industry 4.0 equipment to offer world-class technical training

WorldSkills UK will be improving access to its world-class Industry 4.0 equipment through the Centre of Excellence programme over the next three years, giving educators the opportunity to use the equipment to improve their technical teaching in line with global industry standards. By 2025, the Centre of Excellence will have delivered CPD to over 4,000 educators, with a minimum of 300 participating in intensive high level technical skills training in key sectors such as advanced manufacturing.

4. Partnering with Make UK to share the findings of the research and explore how to inspire the next generation of manufacturing professionals

We will hold a roundtable with Make UK members to discuss the findings of this research and in particular the disconnect between the skills gaps employers in the sector are experiencing, the high numbers of young people that wouldn't consider a career in manufacturing and the finding that 41% of employers are not taking any action to attract young people to the sector and a further 51% of employers aren't working with skills providers to share industry experience. This forum will help develop ideas that WorldSkills UK and Make UK can take forward to help more employers develop a meaningful relationship with the skills system and get more young people interested in manufacturing.

5. Deepening international partnership agreements fostering advances in technical education and training

WorldSkills UK is focused on raising the standards of skills the UK manufacturing sector needs to attract FDI and compete internationally targeting a top 10 place in Engineering and Manufacturing skills competitions at WorldSkills Shanghai in 2026

WorldSkills UK's international partnerships provide a valuable forum for sharing international best practice in skills development, linking UK institutions and educators with those in other countries. In Summer 2023 we will hold an online symposium bringing together skills experts from the UK, Japan, South Korea and Kenya to discuss cutting edge developments in skills critical to the advanced manufacturing sector, giving UK educators access to world-class insights that will help inspire young engineers.

Additional priorities for action

The findings in this report also highlight broader priorities that will need to be addressed by a range of UK stakeholders in collaboration to help build a more internationally competitive manufacturing sector in the UK. This includes:

- exchanging expertise between employers and skills providers to keep courses and curriculum in lockstep with emerging skills demand
- empowering educators to equip young people with first-rate and up-to-date technical and employability skills required by industry
- boosting higher technical education and training to help manufacturers adopt technologies and processes that will enhance productivity and competitiveness
- increasing enrolment numbers on manufacturing courses at all levels to meet replacement demand and the enduring importance of traditional skills such as welding
- developing a compelling narrative about modern manufacturing to attract young women and men of all backgrounds to careers in the sector, challenging the narrow understanding of manufacturing jobs and skills that many currently hold.

Appendix 1: Detailed method

Rapid literature review

The literature review explored existing evidence on:

- skills and job demand in the manufacturing sector, and the impact of advanced manufacturing on this
- gaps between skills supply and demand
- alignment between skills delivered through post-16 education and industry needs
- the response of the UK Government and devolved nations to support sectoral growth.

Evidence explored included government literature; reports and analysis from relevant sector bodies and think tanks; and, where relevant, academic literature.

Secondary data analysis

The secondary data analysis explored a range of datasets to help us set out key trends in the manufacturing sector, including around the labour market, pay, skills demand, and skills supply and shortages. This included analysis of:

- the Business Register and Employment Survey (BRES), the Annual Survey of Hours and Earnings (ASHE), and the Quarterly Labour Force Survey (QLFS), to understand the current occupational profile within the manufacturing sector and which occupations are growing and declining
- ONS productivity measures, to examine trends in manufacturing growth and productivity
- the Employer Skills Survey (ESS), to explore skills gaps for manufacturing employers, and the impacts of these
- National Achievement Rate (NART) tables, the Individualised Learner Record (ILR), and data from the Higher Education Statistics Agency (HESA), to explore participation and achievement rates for manufacturing-related qualifications
- the latest Working Futures projections, to show projected demand for manufacturing job roles and the qualifications needed to fill these roles.

Roundtable events

L&W and WorldSkills UK co-hosted two online roundtable events with industry stakeholders and training providers. The first of these roundtables took place on 6 December 2022, and was attended by nineteen stakeholders, including employers, qualification bodies, and membership organisations. The second roundtable event took place on 13 December 2022, and was attended by fifteen training

providers involved in WorldSkills UK's Innovation Network and Centre of Excellence Network. Both sessions lasted for an hour, and attendees were asked to share their views on three core questions:

- what skills do UK manufacturers need to become global leaders in advanced manufacturing?
- to what extent are skills providers able to deliver these?
- how can the sector become as attractive as possible to young people from all backgrounds?

Both sessions were recorded, and detailed notes were taken throughout.

Semi-structured interviews with training providers

Semi-structured interviews were conducted with 11 training providers from WorldSkills UK's Innovation Network and Centre of Excellence Network. The interviews explored participants' views on how the skills and roles manufacturers require are changing as a result of advanced manufacturing; alignment between manufacturing skills developed in post-16 education and training and industry needs; and how to attract more young people to the sector. The interviews were conducted online via Microsoft Teams between 16 January and 3 February 2023, and were recorded and professionally transcribed.

Survey of manufacturers and young people

- The manufacturing employer survey asked questions around manufacturers' current business priorities; the impact of advanced manufacturing on their organisation; demand for skills and job roles; the impact of skills gaps; how they are currently addressing their skills needs; and how young people can be attracted to the sector. In total, 352 manufacturing employers (at the senior management level) responded.
- The young people's survey asked questions around their perceptions of a career in manufacturing; information they'd received about a manufacturing career; and any perceived benefits of and barriers to a career in manufacturing. In total, 1032 young people (aged 16-24) responded.

Both surveys were conducted online by independent market research agencies, with fieldwork taking place throughout January and February 2023. For both surveys, the data has been weighted to provide a representative reporting sample. Findings have been broken down and reported according to key respondent subgroups, for example, employer size and region for employers, and gender, ethnicity and highest level of qualification for young people. All subgroup differences reported are statistically significant at the 5% level, unless otherwise specified. Subgroup findings for groups of fewer than 50 respondents are not reported, since the sample size is not large enough for these findings to be statistically robust.

Appendix 2: Acknowledgements

We would like to thank the following organisations for their contributions to the research. All errors remain the responsibility of the authors.

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Autodesk	Magna International	Toyota Motor Manufacturing UK
Ayrshire College	Make UK	UCL IOE
BAE Systems	Manufacturing NI	Ultra Electronics
Bedford College Group	Marshall Group	Unipart Group
BMW Group	MBDA UK Ltd	University of Wales Trinity St David
Bridgend College	Middlesex University	
BRUSH Group	Mira Technology Institute	
Caterpillar	MTC Training	
CBI	My Optique Group	
City & Guilds	New College Lanarkshire	
City of Glasgow College	Newcastle College	
Coleg Cambria	Newham College London	
Domino Printing	Next Gen Makers	
Dudley College of Technology	Nissan	
Dundee and Angus College	North Warwickshire and South Leicestershire College	
EAL Awards	Northern Regional College	
Elliott Group UK	Pall Aerospace	
Enginuity	Pearson	
Fashion Enter Ltd	Produmax	
Festo	Rambaldini Welding Ltd	
Food and Drink Federation	Sector Tech	
GKN Aerospace	Sensata Technologies	
Gower College	Shrewsbury Colleges Group	
IMI		
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