

EC
ITB*

**THE ENGINEERING
CONSTRUCTION
INDUSTRY**
Labour Market Outlook



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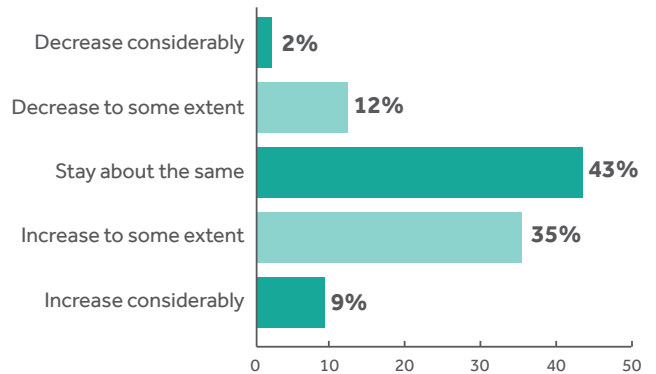
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SKILLS GAPS & SHORTAGES

81% of employers cite applicants' lack of knowledge, skills or experience as the reason for failing to recruit for roles.

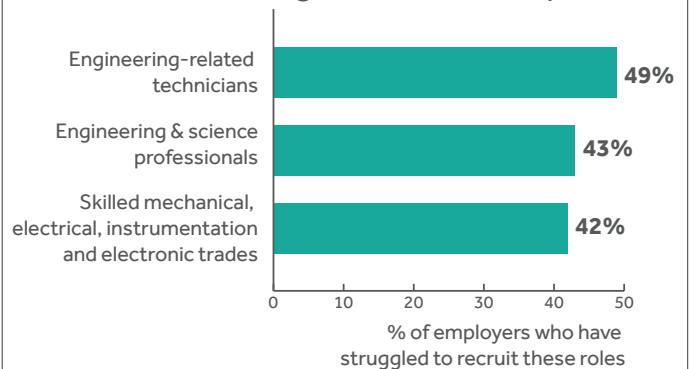
SKILL GAPS:

Expected changes over the next three years:



HARD TO RECRUIT ROLES

due to skills shortages in the marketplace



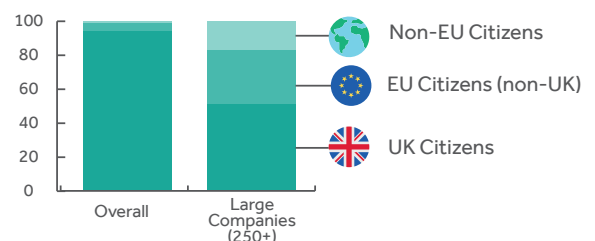
RECRUITMENT AND RETENTION CHALLENGES

62% of employers fear losing out to higher paying competitors

40% say there are not enough apprentices & graduates with the right qualifications

29% fear restrictions on freedom of movement following Brexit

ORIGIN OF WORKFORCE



35%
Increase

43%
Remain the same

EMPLOYERS' EXPECTATIONS OF WORKFORCE NUMBERS

17%
Don't know

5%
Reduce

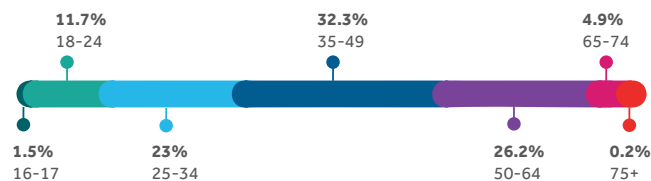
GENDER BALANCE of the Engineering Construction Industry



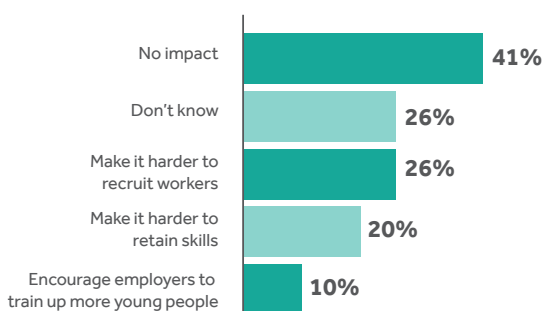
AGEING WORKFORCE

55% of employers think the ageing workforce is the main reason for the skills gap

AGE PROFILE OF THE ECI (%)



EXPECTED IMPACT OF BREXIT



EXECUTIVE SUMMARY

The Report

This Labour Market Intelligence Report provides a comprehensive picture of the Engineering Construction Industry (ECI), reflecting an engineering construction workforce in the broadest possible sense. It presents findings gathered via primary and desk research on the industry, the size and profile of the workforce, skills challenges and opportunities faced, as well as additional support the industry needs to succeed. The fieldwork was conducted between July and October 2018, comprising a desk review, initial scoping telephone interviews with ten industry stakeholders, a telephone survey of 829 ECI employers, in-depth follow-up telephone interviews with fifty employers, and ten stakeholder and eight training provider in-depth discussions.

This survey was targeted at the c. 300 employers 'in scope' of the ECITB (see Appendix I, and explained in greater detail in section 2.1), as well as the 'wider' engineering construction industry, i.e. those employers out of scope to ECITB including supply chain organisations and asset owners. Within the body of this report the terms 'ECI employers' and 'wider ECI' refer to the 'core' ECITB in-scope and levy paying companies, and those companies that classified themselves as companies in the wider ECI respectively.

Industry overview

Engineering construction refers to the design, planning, construction, maintenance and decommissioning of energy and process plant infrastructure with the workforce comprising mechanical and electrical workers, technicians, engineers and many more.

Engineering construction contributes around £100bn in Gross Value Added (GVA) to the UK economy and employs – in the core industry - nearly 190,000 people (0.6% of total UK employment)¹. The wider supply chain is approximately as large as the core industry. Medium and large companies (i.e. those employing more than 50 and 250 staff respectively) collectively represent about 90% of the workforce in the core industry.

The industry is divided into a number of separate sectors, but many companies operate across two or more of them:

- **Nuclear**
- **Oil and gas - downstream**
- **Oil and gas - upstream**
- **Power generation**
- **Renewables**
- **Chemicals**
- **Pharmaceuticals**
- **Food and drink**
- **Water treatment**
- **Others (including steel, cement, glass, paper and brewing).**

The largest sector by both turnover and employment remains oil and gas, but work in the renewables segment is rapidly catching up. Appendix 2 provides a snapshot of the main trends within nuclear, oil and gas, power generation and renewables, and other sectors such as water treatment and food and drink.

To give context to the findings from the survey, the research gave some consideration to key drivers of change - including external forces such as the global and UK economies, climate change and related legislation, policy and political developments and social attitudes. Another area of rapid change is technology, which is subject to a more detailed examination in our separate report on the impact of technology on skills. Similarly, fundamental changes are taking place in the UK's technical and vocational education landscape; Technical Levels (T Levels) in England are being introduced via 15 different routes – each of which are to be on a par with A Levels (covered further in Appendix 3).

At the time of writing, it is difficult to say what impact the UK's exit from the European Union at the end of March 2019 might have on industry. The uncertainty is causing considerable concern for the larger ECI firms, although confidence in general is high about the future outlook.

This research has also taken into account the Government's industrial strategy - which highlights the need to identify and address industry-specific skills gaps, e.g. shortfalls in STEM skills - and its Clean Growth Strategy – which aims to cut greenhouse gas emissions and deliver smart, clean and flexible power via nuclear and renewables.

Current ECI Workforce

According to previous research published by the ECITB, total employment in the UK engineering construction industry stands at 188,000, and its aggregate 'employment impact' is around 745,000 people (this includes jobs which are dependent on the industry in some way – usually through supply-chain links either up or downstream)².

The survey for this report returned feedback from 829 companies, a combination of the core ECI and wider ECI, employing 147,000 people, of which 92% work in Great Britain and some 8% are based overseas.

According to the survey, full time workers account for 95% of the ECI workforce and 88% of workers are male. Around 31% are over the age of 50, while 36% of the workforce are aged under 35. Nearly two thirds of people work onsite (63%) and just over one third work offsite (37%). Of all the companies surveyed, a little over 5% of onsite and offsite workers are not directly employed i.e. they are agency staff or subcontractors³. Some 42% of the workforce work on new build, just over 37% on repair and maintenance, and slightly less than 8% on decommissioning projects.

Of the workforce reported on in this study, 6% originate from outside the UK, with 5% from the rest of the EU. Nearly 95% of the workforce is employed on permanent contracts with just 1.4% on flexible or zero-hour arrangements. The remaining workforce (just under 4%) – those on fixed-term contracts – have an average contract length of 28 weeks although the most commonly reported contract length is 52 weeks.

Workforce supply issues

Rising investment in infrastructure is creating demand for high numbers of new recruits across engineering more broadly. Up to 2024, this includes an annual demand for 124,000 engineers and technicians, as well as 79,000 related roles⁴. ECITB data predict that 91,000 engineers and 29,000 engineering technicians in today's workforce are expected to have either retired or be close to retiring by 2026 – just under one fifth of the entire engineering workforce and almost 18% of engineering technicians⁵. Specifically looking at the ECI, estimates predict employment to expand by about 33,000 jobs between 2016 and 2026⁶.

The majority of surveyed employers are concerned about a lack of suitably experienced, skilled and/or specialist

¹ ECITB/CEBR, 2017, *The economic footprint of engineering construction*

² ECITB/CEBR, 2017, *The economic footprint of engineering construction*

³ Note that this figure is significantly lower when compared to ECITB data on 'core' ECI companies

workers to meet increasing demand for engineers and related roles.

Almost one third of surveyed employers (32%) have experienced hard-to-fill vacancies in the last 12 months due to insufficient applicants and almost 36% of companies have been unable to fill vacancies easily because applicants have lacked the appropriate skills. When asked what sectors they had recruited from, 60% of respondents said they had done so from other construction and engineering companies. All sectors are most likely to recruit from wider construction or engineering companies rather than from core ECI companies, except for the upstream and downstream oil and gas sectors, which are most likely to recruit from the oil and gas sectors (70% and 76%, respectively).

In the in-depth interviews, several different strategies to deal with recruitment challenges were suggested including: focussing efforts on recruiting young workers (either as graduates or as apprentices); providing the existing workforce with further training, or encouraging them to stay in other ways (e.g. offering longer contracts); or introducing formal succession planning.

The most-mentioned barrier to recruitment – cited by 81% of employers – is the lack of knowledge, experience and practical skills in applicants. Sixty-two percent of employers mentioned a lack of applicants, while 54% say that applicants lack relevant qualifications for the role.

When asked what factors affect staff recruitment and retention, almost two thirds of employers fear that competitors will outbid them in salary terms. Four in ten believe there will not be enough graduates and apprentices coming through the system with the right qualifications. Employers say they would like to see more promotion of engineering construction careers (62%) and more training provision for apprentices (57%). Between four and five out of ten employers want more action by the engineering professional bodies (49%), more relevant courses at universities and colleges (47%) that can be directly applied to industry settings, and generally improved technical education (45%).

Skills

Employers were asked to rate skills and occupations by level of current and future importance. Skills and roles that scored highly in terms of their importance at present, are also the ones that are considered of greatest importance in the future. Softer skills such as problem solving, team working, management and safety management were all given relatively high scores for both the current workforce and for the future. Similar high scores were given to

engineering professionals and technicians, design, and business professionals.

Some 49% of employers who responded to this survey reported difficulties in recruiting engineering related technicians, while 43% struggled to recruit engineering and science professionals. A further 45% said they found it difficult to fill vacancies for skilled mechanical, electrical, instrument and electronic trades. Around one third listed project personnel and one quarter had had difficulties recruiting design and draughtspersons and construction operatives.

The main reported reasons for skills gaps (i.e. deficiencies in the skills of the current workforce) are the retirement of older staff, followed by training being too time-consuming and the impact of new methods of working. Of employers surveyed, larger companies are more likely to see skills deficiencies resulting from an inability to retain experienced staff. Around 44 percent of employers expect their skills gaps to increase (worsen) over the next three years.

Over half of employers gave a positive perception of training providers in their in-depth interviews, but one third of employers felt that training provision is not as effective as it should be. Respondents identified the broad nature of the courses and accepted that 'specific skills can only be learned by experience'. They believe that softer skills should be developed by the employer in the workplace. Some respondents suggested that health and safety training has taken too much of a front-seat in driving provision, and that there are gaps in knowledge in pragmatic areas such as "economics" and "working on a budget" and "the importance of relationship management".

A frequently-raised challenge is that of retention. Numerous interview respondents mentioned issues with apprentices not completing the course or leaving to go to another employer once they had completed their training. Several employers were critical of the current Apprenticeship Levy their perceptions being that the criteria for use of the Levy is seen as too restrictive.

Future outlook

Levels of UK infrastructure investment and demand for engineering construction-related programmes and projects are growing – roughly equally divided between public and private sector investment. Currently, around £190bn of investment is in the pipeline for energy infrastructure alone, including almost 100 ongoing or planned energy programmes/projects. In utilities, the pipeline currently comprises 95 projects, programmes and other investments, with a total value of £35.4 billion to

⁴ Engineering UK, 2018, *The state of engineering*

⁵ ECITB, 2018, *Engineering Today – The supply and demand for engineers in the UK*

⁶ ECITB/CEBR, 2017, *The economic footprint of engineering construction*

2020/21⁷.

The majority (62%) of surveyed employers are generally confident about the future, explaining that they have seen an upturn in the amount of work and enquiries and have more projects in their order book. Among the 16% of employers less confident about the economic outlook, this uncertainty primarily arises from the UK's impending exit from the EU which, in turn, has caused a degree of faltering in investment levels. Around one fifth to one quarter of companies appear to be pessimistic about the outlook for recruiting and retaining workers post-Brexit, while four in ten employers expect no impact at all. Twenty-nine percent of employers are concerned that changes to Freedom of Movement could make it harder to recruit.

Employers report a finite pool of skilled, technical workers available and in high demand. Employers interviewed in depth identified Government targets and policies affecting their business, as well as the availability of finance, manufacturers moving overseas, environmental pressures, and the price of oil as other noteworthy challenges.

Employers are divided as to whether the size of their workforce will increase (35%) or remain the same (43%) although only 5% expect their workforce size will reduce. Employers also believed that technology will render some existing roles obsolete and disrupt existing approaches and technologies in possibly unpredictable ways; this is covered in more detail in our sister report which looks at the impact of technology on skills.

Conclusions

The core and wider ECI face a number of labour market issues in three critical areas: recruitment, retirement and skills gaps. The industry needs to replace losses from retirements in an ageing workforce as well as combat the issue that approximately one third of all industry companies are unable to find suitable applicants with appropriate skills. Many others have need of training to upskill their existing workforce.

The difficulty in attracting and recruiting younger entrants from college and university and the relative lack of diversity in the industry workforce are major issues impacting most severely on industries such as the ECI which need highly skilled staff with high-level engineering and digital skills.

The ECI is an increasingly important industry in the UK economy. It will need highly qualified people well into the future and will certainly need to retain and upskill its

existing workforce in order to alleviate the pressures of a wider job market which is close to full employment. This will include retraining and reskilling to retain more of its older workers.

Employers in general believe that the skills that are important now will also be the skills that are important in three to five years' time, a view which may miss some of the more crucial technological impacts. Even though the impact of certain technologies may take longer than five years to fully develop, if nothing is done, the industry may well be ill-prepared to meet the radical skills needs and changes arriving over the longer-term.

Employers also recognise a shortage of soft skills in such areas as leadership and management, project management, languages, and exporting, but attention must also be paid to future skill needs as a result of the impacts of digitalisation, automation, robotics, and associated fields.

A degree of concern about education and training provision has arisen that suggests providers, through no fault of their own, may not be as up to date in technology and skills as will be needed.

There is a vital need for the industry to be adequately prepared for the future. The ECI would undoubtedly benefit from a more collaborative approach, particularly across the wider supply chain in order to respond effectively to changes and developments in the labour market.

There appears to be more work to be done to help ECI employers, some of whom are concerned that their own area of the economy is not as well regarded as they would wish. They point to what they perceive as low awareness among young people, low understanding, and a lack of status. A range of suggested actions have been provided as a result of this research which may help to capture greater detail on, and find ways to address, retention issues, recruitment of younger people and the impact of changes in the labour market on the ECI.

⁷ *Infrastructure and Projects Authority (2018) Analysis of the National Infrastructure and Construction Pipeline*

Part I: The Engineering Construction Industry (ECI)

This chapter provides an overview of the research and gives an outline of the political, economic and policy backdrop against which the research was undertaken.

1.1 About the research

1.1.1 Aims and research questions

The Engineering Construction Industry Training Board (ECITB) is the statutory skills body for the Engineering Construction Industry (ECI) in Great Britain. A non-departmental public body (NDPB) sponsored by the Department for Education (DfE) and accountable to parliament, the ECITB works with employers and governments to attract, develop and qualify personnel across a wide range of craft, technical and managerial disciplines.

The ECITB commissioned Pye Tait Consulting in 2018 to undertake detailed research and develop two reports on:

1. The ECI labour market
2. The impact of technology on skills

This report – **The ECI Labour Market Outlook** – provides a comprehensive picture of the industry by discrete sector, the size and profile of the workforce, types of challenges and opportunities faced, as well as additional support needed to succeed. Specific aims in conducting the research and developing this report were to:

- gather up-to-date employment and skills data to permit future strategic planning and meet current and future opportunities and challenges facing the industry;

The key research questions were to:

- establish the profile of the ECI workforce, including current and future numbers;
- highlight business/economic trends and outlook for the industry, including implications for skills/productivity/training;
- understand employers' current and future skills needs; and
- identify the approaches employers take to training and any barriers experienced.

This research and the survey was targeted at the circa 300 employers 'in scope' of the ECITB (see definition of 'in scope' used for the survey at Appendix 1), as well as the 'wider' engineering construction industry, including supply chain organisations and asset owners. Within the body of this report the terms 'core ECI' and 'wider ECI' are used and refer to core ECITB in-scope companies, and those companies in the wider ECI that nominate themselves as supply chain companies respectively. In total, 177 companies from the core ECI and 629 companies from the wider supply chain responded. Further detail about the methodology regarding how the research was conducted is provided in section 2.1.

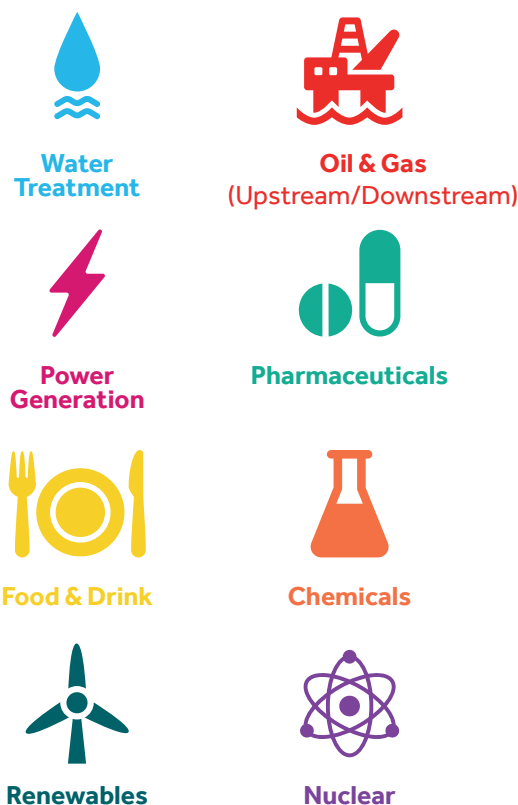
1.2 ECI - Overview

Based on existing intelligence, engineering construction contributes around £100bn in Gross Value Added (GVA) to the UK economy. It employs some 188,100 people (0.6% of total UK employment)⁸ although some employees are linked to international ECI companies, which would make the industry considerably larger.

The core ECI relies upon a supply chain which our survey shows is approximately as large again as the core industry. This latter consists of companies supplying components, piping, semi-completed structures, valves and pumps, electronics, software and related equipment, buildings, port and facility infrastructure, subsea services, chemical containers, machinery and so on.

Large companies in the industry – those each employing more than 250 people – account for around 70% of the core industry. Unlike many industries in the UK, employment in the core ECI is heavily biased towards medium and larger companies, which together employ over 90% of the workforce in the core industry.

The industry is usually divided into a number of separate sectors, but many companies operate across two or more of the following:



The largest sector by both turnover and employment remains oil and gas but work in the renewables segment is rapidly catching up. Appendix 2 contains additional detail relating to the sectors listed above.

Core roles i.e. engineers, technicians, draughtspeople etc. account for roughly two thirds of workers in the ECI (64%), while supporting roles such as directors, managers and administrators account for the remaining 36% of jobs⁹.

⁸ ECITB/CEBR, 2017, *The economic footprint of engineering construction*
⁹ *Ibid*

1.3 Business trends and policy environment

1.3.1 Industrial Strategy

The Government's Industrial Strategy (published in November 2017) brings the value of engineering construction sharply into focus by highlighting how embracing technological innovations and negotiating the potential impact of Brexit are key actions for the industry over the coming years. This is of particular importance in consideration of the need to recruit and retain sufficient highly-skilled workers to deliver major planned infrastructure projects.

The Industrial Strategy sets out five 'foundations' for growth – ideas, people, infrastructure, business environment and places. It also introduces 'grand challenges' designed to ensure the UK is properly positioned to shape and lead the industries of the future. These include:

- putting the UK at the forefront of the artificial intelligence and the data revolution;
- maximising the advantages for UK industry from the global shift to clean growth;
- becoming a world leader in shaping the future of mobility;
- harnessing the power of innovation to help meet the needs of an ageing society.

The strategy identifies artificial intelligence (AI) and data as key to driving economic growth. To accelerate AI take-up by industry, the government will create an industry-led Office for AI that will focus initially on six sectors: energy, construction, cyber security, life sciences, manufacturing and agricultural technology.

Meanwhile, a global shift to clean growth offers significant opportunity for the UK to become a world leader in low carbon technologies, systems and services¹⁰.

For its part, the Government is serious about working with partners and across sectors to improve delivery of smarter projects and use its purchasing power to increase productivity and drive innovation in infrastructure. As a result of this strategy the Government launched the concept of sector deals for significant or strategic sectors. It has since published a number of deals including for sciences, construction, nuclear and offshore wind.

1.3.2 Technical education and careers

The Industrial Strategy emphasised the important role of technical education in driving skills, economic growth and productivity and the need to identify and address sector-specific skills gaps. As such there have been significant policy initiatives aimed at increasing the take-up of STEM

subjects, the status of technical education and the supply of key skills.

In December 2017, the Department for Education (DfE) published *Unlocking Talent, Fulfilling Potential*, which set out the government's plan for improving social mobility in England. High quality technical education options are positioned as a way to both address skills shortages and increase social mobility. Involving employers in setting standards for both apprenticeships and technical qualifications is seen by the DfE as key to ensuring that young people who pursue technical routes are employable upon their completion. Also in December 2017, the DfE published the long-awaited *Careers Strategy for England*, which set out a plan to improve careers advice and guidance provision in England.

The education and skills landscape is explored in more detail in Appendix 3.

1.3.3 'Brexit'

The UK voted to leave the European Union (EU) in 2016 and the intervening months have been extremely taxing for UK businesses. This has been particularly so for the larger ECI firms, which have significant overseas interests and large proportions of their workforces from other EU nations.

At the time of writing, the terms of the UK's exit from the EU remain unclear, with a similar sense of unpredictability for the potential impact on inward migration, the engineering construction industry's ability to tackle skills shortages and to ensure sufficient resource for large-scale pipeline projects. The debate on immigration and rhetoric around Brexit may also impact on the views of international students considering the UK, and institutions will need to work hard to ensure that their commitment to equality and diversity is clear and that the UK remains a destination of choice. Moreover, the current strength of the Euro means there is a risk that the UK talent pool could be tempted to relocate to other markets.

At best, the ECI employers we spoke to hoped for a reasonable transition period during which businesses will be able to make adjustments. At worst, they expected that a no-deal exit will lead to economic recession and a period of stagnation over the following three to five years before growth can be reinstated.

1.3.4 Business trends

The industry is – like many others – affected by a number of external forces: the global and UK economies, commodity prices (namely oil), political and social attitudes, government policy, global treaties, and so on. Each has driven major changes ranging from the ability of the

¹⁰ HM Government (2017) *Industrial Strategy*

industry to implement new business ideas, to the way it responds to employment market changes. But perhaps none has impacted more in recent decades than climate change, the environmental legislation which followed, and the significant upheaval in social attitudes.

Once seen as the drivers of economic growth for decades to come, hydrocarbon fuels, while by no means finished, have a finite lifespan. Oil continues to flow from the North Sea and the Atlantic and will do so for many years but the trend for consumption of both oil and gas is downward. BP, in common with most large oil and gas producers, have been expanding their investment in renewables including biofuels, biopower, and wind and solar energy. Its biofuel efforts are currently focused on bio-isobutanol; it produces 1.4GW of wind power in the UK alone, and is in a partnership which already produces 1.3GW of solar power. The focus on climate change is also driving a significant ECI trend towards renewables – such as wind, solar and wave. EU targets mandate that 15% of energy will come from renewable sources by 2020. The UK government has said that this average will be met by it achieving 30% of electricity, 12% of heat energy, and 10% of transport energy from renewable sources¹¹.

Unlike some countries, which are reversing their nuclear programmes, the British Government – among others – is building new nuclear plants. The UK is now initiating a programme of new builds which will partially replace its existing 15 nuclear power plants. Sizewell C is under public consultation, the proposed site for Bradwell B is undergoing preliminary investigation, and when complete, Hinkley Point C will provide 7% of the UK's electricity needs.

As part of Government reforms to the energy market, the Contracts for Difference (CfD) scheme was introduced in 2015, which provides a guaranteed price ('strike price') for electricity produced from new low-carbon energy projects. Through the introduction of competition to award CfDs, the strike price required to support offshore wind projects has more than halved in just two years. Recent examples of success in the offshore wind sector include Orsted's completion of their Burbo Bank Extension project, where the world's largest wind turbines were installed.

1.3.5 Shift towards cleaner energy

As discussed above, gradual changes in attitudes to fossil fuels has seen a decline in the non-renewable energy sources such as coal, oil and gas, and an upturn in renewables such as nuclear and wind power¹². The Government's 2017 Clean Growth Strategy aims to grow national income while cutting greenhouse gas emissions; deliver clean, smart and flexible power by phasing out the use of unabated coal to produce electricity by 2025; deliver new nuclear power through Hinkley Point C; progress discussions with developers to secure a competitive price for pipeline projects; and improve the route to market for renewable technologies.

The *Nuclear Sector Deal* (NSD), stemming from the Industrial Strategy, was published in June 2018 in recognition of the importance of nuclear energy in supporting the UK's energy mix. This includes a target to reduce the cost of new build projects by 30% by 2030. In June 2018, the Secretary of State for Business, Energy and Industrial Strategy (BEIS) announced that the government had entered formal negotiations with Hitachi on the proposed Wylfa Newydd project, as well as reviewing the viability of a Regulated Asset Base model for financing future new nuclear projects. However, Hitachi suspended work on Wylfa in January 2019, citing concerns around financing such a long and complex project, while Toshiba also pulled out of the Moorside project. Construction of the Hinkley Point C nuclear site is underway, with significant progress on the earthworks following the formal decision to proceed at the end of September 2016¹³.


¹¹ European Commission, 2009, *National Renewable Energy Action Plan for the United Kingdom*.

¹² The Climate Change Act 2008 committed the UK to reducing greenhouse gas emissions by at least 80% by 2050. Since then the UK has reduced emissions by 42% - a faster rate than any other G7 nation.

¹³ Infrastructure and Projects Authority (2018) *Analysis of the National Infrastructure and Construction Pipeline*

Part II: The Labour Market

This chapter explores the engineering construction labour market as evidenced from the findings of this research.

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2.1 Methodology

All aspects of the fieldwork were conducted between July and October 2018 and the methodology comprised:

- Desk review, encompassing current policy and business intelligence;
- Initial scoping telephone interviews with ten industry stakeholders.
- Telephone survey with 829 ECI employers;
- Follow-up in-depth telephone interviews with 50 employers and creation of case studies;
- Telephone interviews with eight training providers (further and higher education).

Which companies participated in the research?

This survey was targeted at the circa 270 to 300 employers 'in scope' of the ECITB, as well as the 'wider' engineering construction industry, including supply chain organisations and asset owners. Within the body of this report, the term 'ECI employers' encompasses the 'core' ECITB in-scope companies, and the 'wider ECI' are those companies in the supply chain.

The survey was open to employers (contractors/sub-contractors) based in Great Britain in which at least some of the total workforce undertakes principal or related engineering construction activities namely, relating to the design, engineering, procurement, project management, construction, maintenance, repair, replacement, testing or decommissioning of any chemical, electrical or mechanical apparatus, machinery or plant, to be used on or installed on a process site. It includes all such activities in relation to the oil and gas, renewables, nuclear, petrochemicals, pharmaceuticals, food and drink, waste and water sectors.

Responses were achieved from 177 of the core companies that are 'in scope' to the ECITB. Privacy demanded by GDPR means that those same companies are not identifiable within the resulting data. The remainder of the survey responses – 652 – were from the wider industry.

What do we mean by 'in scope'?

The full scope statement, taken from the ECITB's website, is outlined in Appendix I, and the full definition of engineering construction activities is outlined in the 1991 Board Order. A summary of this statement was read out to potential respondents who were asked to confirm this was of relevance to them before continuing with the survey (see below).

In the separate online survey, respondents were directed to ECITB's web-pages if they were in any doubt as to their potential qualification for the survey.

Further details about the scope of the survey (including respondent qualification criteria) are set out in Appendix 1. Information relating to the ECI sectors is set out in Appendix 2.

In all cases interviewed employers were informed of the definition of the engineering construction industry (as provided and refined in discussion with ECITB) and asked whether their companies conformed with that definition. Even for those in scope to the survey, however, the difficulty for most employers appears to centre on the distinctions between construction, engineering construction, engineering, and civil engineering. Survey interviewees told us that they may fall into one of those broad categories but that their work tends to cross two or even more boundaries. The rapidly accelerating development of digital systems, automation, and robotics also blurs the lines.

We know from earlier research that the core in-scope companies consist of predominantly large and medium sized companies and that the survey also records responses from large proportions of small to medium sized companies which will be mainly from the wider ECI supply chain.

Cross-tabulations of survey results (for example by size of business or geography) have been performed and mentioned in this report where the descriptive analysis has revealed apparent differences between respondent groups. For certain questions, base numbers for each geographical region are too low for the cross-tabulation results to be meaningful.

Survey findings are supplemented, where possible, with findings from in-depth interviews and vice versa. In some instances, however, there may be little open text to qualify some survey findings, or little quantitative data to corroborate qualitative findings.

The occupations discussed in the report arose as a result of the agreement to focus on the following categories:

- Engineering and science professional roles
- Designers and draughtspersons
- Engineering-related technician roles
- Other business professional roles
- Craft supervision roles
- Skilled metal trades
- Electrical trades
- Electronic trades
- Construction operative roles
- Plant/process operative roles

It was agreed that these needed to be contained and concise to avoid the questionnaire becoming overly long and potentially off-putting to respondents.

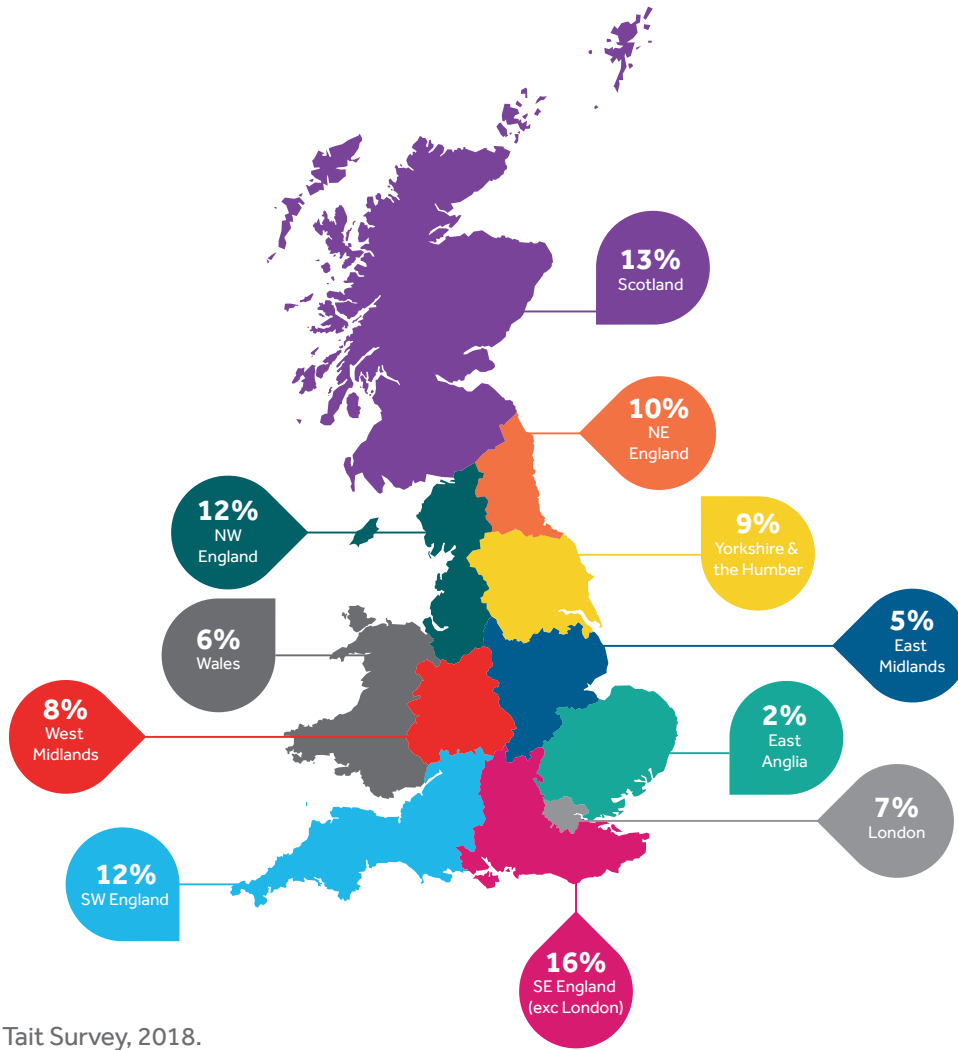
2.2 Overview

ECI workforce

- The telephone survey aspect of this study achieved responses from 829 ECI companies employing 147,000 people, of which 135,000 work in Great Britain and the remainder based elsewhere.
- While medium and large companies collectively represent about 90% of the workforce in the core industry, of the 829 employers participating in this research, just under half (46%) were small companies (employing between 10 and 49 staff) and a large minority (34%) were medium-sized firms (50-249 employees). Large companies (14.5%) with over 250 staff and micro companies (5%) with fewer than ten workers accounted for the remainder (Figure 3).
- These 829 employers are spread across Great Britain (see Figure 1) with the highest proportion based in the South East of England¹⁴ (16%) and the lowest from East Anglia (2%) or 'Other' e.g. Isle of Wight (1%).
- The ECI is usually divided into a number of separate sectors, but many companies operate across two or even more of them.
- The type of work undertaken by firms (see Figure 2) varies by sector, but is most commonly Engineering, Construction & Project Management (ECPM) (77%) or mechanical engineering (56%). The least common types of work undertaken are chemical and process engineering (11%) and scaffolding (13%).
- Job roles/titles of those responding on behalf of their organisation ranged from HR Manager to Director, and from SHEQ Manager to Learning and Development Advisor, plus several others in between.

¹⁴ The survey utilised standard government regions in England, but for information the South East includes counties such as Oxfordshire, Buckinghamshire, Berkshire and Hampshire.

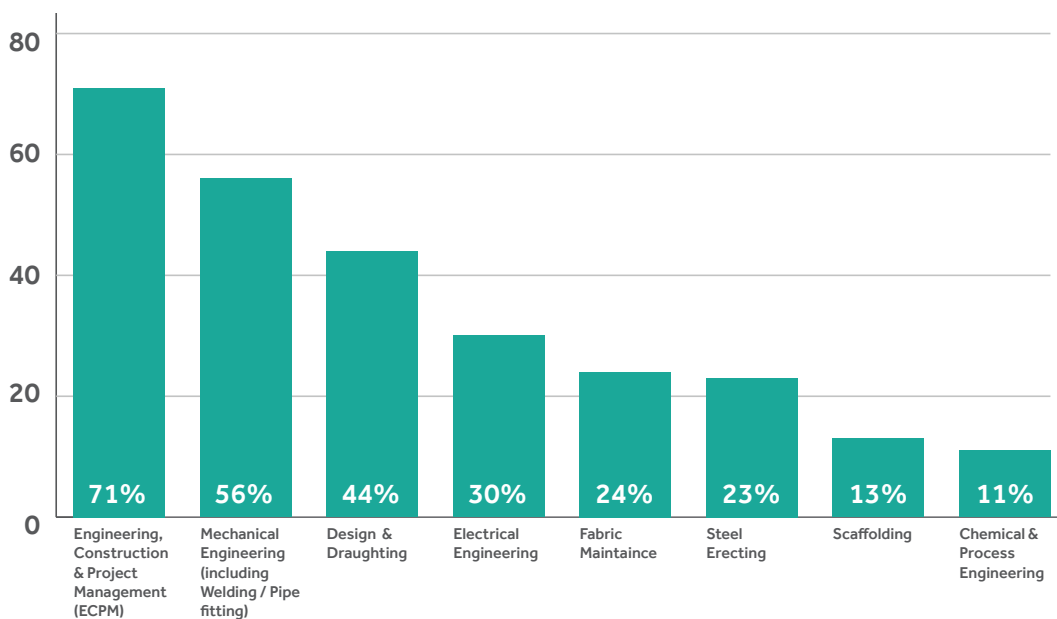
Figure 1 Regional location of respondents' organisations



Base: 829. Pye Tait Survey, 2018.

These companies work across of a variety of ECI sectors and undertake a variety of work.

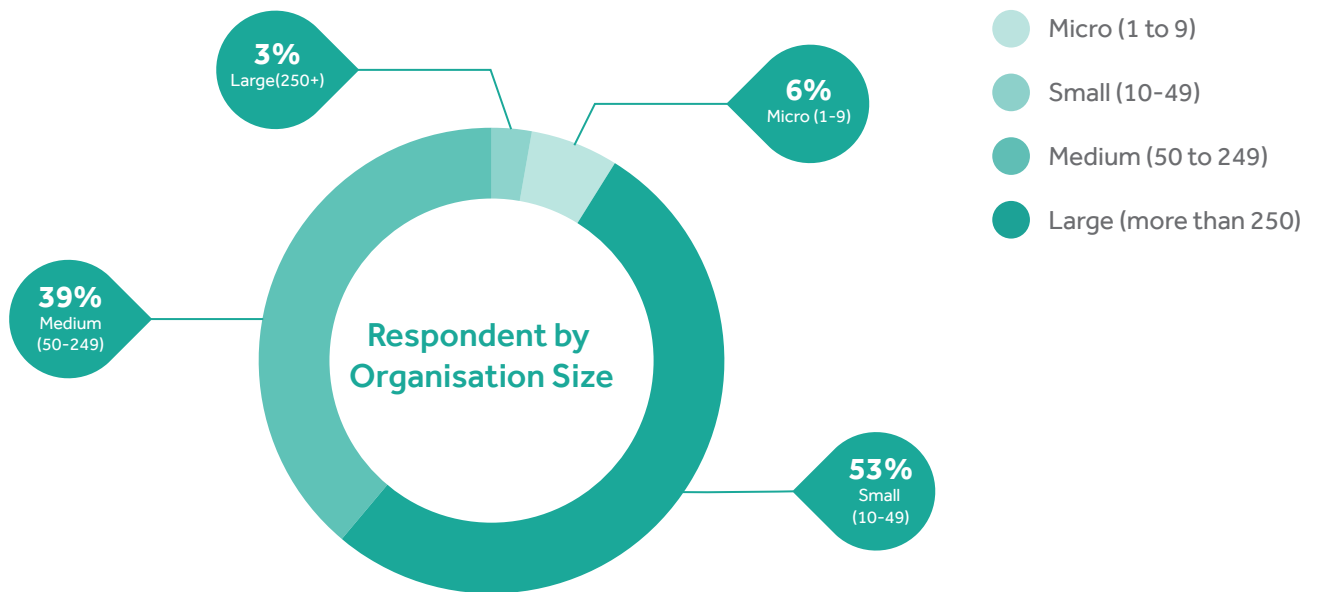
Figure 2 Type of work undertaken



Base: 789. Pye Tait Survey, 2018.

Organisations of different size were surveyed with most being small (53%) or medium (39%) firms.

Figure 3 Respondents by organisation size



Base: 815. Pye Tait Survey, 2018.

2.3 Current ECI workforce

2.3.1 Workforce numbers

The ECITB's 2017 report, The Economic Footprint of Engineering Construction, produced in conjunction with the CEBR, put the total employment of the engineering construction industry at nearly 190,000, and its aggregate "employment impact" at around 745,000 people in the UK (this includes people whose jobs are wholly or partly dependent on the industry in some way – usually through supply-chain links either up or down stream).

The survey for this report returned feedback from 829 companies employing 147,000 people, of which 92% work in Great Britain and 8.4% are based elsewhere.

Figure 4 ECI Employment



Base: 789. Pye Tait Survey, 2018.

2.3.2 Workforce characteristics

Figure 5 Full-time/part-time workers (average)



Base: 802. Pye Tait Survey, 2018.

According to the survey responses, full-time workers account for 95% of the ECI workforce. The proportion of part-time workers varies with the size of company, with micro companies having slightly more in terms of proportions compared to others.

Around 31% of the workforce are over the age of 50, while some 36% are aged under 35. The survey shows an industry whose age profile, while not ageing to the same extent as some other sectors (e.g. construction) is made up of a large proportion of the over-35s (over 60 percent). These findings are in line with UK-wide figures where the proportion of workers aged over 50 is 31% (ONS 2018). The CEBR study in 2017 reported 16% of the ECI workforce to be aged 55 or over.

Most companies – whatever their size – tend to exhibit similar age profiles for their workforce with the exception of micro businesses which tend to have a greater proportion of their workforces in the older age categories and almost double the proportions of over-75s as other companies.

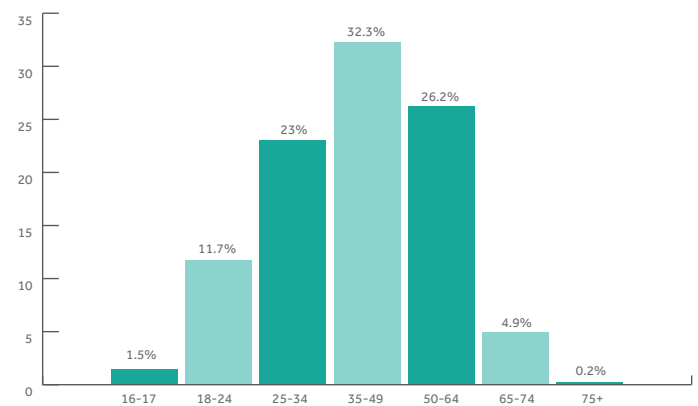
Figure 6 Gender balance (average)



Base: 802. Pye Tait Survey, 2018.

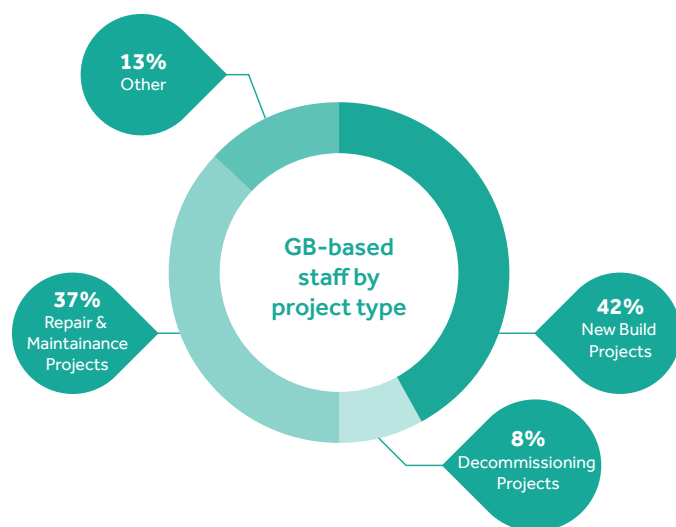
Just under 88% of workers are male. Although this is the overall picture, micro companies tend to have higher proportions of females in their labour forces (about one fifth) compared to large or medium sized companies.

Figure 7 Age profile of the ECI (%)



Base: 802. Pye Tait Survey, 2018.

Figure 8 GB-based staff by project type



Base 829: Pye Tait Survey, 2018.

Some 42% of the workforce is working on new build, just over 37% on repair and maintenance, and less than 8% on decommissioning. 'Other' types of work mentioned included general engineering, manufacturing, operations and design.

The survey also examined the balance in the industry between the onsite and offsite workforce. Respondents answering this question reported a total of 83,069 people working onsite and 48,156 offsite (131,225 in all), giving the proportions of onsite and offsite workers as 63.3% and 36.7%, respectively.

Of those employers surveyed, just over 5% of onsite and offsite workers are not directly employed i.e. they are agency staff or subcontractors¹⁵.

¹⁵ Note that this figure is based on the survey which comprises 'core' ECI companies and wider supply chain companies. The ratio for core ECI companies is around 75% directly employed to 25% non-directly employed.

Employers responding to the survey reported the sectors in which their employees operate (for a total of just under 64,000 employees). Sixty percent of this workforce operate in nine sectors as shown in Figure 6, with the highest proportion (13.2%) in upstream oil and gas. Over a third of employment is in upstream and downstream oil and gas (35%). Some 6% are working in renewable energy, compared to 7% in conventional power generation.

A large proportion of employers also classified themselves as working in 'other' sectors (almost 40%), often in combination with one or more of the other core ECI sectors. This proportion reflects the complexity of the ECI today, in that companies may operate mainly in a slightly different, but related, industry yet still undertake a proportion of their work in the ECI; as outlined at the start of this chapter, respondent employers included firms from both 'in scope' of the ECI, and the wider supply chain.

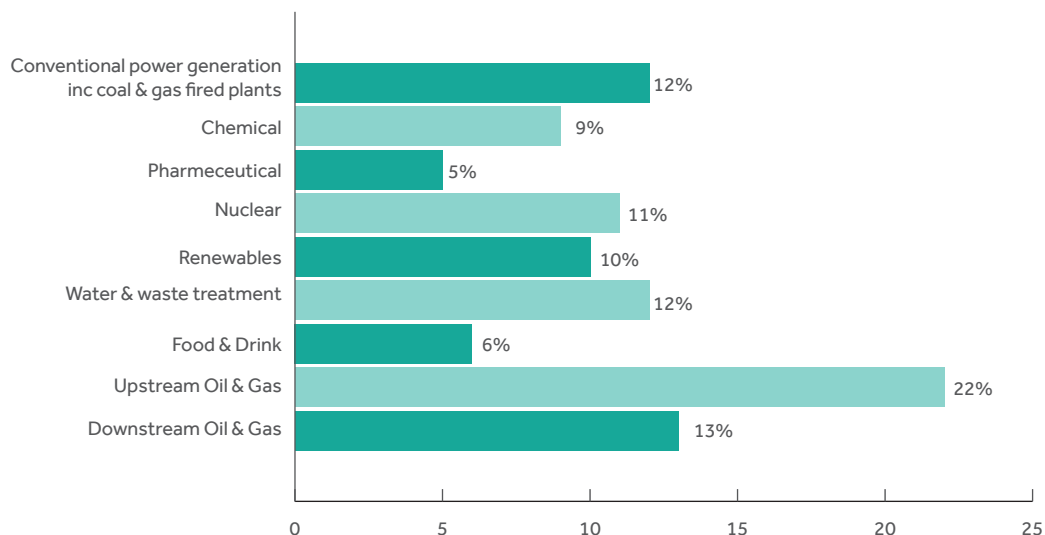
Examples of the other sectors in which they work include civil engineering, aerospace and manufacturing - a generic heading which included supplying parts to the ECI, steel fixing, and installation of pipework, vacuum

systems, and machinery, etc. A few said that they provide software services to sectors such as food and drink and pharmaceuticals to manage and control the supply of raw ingredients and chemicals. Others explained that they work mainly in general construction but also build or contribute to ECI in such areas as waste treatment, nuclear plants, offshore facilities, facilities for food and drink and pharmaceutical industries, and so on.

Several operate in general subsea work but also provide services to offshore oil and gas and wind-farm construction. This blurring of boundaries between sectors may also explain why the proportion of 'offsite' workers (above) is lower than expected.

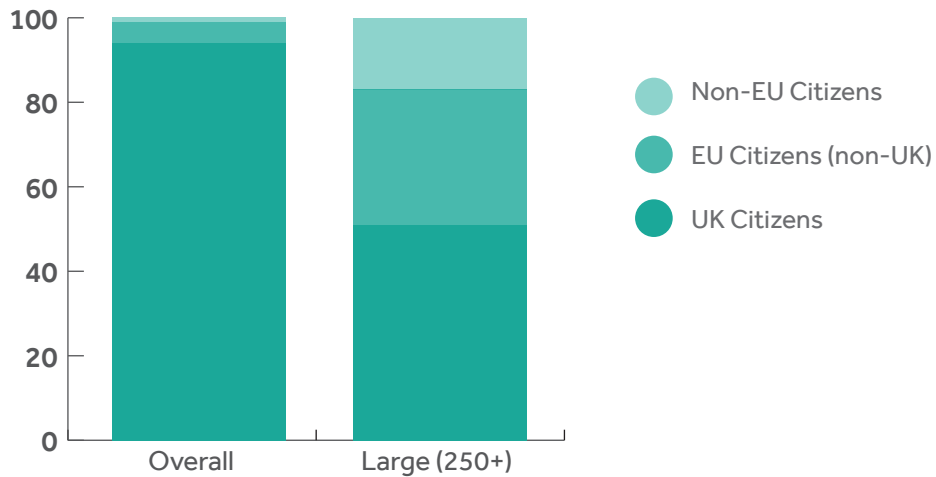
The CEBR report, mentioned earlier, puts the ECI's overall employment impact at about three-quarters of a million – almost four-times the size of the core industry – and this would appear to be borne-out by the difficulties that employers encounter in classifying themselves into the main areas.

Figure 9 Staff working on projects in the ECI sectors (%)



Base: 829. Pye Tait Survey, 2018.

Figure 10 Origin of workforce (by size)



Base: 793. Pye Tait Survey, 2018.

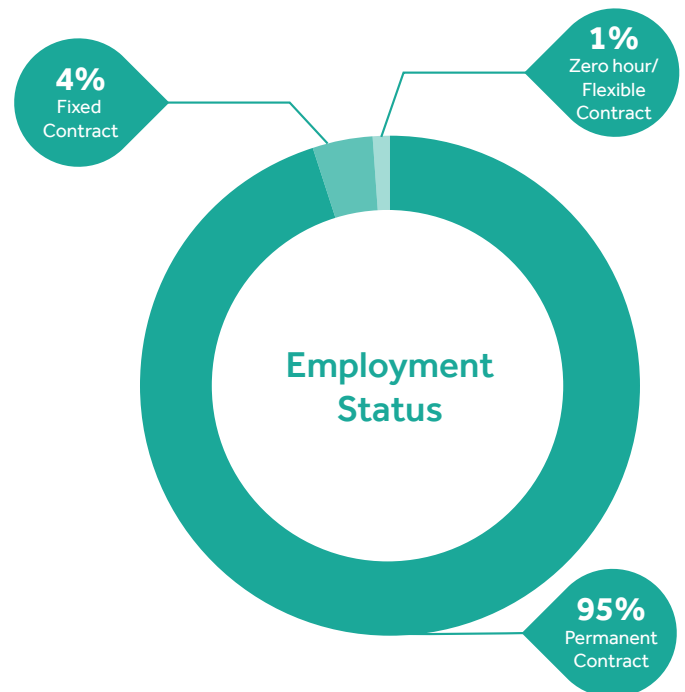
Of the workforce reported in this study a total of 6.3% originate from outside of the UK, of which 5.3% come from the rest of the EU. Larger companies are more dependent on non-UK workers than smaller companies. Around 13% of the workforce of large companies is composed of non-UK citizens compared to just over 4% of employees in small and micro companies. Almost two thirds of these are from the EU and the remainder from non-EU nations.

Within employers surveyed for this research, nearly 95% of the directly-employed workforce is employed on permanent contracts with just 1.4% on flexible or zero-hour arrangements (Table 7).

Micro companies proportionately employ slightly more part-time workers and this is reflected in their employment status. Just over one in eight (12.5%) of the workforce of micro companies is employed on either fixed term or zero-hours arrangements. This compares with around 8 percent of the workforce of large companies, and around 5% of small and medium companies, on similar terms.

For those on fixed-term contracts the average length is 28 weeks although the most commonly reported contract length is 52 weeks. This confirms the short-term nature of a number of jobs which, while allowing companies to more easily plan out work, offers little long-term job security to these temporary workers. This instability may end up driving such workers to other companies within ECI, or away from ECI to less skilled but more reliably paid roles. The advantage for ECI sectors is that these workers tend to have a specialised skillset; the people within this limited pool are thus able to rotate between companies, responding to demand. Short-term contract working can also, of course, be a lifestyle choice of the individual, allowing flexibility in when and where they work.

Figure 11 Employment status



Base: 790. Pye Tait Survey, 2018.

2.4 Workforce supply issues

2.4.1 Future employment predictions

In response to growing investment in engineering construction infrastructure, previous research has estimated the need for a significant number of new recruits. Up to 2024, this includes an annual demand for 124,000 engineers and technicians, as well as 79,000 related roles. Furthermore, the increasing fusion between digital, and physical and biological sciences continues to drive already strong demand for highly skilled labour, especially in the area of STEM¹⁶. Net requirement projections from Working Futures 2014-2024 indicate that by 2024, 54% of the workforce will require Level 4+ qualifications. This compares with 41% in 2014¹⁷.

Previous ECITB research suggests that the recruitment challenge is exacerbated by the 91,000 engineers and 29,000 engineering technicians in today's workforce expected to have either retired or be close to retiring by 2026 - effectively representing just under one fifth of the entire engineering workforce and almost 18% of engineering technicians. This means that, on average, more than 9,000 engineers and almost 3,000 engineering technicians will be retiring every year. In addition, there will be more than 233,000 retirements among the skilled trades and over 176,000 retirements among the managerial and other related professions¹⁸.

The same research argued that while there is no supply shortage of engineering graduates (based on the UK producing enough engineers every year to fill demand), this would only be true if all engineers went into the engineering workforce, which they do not, and if the skills mix of new engineers exactly matched the employer/occupational requirement, which industry had reported is not always the case¹⁹. Additionally, with unemployment at a record low, only limited economic growth can arguably be achieved by simply recruiting more people. The productivity of existing employees needs to be improved, both through investment in technology and in skills²⁰.

2.4.2 Workforce challenges

The majority of employers interviewed are concerned about a lack of suitably experienced, skilled and/or specialist workers to meet increasing demand for engineers and related roles. Roughly a quarter of interviewed firms commented that more youngsters need training up to boost entrants to the industry and keep up with demand. A slightly smaller cohort noted that a dearth of skilled workers in some areas was driving up wages for those who were available.

Other challenges include the loss of workers, either due to retirement or perhaps following Brexit. Some employers mentioned that they are being more proactive in recruitment to meet rising demand by targeting and recruiting experienced workers from other sectors. A small minority of employers felt that they were not well-placed to meet the increase in demand and foresaw problems in this regard.

"We're not well placed. The industry has neglected apprenticeships, and this has fed through to the current situation where we're facing a lack of skilled staff."

"We may face problems replacing experienced people. Increased demand is already driving wages upwards."

A stakeholder in the industry commented on this situation:

"There is very low or a non-existent appetite for apprentices. They prefer to employ graduates and above. That's an issue now because employers are paying into (the apprenticeship levy) but not making use of those funds. ... There needs to be more higher-level apprenticeships for employers to make use of the levy particularly within chemical or process engineering."

Some employers in their in-depth interviews noted that salary expectations have changed, either due to skilled workers demanding greater recognition, or because younger workers with little experience are entering with unrealistic expectations.

"Finding engineers is still difficult, more experienced ones particularly."

"Skilled welder fabricators and designers are nearly impossible to find, and expensive when you do."

"Engineering is not very glamorous, and we don't promote as well as other industries."

One stakeholder felt the main issue that needs to be tackled is a cultural behavioural skills issue.

"We are 'pale, male and stale'. Outsiders looking in would be daunted. They have a more traditional / old-fashioned attitude to working life, and there is not really any ... diversity."

¹⁶ Engineering UK (2018) *The state of engineering*

¹⁷ UKCES (2016) *Working Futures 2014-2024*

¹⁸ ECITB (2018) *Engineering Today – The supply and demand for engineers in the UK*

¹⁹ ECITB (2018) *Engineering Today – The supply and demand for engineers in the UK*

²⁰ Engineering UK (2018) *The state of engineering*

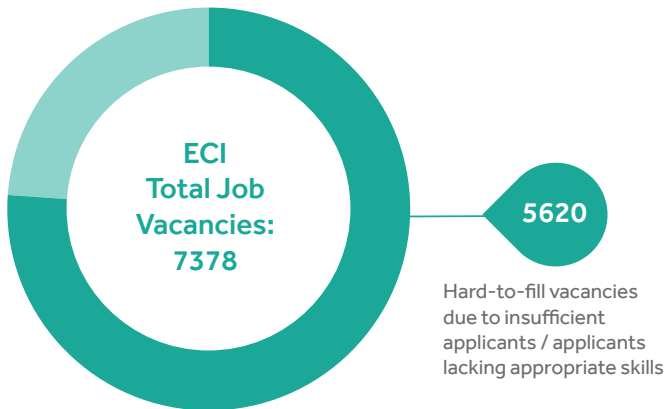
A minority of interviewed firms stated that they do not face any workforce demand/supply issues as they have a balanced workforce and undertake succession planning.

2.4.3 Vacancies (including Hard to Fill)

Almost two thirds (64%) of surveyed companies reported having vacancies during the previous twelve months. These totalled 7,378 job vacancies – some five percent of total employment recorded from the survey respondents. Those companies each experienced just short of 14 job vacancies each on average. Almost a third (32%) said that they had experienced hard-to-fill vacancies due to insufficient applicants and almost 36% of companies have been unable to fill vacancies easily due to applicants lacking the appropriate skills.

In the in-depth interviews conducted with employers, respondents identified skilled workers and those at supervisory and managerial level as being the most difficult to find. Skilled workers included: welders, platers, fabricators, electrical engineers, mechanical engineers, quantity surveyors, estimators, plant machine operators, fitters, erectors, riggers and design engineers. Experienced project managers and experienced supervisors were most frequently highlighted, and it was suggested that the role of a supervisor was thought to have become more demanding and less attractive as a result of increased Health and Safety regulations.

Figure 12 ECI job vacancies



Base: 829. Pye Tait Survey, 2018.

2.4.4 Ageing workforce

Most of the employers that we spoke to, in the survey and subsequent in-depth interviews, said that they are facing (or will shortly face) problems to replace older staff as they retire and take their experience and skills with them. Several employers told us that they see a missing age band in their workforce - roughly between the age of about 35 and 50. A few blamed their own lack of investment to recruit new talent from that generation, but most said that their problems were due to lower numbers of people in those age groups and greater competition for them.

Of those expressing concern, a variety of different approaches are being taken to address the issue. Roughly half of these firms are focussing efforts on recruiting young workers, either as graduates or as apprentices. A slightly smaller number of employers are, instead, focusing on their existing workforce by either providing them with further training or encouraging them to stay in other ways (e.g. offering longer contracts). Several employers also told us that they have introduced formal succession planning.

A small number of companies also mentioned that they bring back older and/or retired workers on an ad hoc basis as required. Others told us that they would hire in experienced, new staff to replace leavers.

A small minority of employers said that they do not experience any issues with older workers leaving, explaining that they had a balanced workforce with a range of ages, and with enough younger workers coming through.

"Replacing skilled and experienced staff who leave is a problem. This is always difficult; we manage to attract good people to be apprentices and bring them on ... But there are always difficulties balancing numbers of skilled staff against the work we have."

"We would be facing issues, however, we've worked hard on having good succession planning in place. We invest in people and their training."

During a stakeholder interview, an employer added to this with:

"There is an aging workforce but that's always been the case. Most organisations are global and the days of doing all the work in the UK have gone. The rest can be done in lower cost centres around the world and shipped in. In terms of construction, onshore facilities still require a large amount of workforce, but offshore has a smaller staffing requirement so construction of modules would have been done overseas."

2.4.5 Workforce mobility

In the in-depth interviews, employers were asked about mobility – how important it is to their business and what issues they face in ensuring that their workforce is sufficiently mobile. The majority of employers we spoke with were emphatic that the mobility of their workforce was of vital importance to their operations. On the whole, most of this group did not raise any concerns regarding travel for work, with most stating that workers simply accepted it as being part of the job. This included a number of employers whose staff are expected to travel globally. A small number of companies we spoke to said that mobility was unimportant as they only worked locally.

The most common concerns around workforce mobility raised by employers were either the cost of travel being a significant overhead to the company, or logistical issues faced when employing staff without driving licences.

"It's definitely important but we don't tend to have an issue with it. Round here people mainly accept that they have to travel and we have a fleet of company cars; they are flexible."

"It's important and not an issue – people understand it's part of the job."

"We're just in the North East, but we do need to get to different sites across the whole of the Northumberland area. Often, we have non-drivers and we have to provide vehicles, getting them moved around can add a burden, though it is factored in, but it's an overhead that'd be nice to avoid."

Several, however, said that they had noticed a distinct trend, as they saw it, towards people being unwilling to travel far for work, preferring to work in the local area with a short and straightforward commute.

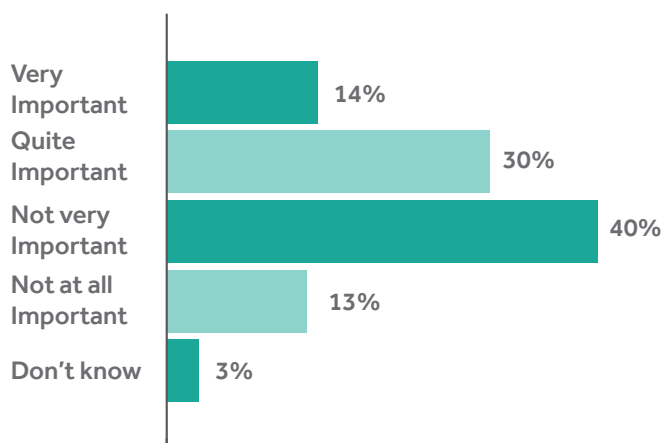
2.4.6 Recruitment (general)

Forty-four percent of surveyed employers consider recruiting from other sectors to be very or quite important to them (although 53% feel this is not very or not at all important).

A detailed look across individual sectors reveals that surveyed employers in the nuclear sector are comparatively more likely to state that recruitment from other sectors is very or quite important to them (53%). Analysis by size band reveals that micro employers seem more likely to consider it important to recruit from other sectors.

Analysis by geography shows no strong discernible differences across the regions.

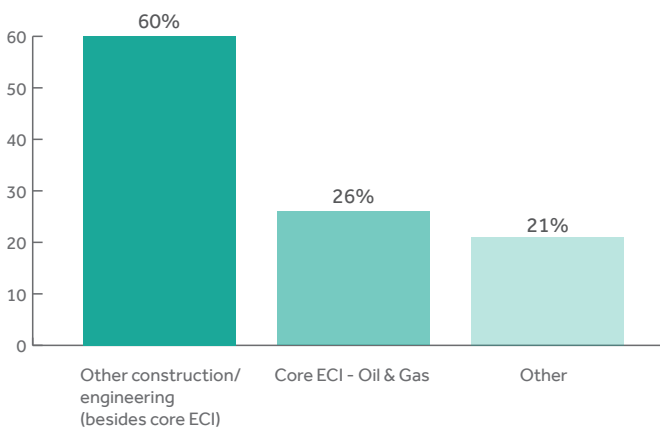
Figure 13 Importance of recruiting from other sectors



Base: 818. Pye Tait Survey, 2018.

Nevertheless, when asked what sectors they had recruited from, 60% of respondents said they had done so from other construction and engineering companies. Manufacturing has been a source for 18% of employers and a range of other sectors for between 4% and 9% of the respondents, such as education, mining and quarrying, information and communication, transport and storage, finance and insurance, and public admin and defence.

Figure 14 Recruited from in last 12 months



Base: 765. Pye Tait Survey, 2018. Multiple selection

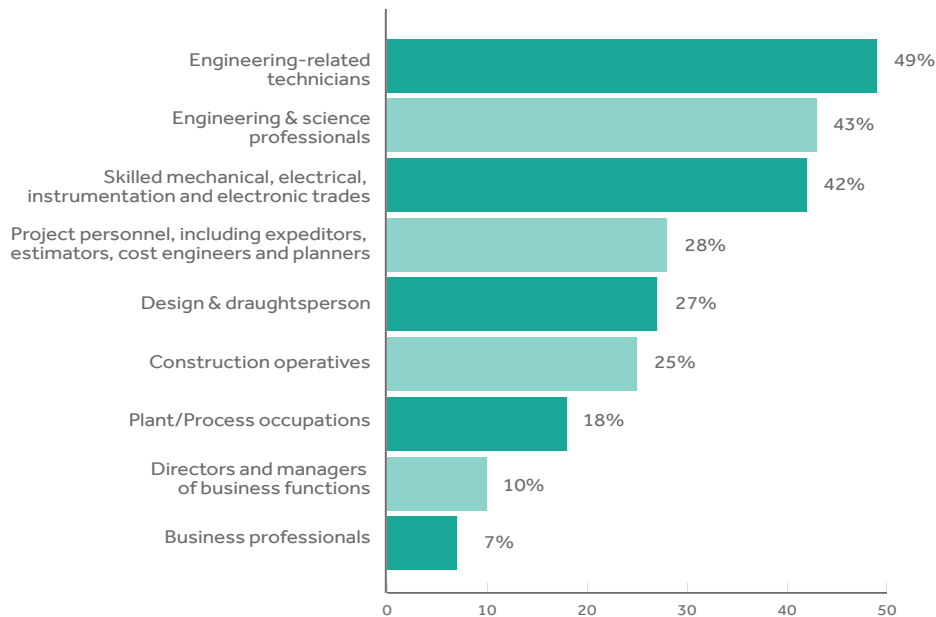
Examining responses by sector, all are most likely to recruit from wider construction or engineering companies rather than from core ECI companies except for the upstream and downstream oil and gas sectors, which are most likely to recruit from the oil and gas sectors (70% and 76%, respectively). The nuclear sector has an almost equal tendency to recruit from within the sector (48%) than from other sectors (56%).

Analysis of the above findings by geography reveals that surveyed employers in East Anglia are comparatively more likely than those in other regions to recruit from manufacturing organisations (36%). Employers in North West England are slightly more likely to recruit from the nuclear sector (27%) while employers in Scotland have a greater tendency to recruit from oil and gas (43%).

Skills shortage recruitment issues

Some 40% of the employers who responded to the survey reported experiencing difficulties in recruiting. The figure below shows the skills-shortage job-roles in order of priority with engineering and technical roles being mentioned by between four and five in ten respondents. Around one third listed project personnel and a quarter had had difficulties recruiting design and draughtspersons and construction operatives.

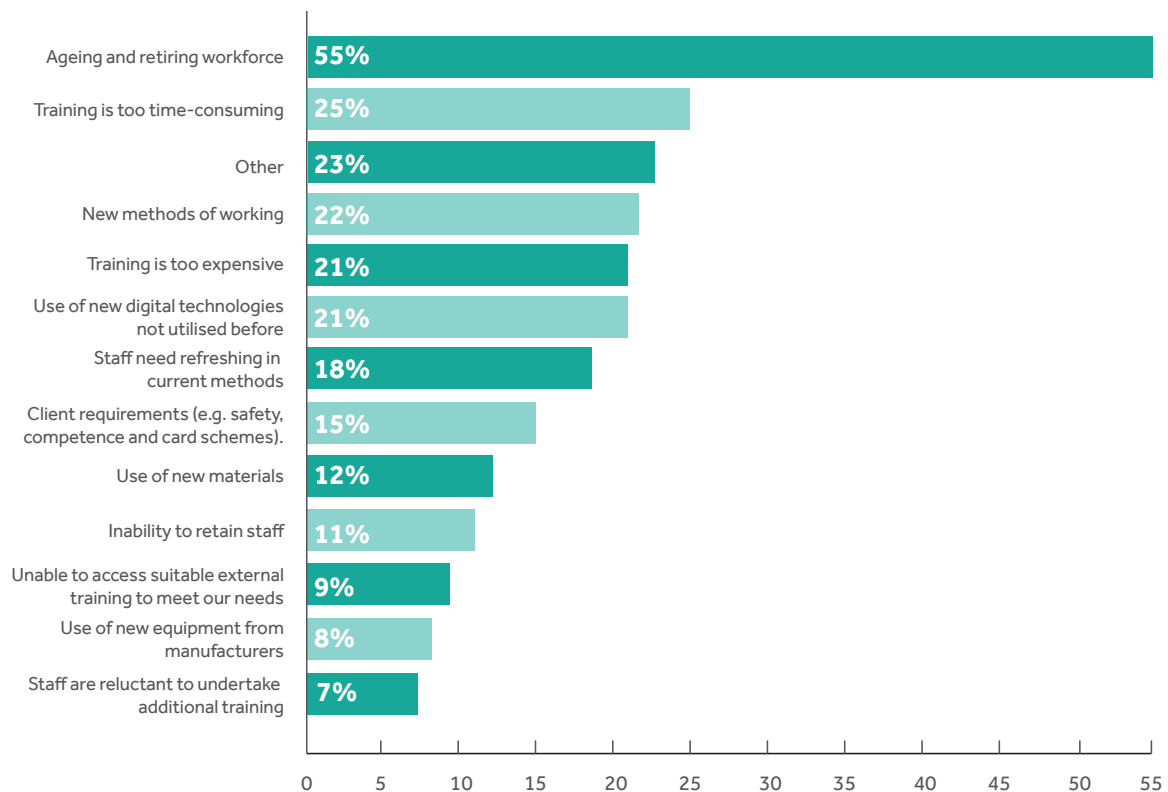
Figure 15 Jobs difficult to recruit due to shortages of skills in the marketplace



Base: 349. Pye Tait Survey, 2018.

The larger the company (excluding micro companies due to the small sample size), the harder they find it to recruit directors, managers, project personnel, and engineering professionals. Larger companies find it slightly easier to recruit to technician, skilled mechanical and operative roles. Employers views on the reasons for the skills gap are in Figure 16.

Figure 16 Reasons for skills gap given by employers



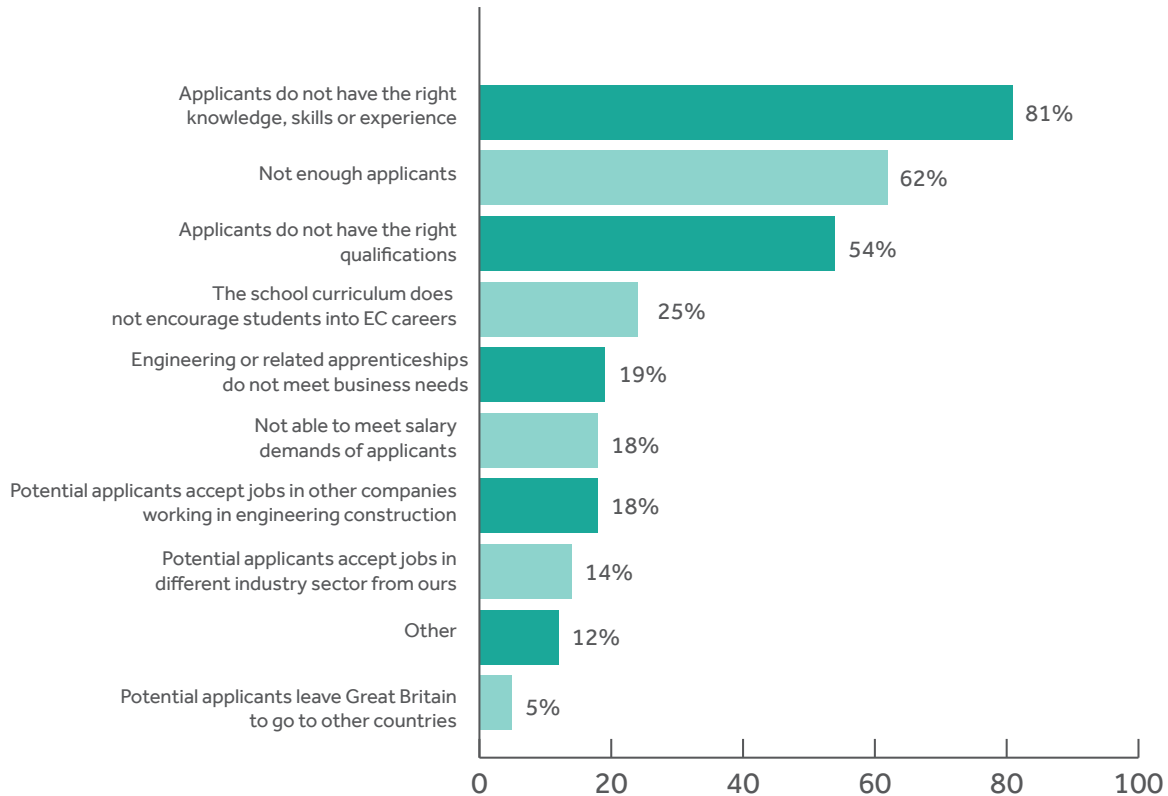
Base:349. Pye Tait Survey, 2018. Multiple selection by respondents.

²¹ Encompasses SOC codes 3112 (Electrical and electronics technicians), 3113 (engineering technicians), 3114 (building and civil engineering technicians) and 3119 (science, engineering and production technicians).

Reasons for general recruitment difficulties

Eight out of ten respondents to a question on the reasons for recruitment problems said that these are due to applicants not having the right knowledge, skills or experience – a finding which appears to significantly underpin the argument for skills shortages in the industry. A little over half say that a contributory factor is the applicants' lack of appropriate qualifications and almost two thirds mention a general shortage of applicants.

Figure 17 Top 3 Reasons for recruitment difficulties



Base: 353. Pye Tait Survey, 2018.

In the in-depth interviews, employers often mention their perception of a lack of motivation in young people, and particularly a lack of a desire to work even moderate distances from their homes (see earlier discussion in section 2.4.5). This contrasts to the established workforce who expect to have to travel to some extent as a natural part of the job. One employer said that they often get applicants who require travel to and from work, and additional accommodation subsidies as part of a salary package.

"The expectations of candidates are far higher than they should be in terms of remuneration."

Larger companies reported fewer recruitment difficulties than others in terms of number of applicants and applicants having appropriate qualifications. However, they seem to experience slightly more difficulty with applicants accepting jobs in other companies or sectors or leaving the country to find work. The differences in the latter cases may be due to better HR facilities and more effective tracking of applicants.

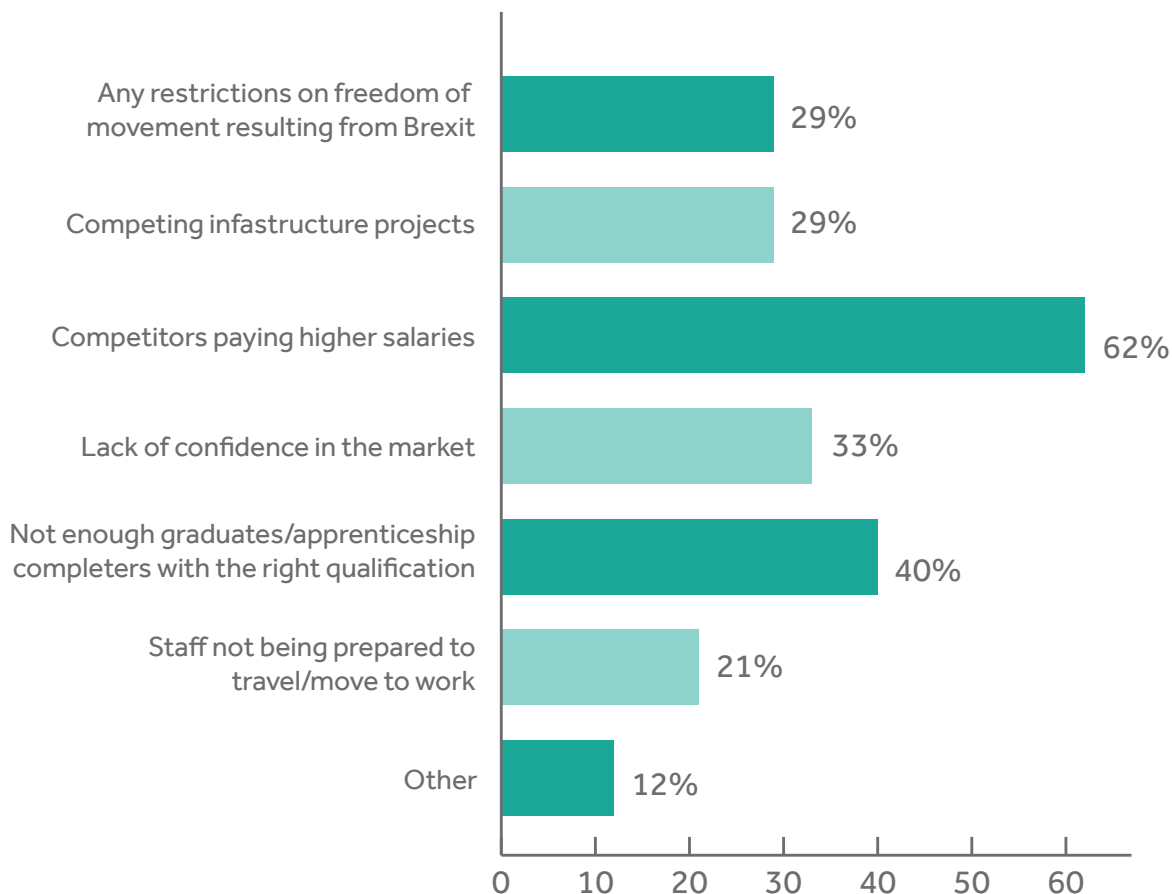
Recruitment and retention problems foreseen

When asked what factors affect staff recruitment and retention, almost two thirds of employers fear that competitors will outbid them in salary terms. Four in ten believe there will not be enough graduates and apprentices coming through the system with the right qualifications. Just under one third of employers point to the possible negative effects of freedom of movement being restricted after Brexit. Companies that listed an "other" response to this question generally reiterated the items listed – in particular, expanding upon the perceived danger of fewer young people, their unwillingness to enter the industry, lack of work ethics, unwillingness to travel either to/from/for work and so on.

Analysis by company size reveals similar results. Larger companies tend to exhibit greater confidence in the market and are slightly less concerned about a lack of graduates and apprentices. However, over half of all surveyed employers, regardless of company size, are concerned about the potential for recruits to be poached by competitors offering higher salaries and benefits.

Analysis by geography suggests that any restrictions on freedom of movement resulting from Brexit could be a bigger issue for employers in South East England and London (40% and 38% respectively) compared with in Wales (15%).

Figure 18 Thinking ahead – factors making it harder to recruit



Base: 766. Pye Tait Survey, 2018. Multiple selection by respondents

CASE STUDY 1:

Amanda McMahon,
Manager of Engineering, K Home International Ltd

"Offering continuity of work and investing in people has been challenging."

Amanda McMahon is Manager of Engineering at K Home International Ltd, a medium-sized organisation providing global engineering design, project and construction management services across a range of industrial sectors, with its head office situated in Teesside. Recently, Amanda has seen an increasing take-up of new technologies. "We're seeing a lot more 3D point cloud surveys which is helping us get more accurate data from site. It will become more commonplace. We are in the process of upgrading our computers and software as the 3D model file sizes can be huge for our computers," she said.

Economic impacts have meant that recruitment has slowed over the last few years. "Job vacancies have not been there," said Amanda. "We had someone on a year in industry placement who was good, but we couldn't guarantee the workload for him to return, and we weren't in a position to make an offer and guarantee there'd be work after his final year of studies."

It's not just the downturn which has affected recruitment, but Amanda believes the region K Home are based also presents challenges. However, Amanda feels they are turning a corner, and are taking a more targeted approach to recruiting new talent. "We haven't recruited new apprentices or graduates for a couple of years, but we have made a decision that next year and in the coming years we will start that process again," she said. "We are continuing a policy of taking the skills shortage into our own hands and developing our own staff. We used to take apprentices as school leavers, now we're targeting the business needs and will be taking them from a local college."

Furthermore, Amanda appreciates the need to train up youngsters before the generation above retires. "That age category of 30-50 is quite empty, you have the older generation and the younger one. When the older

workers retire, who's there to train the younger ones? We need to catch it before it's too late."

While aware that the industry is the traditionally male orientated, K Home have an open view when recruiting and only look to take on the best people. Amanda said: "Schools should promote engineering as a career, and it should be promoted to all people. I don't want to positively discriminate as we risk recruiting someone who's not the best person for the job and then the business suffers."

In addition, Amanda has noticed that: "We find engineers prefer to stay at engineer level, they don't want to progress to that middle management role to lead teams as they perceive this brings the hassle of people management. People are technically competent but don't always want to perform the management part of it."

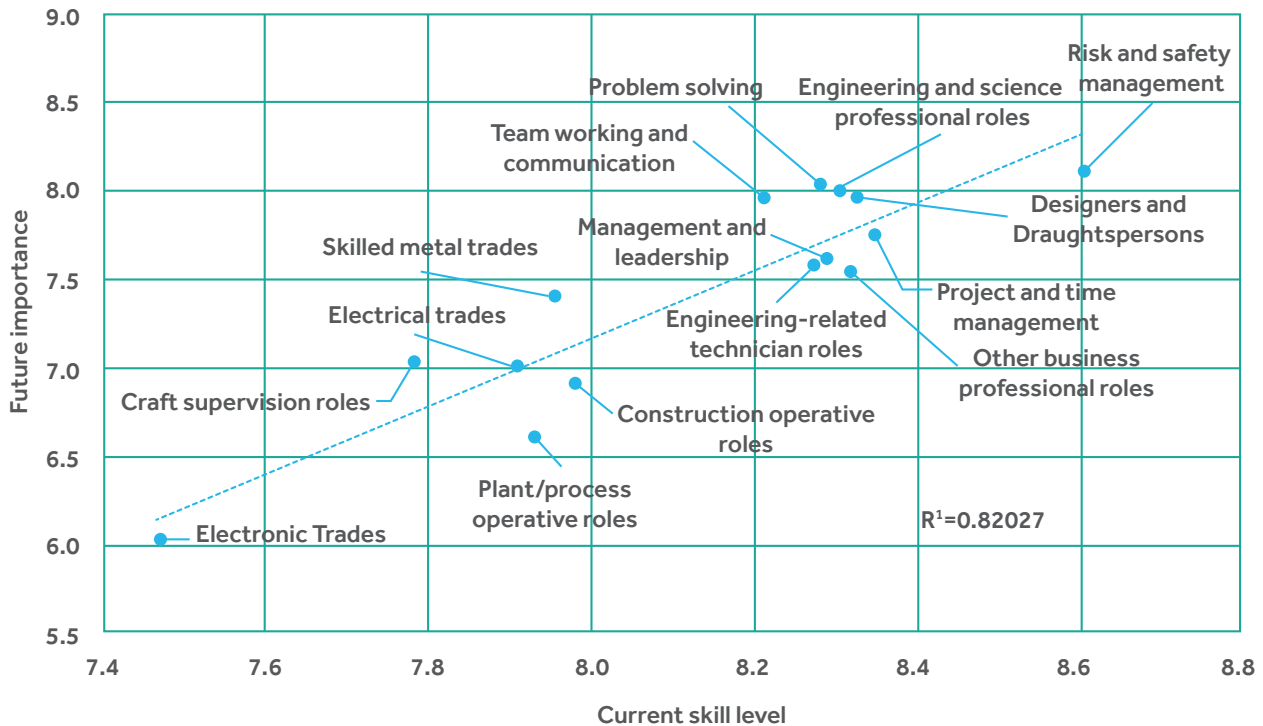
However, Amanda feels one of the greatest challenges currently facing the sector is a lack of clear support from Government for UK businesses. "Things are too stop-start at the moment. If work was more regular that ripples through to design and we can offer continuity of work. We're looking for longer term work, but it's tricky as sometimes projects just go on hold. There should be more investment in the UK supply chain, that'd help the whole UK. We hear we're buying steel from China, while our local steelworks in Redcar has closed, it's counter-productive. It doesn't seem like there's enough manufacturing going on here. Regular investment should be demonstrated by Government."

2.5 Skill

2.5.1 Current and future skills

Employers were asked for their perceptions as to the level of skill in their current workforce and the importance of those same skills and roles in the future (all were given a score from 1 to 10 with 10 being the highest).

Figure 19 Employers' perceptions of skill levels in, and importance of, specified roles



Base: 829. Pye Tait Survey, 2018.

Overall, the results show that skills and roles rated highly at present are also those that employers feel will be of greatest importance in the future. Softer skills such as problem solving, team working, management and safety management were all given relatively high scores for both the current workforce and for the future. Similar high scores were given to engineering professionals and technicians, design, and business professionals. As can be seen, employers score the professional and technical roles highly for the future along with the all-important softer skills.

A separate group of more applied roles were accorded slightly lower scores. These included craft supervision, skilled metal trades, electrical and electronic trades, construction operatives, and plant process operatives.

None of the roles/skills scored less than 7.47 for current skill levels which would usually be interpreted as being important, but the relative position of the craft and operative trades seems to indicate either that those roles are relatively less skilled than they should be, or that they are regarded as relatively less important than other roles and skills. If one takes into account the likely trend of the industry towards more sophisticated technology

and digital skills, these results might be seen as entirely rational.

A knock-on effect of the changing skills requirements will be that modification and updating of existing training and apprenticeship standards is required so that new entrants are adequately prepared for the workplace. It is crucial that industry and representative bodies are closely consulted at the time of review to ensure that standards provide a useful means of entry to work.

Against this backdrop of changing skills needs, it is difficult to predict whether employers will look to take on greater numbers of apprentices, or graduates (or both) in the future, as this very much depends on individuals' preparedness to work and the content and quality of courses available to learners, the latter of which can be perceived to be in constant flux.

When Further/Higher Education (FE/HE) training providers reflected on their own skills and abilities and any gaps, they identified teaching strengths in traditional disciplines and strong industry links. Knowledge gaps across staff ranged from electronics engineering and mechanical principles engineering to robotics, while CPD and upskilling were said to be limited by time constraints and cost concerns.

2.5.2 Skills gaps: reasons for skills gaps, predictions of skills gaps

Reasons for skills gaps

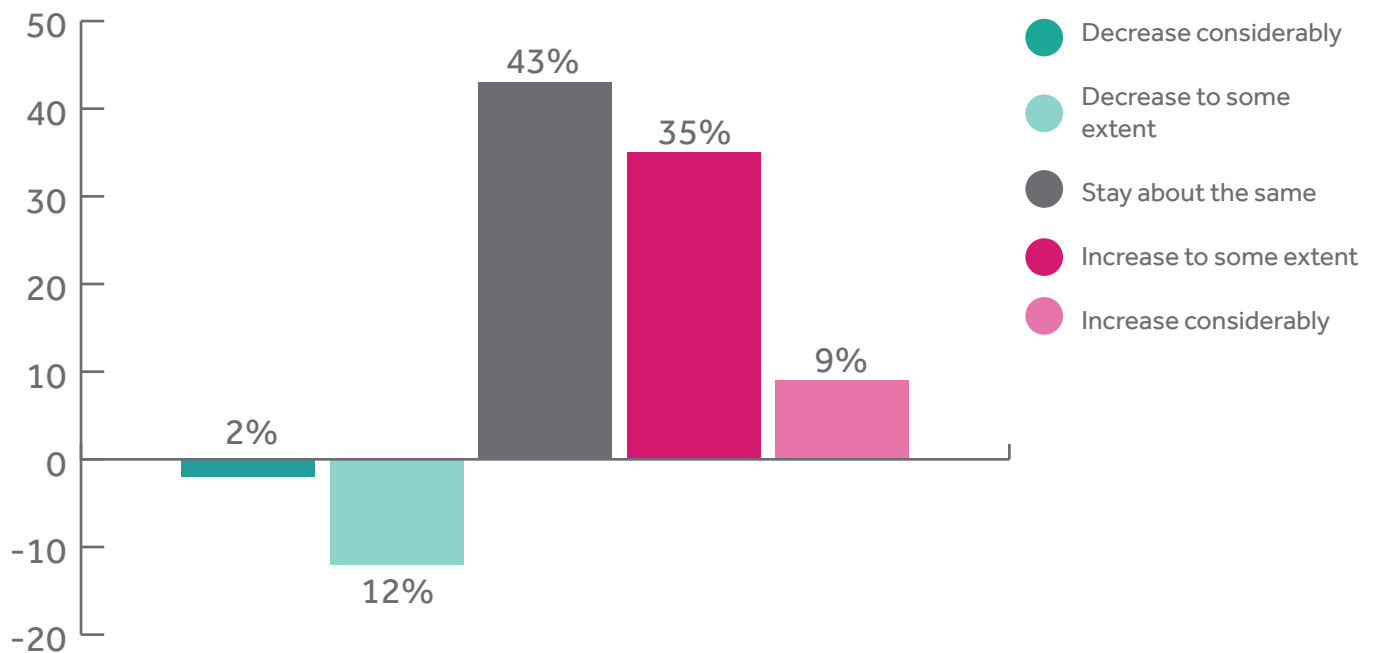
Over half of employers believe that the main reason for skills gaps (i.e. deficiencies in the skills of the current workforce) is the retirement of older staff. Around one fifth to one quarter point to expensive or time-consuming training, and new methods of working or the introduction of digital technologies (both of which may be connected to the need to train). Nine percent say that they are not able to access external training.

Employers who mentioned 'other' reasons for skills gaps listed insufficient young people wanting to work in the industry and lack of experienced, qualified operatives and technical workers.

When looked at from the perspective of the size of company, the reasons for skills gaps in the current workforce showed areas of considerable difference. Larger companies are more likely to see skills deficiencies resulting from an inability to retain experienced staff, from new materials, new digital technologies and new manufacturers' equipment. On the other hand, the larger the company the less likely it is that they will see skills gaps arising from a reluctance of staff to undertake training, and training expense and time demands.

Around 44% of employers expect their skills gaps to increase (worsen) over the next three years, albeit almost the same proportion expect no change.

Figure 20 Skills gaps: expected changes over next three years



Base: 789. Pye Tait Survey, 2018.

Analysis by geography reveals that employers in North West England are mostly of the view that skills gaps will increase (58%) compared with Wales (33%) and Scotland (32%).

Larger companies seem to be more pessimistic about the future of skills gaps. A larger proportion of these companies expect gaps to get considerably worse over the next three years – almost half expect them to increase.

2.5.3 Skills provision

Effectiveness of provision

In the in-depth interviews, we asked employers how effective they think engineering construction training providers are at equipping learners with the knowledge and skills they need for today's economy, including the latest technologies, and what they thought FE and HE could do better.

Two in three interviewees felt that, in general, provision is effective. Respondents identified the broad nature of the courses and accepted that "specific skills can only be learned by experience." They tended to believe that softer skills should be developed by the employer in the workplace with one employer commenting that he did not see 'behaviours' as a job for FE and HE.

Other positive comments highlighted what the respondents see as the "broad spectrum of [education and training] suppliers" and the availability and relevance of local provision. One respondent spoke of the flexible nature of providers and their experience of working together with them to design bespoke courses. In contrast, one respondent commented that provision is "too prescriptive, too rigid and inflexible. It's outdated and no longer reflects the industry", which was endorsed to some extent by several other respondents.

The remaining third of respondents believe training could be more effective. One respondent felt that health and safety had become "too restrictive and too much of a driver of how we teach and what we allow young people to do and experience." Another felt that providers "have a broad spectrum they have to cover in a short space of time, which doesn't allow students to master something before they are forced to move on." Conversely, another respondent saw merit in condensing the 4-year apprenticeship into 3 years, although this was motivated by the view that employers struggle to fund it for 4 years.

While it was recognised that certain elements of courses were well covered, gaps in knowledge are identified in pragmatic areas such as "economics and budgets" and "the importance of relationship management". In addition, one respondent felt the teaching staffs' knowledge was "out of date with the industry and technological developments especially". The way in which FE and HE colleges are funded was highlighted by some to be a problem, with one respondent suggesting that "it's the number of people on the course that counts" and another thought that providers were simply "making money by ticking boxes".

"Some [providers] are very good, but some are trying to be all things to all people, by trying to provide the same course for someone operating a power station and for someone doing household wiring. It's the way they're funded, it's the number of people on their course that counts. They struggle to provide courses due to funding constraints. They try to please everyone across the spectrum of industry."

Areas for improvement

A number of suggestions were offered as potential areas for improvement in courses and delivery. Work ethics and soft skills are regarded as gaps in apprentices' understanding and skills. One employer suggested that part of the course should cover "how to be a responsible employee" and another highlighted "people skills and dealing with customers". There was general support for more practical experience and practical application of learners' paper-based learning and the need for exposure to the site environment.

There was another angle on provision which focused on the way courses are designed. The respondent said that the modular nature of courses can sometimes act to reduce the retention of knowledge and skill in students:

"Quite often courses are designed in modules, so they move on from a subject after a semester. The way degrees are designed doesn't lend itself to the continuity of knowledge."

Several alluded to a perceived lack of engagement between education and industry – especially between universities and the broader engineering construction industry, which one respondent calls 'the forgotten industry'. While most employers see this as the responsibility of schools and colleges to do more to promote the ECI, it is equally beneficial for businesses themselves to nurture relationships with institutions to raise awareness of the industry among young people.

Another respondent suggested teaching staff "need to be more involved in industry to ensure their skills are up-to-date to enable them to teach more effectively". Another respondent saw benefit in a more consultative approach by educational providers seeing them as being well placed to 'help businesses know when there are possibilities or opportunities elsewhere' because of their contact with a variety of people in the industry.

Apprenticeships and training

On the subject of apprenticeships, a frequently raised challenge is that of retention. Numerous respondents mentioned issues with apprentices not completing the course or leaving to go to another employer once they had completed their training. Conversely some did not regard retention as a problem but emphasised the efforts made to retain staff as an advantage:

"By training them and giving them skills, they will remain with us to make the whole organisation successful."

Attracting applicants, particularly those of the right calibre was also seen as an issue. However, one respondent felt this was more of a problem in England whereas in Scotland the role of apprentice is seen as a "highly sought-after position".

Several comments were critical of the current apprenticeship scheme which was seen by some as too restrictive. Furthermore, cost implications were also raised with respect to the apprenticeship levy, with one respondent claiming: "we don't get our money back in terms of what we get out of it". Another said that:

"We pay the apprenticeship levy but it's hard to use and you still have to pay all the associated costs (and the time involved to train)."

Criticisms of the Government's apprenticeship programme were limited in number but one employer was dissatisfied with the regional arrangements:

"Some of the regional apprenticeship programmes are tepid, really poor, we've had experience of 3 outfits who come with all the bells and whistles on the surface, but the quality of the delivery of the service has been poor."

One respondent raised an issue with being able to provide "a sufficient variety of work for their broad experience" and another pointed out that apprentices were of no use to their business as "[we] can't send them offshore and we have little onshore work to keep them busy".

There was a perception among several respondents that there had been a hiatus in apprenticeship recruitment and that this was an industry-wide problem.

"Apprenticeships fell off the radar for a number of years, and because of that the industry is suffering now as so many people stopped doing them for several years and we're now paying the price and companies are in catch-up mode."

The most frequently raised advantage of taking on apprentices is the ability to 'grow your own' along with the way in which they enable employers to maintain a skilled staff base.

Managerial and supervisory roles

Where managers and supervisors are concerned, more than one third of respondents feel there are no challenges associated with upskilling their staff at manager and/or supervisor level. Where challenges were deemed to exist, these were thought to be primarily focused on the time and cost of the training, and its immediate value to the business. Respondents noted that it was frequently not simply the cost of the actual training, but also the cost to the business of losing a member of staff in order to attend that training. Few solutions were suggested, but one respondent thought that providers should sub-divide the courses so that each segment took less time to complete and another suggested that funding be made available to bring the training to their company.

Five respondents also expressed the view that supervisors and managers sometimes lack the motivation to upskill, suggesting they can be "set in their ways" and "just want to do their job and go home". One pointed out "it's difficult to change someone's outlook" and suggested there should be more courses designed to change these mindsets by perhaps showing the benefits of moving from technical skills to management competencies.

Conversely, one respondent felt their staff are "willing to learn and are well supported by HR" as a result of making sure they understand how the training fits in with their role and that of the bigger picture of the company too. Another respondent also said they valued the role HR plays in addressing the challenges, as they are now investing in their managers to ensure they are supporting their teams.

2.5.4 FE/HE training provider views

If an increase in demand for workers is to take place, as predicted, providers feel well-placed to meet this demand but identified significant challenges around funding and finding sufficient staff. The majority of the providers we spoke with said that they are generally at, or near, a full complement of staff, but attracting staff to education - where salaries will be lower than industry - is challenging. Particular areas in which providers have struggled to find teachers/tutors include welding, instrumentation and control, and business development.

When asked why graduates might not be entering the industry, providers suggest a number of major issues including a too-strong focus on theoretical skills, perceived limited career progression, salary levels and uncertainty such as fluctuation in the oil and gas sector.

Similarly, when asked about apprenticeship recruitment, providers noted that competition with local industry or local restricted recruitment practices may have adverse effects. When training apprentices, providers face issues such as a lack of computer skills, or of higher national maths and English skills, and suggest that additional resources are needed to tackle this shortcoming. Providers also suggest that business, particularly, small and medium sized firms, could assist the industry by offering more apprenticeship placements. In addition, insufficient mentoring for apprentices and obsolete curricula were identified.

Asked about their own staff training and development, providers most valued recognised qualifications, communication skills and keeping up with new technological developments. Some providers will hire staff with industry experience, but not necessarily management experience or qualifications. One respondent emphasised that any staff training needs to be closely tailored to the vocation in question, to reflect the needs of the sub-sector.

Providers, on the whole, called for more investment in young people, and to increase practical skills training and promotion of STEM-related subjects; the attractiveness and awareness of the industry could be enhanced, for example, through campaigns at schools.

2.6 Graduates and Apprentices

2.6.1 Graduates

On the subject of graduate recruitment, employers were asked questions on what they regard as the main barriers, salary levels, and the potential reasons why graduates might not seek to enter the engineering construction industry. In the past three years, some 39% of surveyed companies have recruited male graduates (average 8.9 per firm) and 17 percent have recruited female graduates (average 5.1 per firm).

Large companies tend to recruit more graduates of both genders than any others; an average of almost 18 male and 7 females graduates over the past three years.

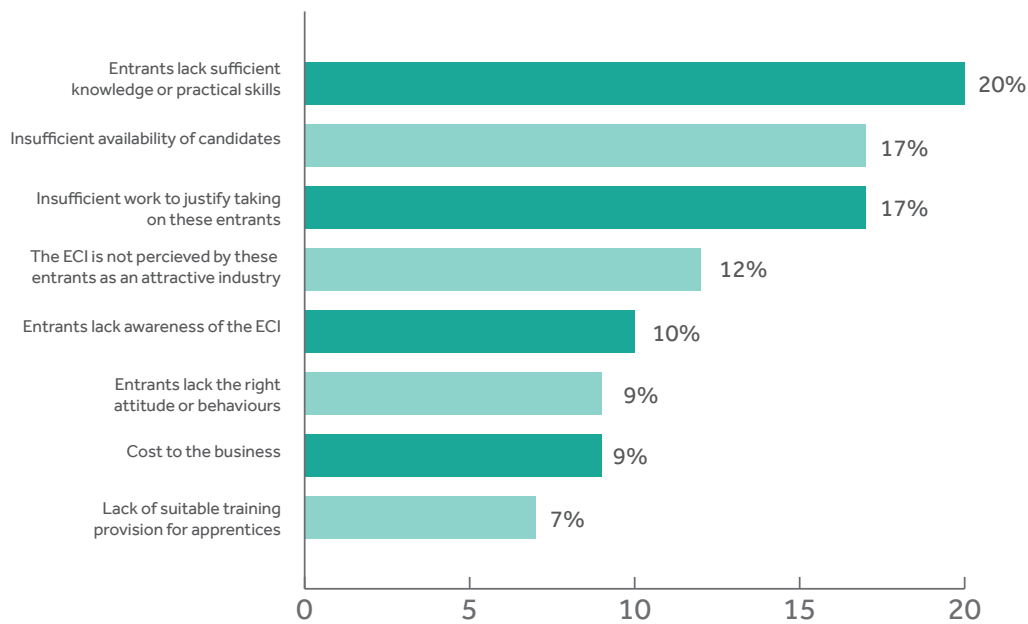
Table 1 Graduate recruitment over the last three years (by size)

Numbers	Micro (1-9)	Small (10-49)	Medium (50-249)	Large (250+)
Males	6	3	4	18
Females	8	2	3	7

Base: 793. Pye Tait Survey, 2018.

Employers identify the main barriers to graduate recruitment as the lack of knowledge and practical skills in applicants (with in depth interviews highlighting soft skills such as communication as key, missing attributes), and too few candidates. Nine percent said that graduate candidates lack the right attitudes and behaviours. High proportions of employers also pointed to barriers related to the lack of awareness of the industry and its perceived unattractiveness.

Figure 21 Barriers to graduate recruitment

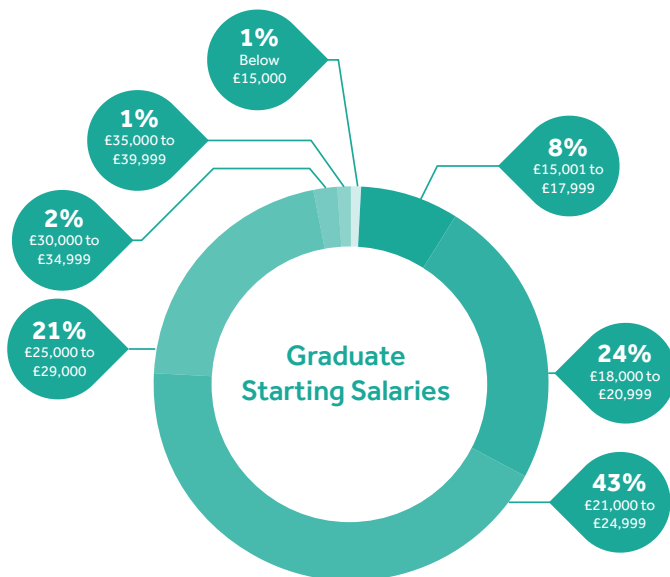


Base: 484. Pye Tait Survey, 2018.

According to respondents, graduates in the engineering construction industry attract average starting salaries of just over £23,000 (with a modal salary of £25,000). Most ECI sectors were in general in agreement on this point, although the food and drink sector was an exception, with graduates beginning on an average salary of just below £21,000 (and a modal salary of £22,000). Two thirds of graduates start at salaries between £18,000 and £24,999 per year, with a further 21% being paid up to almost £30,000.

To compare to the wider picture, the average starting salary of graduates across the broader engineering industry ranges around £27,000 - £30,000. The median weekly wage of an ECI worker is £631, equating to £32,812 pa²².

Figure 22 Graduate Starting Salaries



Base 309: Pye Tait Survey, 2018.

²² ECITB/CEBR, 2017, *The economic footprint of engineering construction*

Larger companies are slightly more likely to pay higher starting salaries for both graduates and apprentices.

Reasons new graduates might not enter the industry

Nearly one third of employers we spoke with via in-depth interviews believe that the perception of the industry is putting new graduates off entering the industry. This is either because it is seen as hard and dirty work, because of the lack of work-life balance, or even due to the perceived lack of progression.

A slightly smaller group commented that engineering itself comprises a broad range of sub-sectors, meaning that graduates end up working as engineers but in sectors other than engineering construction. Some employers also told us that graduates might seek employment elsewhere due to the higher salaries offered.

A quarter of respondents note that firms only wish to hire workers with experience, as they cannot afford the time and financial costs involved in training inexperienced recruits. While some companies were unable to comment on this issue as they do not recruit graduates, a small number of employers stated that they had observed an excess of graduates applying for vacancies. Two employers also mentioned that they are developing schemes to engage with students, either by offering internships or graduate programmes.

"When we take graduates on we have to spend time, effort and money in developing their hand skills. They have all the theory but no practical skills. Young people want to have the degree, but lots of companies still want the practical application, but they don't get enough of that in their course."

"Graduates have to start at the bottom. I think there is a perception that other disciplines e.g. IT have more rapid progression and better working conditions."

"You're looking for individuals we feel will blossom in our environment and then we work with that individual, which I don't think is too different to other businesses."

"The last few years we've made a huge difference to training and development: there's impetus for graduates and apprentices. But clients through parent companies are squeezing, which squeezes the company and the supply chain. When you go down that route, things that are "nice to have" are training/development. There's been a huge reduction in the investment in training and development unless it's at a critical position. The majority will handle this as it happens."

A small number of employers argue that the dearth of graduates entering the industry is partly due to careers advisers in schools, colleges and universities not understanding the industry or the opportunities it offers.

2.6.2 Apprentices

In the past three years over 60% of surveyed companies have each recruited an average of 8.8 male apprentices, while 91 companies recruited female apprentices, averaging 7.4 per company. Large companies in the industry took on an average of 21 male and 6 female apprentices over the past three years. No other size of company came close to these figures.

Table 2 Recruitment of Apprentices over the past three years by size

	Micro (1-9)	Small (10-49)	Medium (50-249)	Large (250+)
Males Mode	1	1	2	4
Females Mode	0	1	1	1

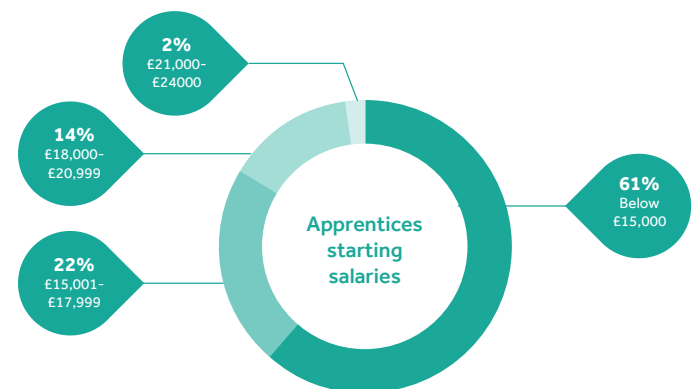
Base: 510 Pye Tait Survey, 2018.

Where apprenticeship recruitment is concerned the picture is somewhat complicated by the spread of responses in terms of company size. The usual measure of central tendency – the mean or average – is therefore misleading. This is because one or more large companies, recruiting large numbers (up to 149) over the past three years have skewed the results. The mode has instead been used to highlight the number of apprentices most referenced by companies in order to give a more representative figure.

In the case of apprentices, most large companies recruited four male and one female over the past three years. In the case of female apprentices, large companies did only a little better than small and medium sized businesses – mainly due to one or more large firms.

The salary picture for apprentices is different to that for graduates, with an average starting salary of a little less than £15,000 per year (the UK average starting salary for apprentices across other industries ranges from £12,000 to £16,000). Sixty percent of employers pay less than £15,000 per year and 36 percent pay between that level and £24,999. Perhaps due to industry-wide agreements there is no statistically significant difference between the salaries paid to apprentices by different sizes of company. However, there was some variation between sectors with conventional power generation apprentices averaging just over £16,500 while new food and drink apprentices average around £13,500.

Figure 23 Apprentice starting salaries

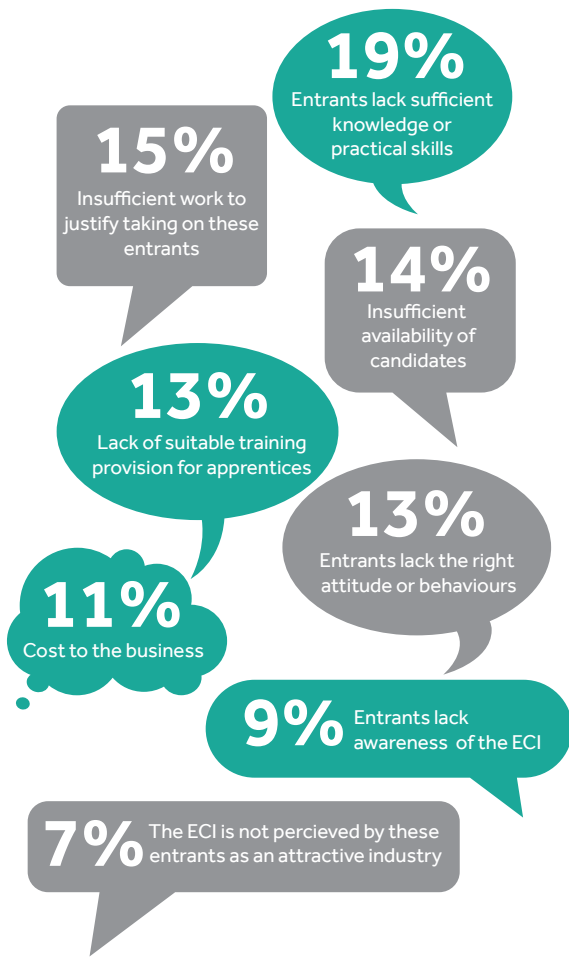


Base: 541. Pye Tait Survey, 2018.

Barriers to apprentice recruitment

In parallel with employers' views on graduate recruitment, the most-mentioned barrier to apprentice recruitment is the lack of knowledge and practical skills in applicants. Employers in in-depth interviews cited a lack of softer skills in particular, and candidates not reaching a certain calibre. Fourteen percent of employers mentioned a lack of applicants, and 13% what they feel is a lack of suitable training provision. Thirteen percent also mentioned what they see as a lack of appropriate attitudes and behaviours. Where apprenticeships are concerned employers also pointed to what they feel is a lack of understanding of the industry.

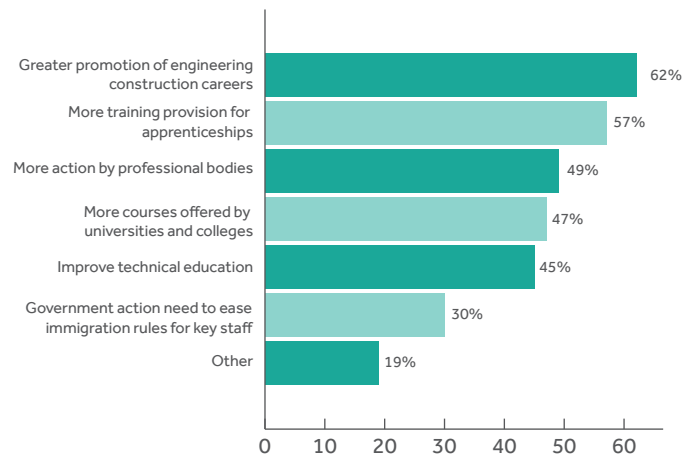
Figure 24 Barriers to apprentice recruitment



Base: 801. Pye Tait Survey, 2018.

Employers were asked about actions needed to tackle recruitment problems. While the question was about general recruitment problems, many of the responses focused on encouraging new entrants, including graduates and apprenticeships into the industry. Sixty-two percent of employers said they would like to see more promotion of engineering construction careers - with further comments noting that schools and colleges should be doing this and also offer more training provision for apprentices (57%). Almost five out of ten employers suggested more action by the engineering professional bodies (49%), more relevant courses at universities and colleges (47%) that can be directly applied to industry settings, and generally improved technical education (45%). More detailed comments focussed on availability, accessibility and quality of courses. One third would wish to see the Government ease immigration restrictions on what they see as key staff.

Figure 25 Actions to tackle recruitment problems



Base: 767. Pye Tait Survey, 2018.

These survey findings are supported by feedback from the in-depth interviews in which many employers would like to see engineering professional bodies engage more with teachers and college tutors about the industry and its careers.

Geographical analysis reveals that an above average number of surveyed employers in the East Midlands (65%), would like more courses to be offered by universities and colleges. A similar share of employers in Yorkshire and the Humber (67%) want more training provision for apprenticeships. Other comments included one respondent who wants to see college courses adapted to bring the latest developments into the courses for operative and technician level workers (fibre-optics and laser optics were mentioned), and others called for improved technical education at school level and the cross-skilling of experienced staff. One respondent asked for more focus on recruiting females into the industry.

CASE STUDY 2:

Debbie Irving, Business Development Manager, Euro Precision (and Office Manager at Euthenia Recruitment AIRP)

"A passionate belief in the long-term benefits for the industry of working with schools."

Euro Precision is a leading subcontract engineering company based in Fife, Scotland. They manufacture critical precision components & assemblies across multiple industries (aerospace, defence, oil and gas, renewable, microwave and laser technology sectors) and hold a generally positive view of the economic outlook over the following 5 years.

Debbie's view of major drivers for change over the next few years include the uncertainty of Brexit and more specifically the likely impact it will have on construction, however, of greater concern to her is the "national skills shortage within the UK and a lack of flexibility in recruiting managers: they want people who are recently qualified with 10 years experience!" Alongside her role at Euro Precision, Debbie is also involved in running Euthenia Recruitment AIRP and therefore feels well placed to talk about staffing and job market trends. She believes that "employers are beginning to realise and accept that they have to pay the money to get the person they want".

The recruitment of apprentices has been an important aspect of Euro Precision's succession planning, particularly in light of replacing older staff and leavers. Unfortunately, the Skills Development Scotland scheme is perceived as inflexible, i.e. "it doesn't allow employers to select or interview candidates and – in our experience – they are rarely properly vetted". As such the organisation now takes them on independently.

Debbie also pointed out that "when other companies were closing down, we were taking on the best of the engineers we could find. That's paying off now, we're certainly better placed than many".

Debbie has concerns over the attitude of some apprentices and younger members of the workforce, commenting that "they simply don't have the same work ethic". She cited disproportionate sickness levels, poor attendance and "simply a lack of awareness of how to be a responsible employee".

Although Debbie saw FE and HE as "generally effective" she feels that they could and should be doing more to develop these softer skills: "arriving on time, the need for consistent attendance, working hard, politeness and how to deal with people should all be covered as part of the course to meet the expectations of employers".

The company places great importance in encouraging more women into the workforce and as such they have established a link with a local girls' school. Debbie explains that they go into the school regularly and give talks "which the girls are really interested in". They feel they have been successful in making the girls aware of the challenging opportunities which working in their sector bring. Their involvement with the school has led to them supporting a local team of school girls, 'F1 in Schools' science and technology competition, enabling them to attend the World Finals in Singapore.

Following on from this success with a local school, the company plan to increase their involvement with other local schools. Debbie explained that "being able to offer structured work experience placements is a key aim for 2019."

2.7 Future outlook

2.7.1 Work pipelines

The level of UK infrastructure investment and demand for engineering construction-related programmes and projects is growing. This is roughly equally divided between public and private sector investment. Local Industrial Strategies developed by Local Employment Partnerships (LEPs), city regions, the Greater London Authority (GLA), and central government schemes in each of the UK's nations are driving a strong trend towards different forms of energy generation and conservation. Local generation – sometimes called community energy – is spreading fast with over 200 schemes currently underway or completed in England alone (including the large 'High Winds Community Energy Society' scheme). Demand for Combined Heat and Power (CHP) projects is strengthening, with recent projects including the Leeds Leisure Centre, the new Residential Quay in Newport, and many schools and hotels. Some of the projects are based on plant or even food waste.

Waste Heat Recovery approaches are also drawing much attention with one of the largest being the Tees Valley £40m scheme announced in 2018. An allied field – District Heating – is also a focus of government targets. The Department of Energy and Climate Change (DECC) has set a figure of 20% of UK heating supplied by district schemes by 2050 and over 180 feasibility studies have been launched.

Currently, around £190bn of investment is in the pipeline for energy infrastructure alone, including almost 100 ongoing or planned energy programmes/projects. In utilities, the pipeline currently comprises 95 projects, programmes and other investments, with a total value of £35.4 billion to 2020/21²³. These investments are essential to creating the conditions for the UK to raise productivity, keep pace with technological change and support long-term economic growth. This is expected to be bolstered by a new National Infrastructure Strategy, due to be published in 2019.

2.7.2 Confidence and workforce change

Employers were asked how confident they are in the outlook for ECI over the next three to five years. The majority (62%) are generally confident, explaining that they have seen an upturn in the amount of work and enquiries and had more projects in their order book; moreover, many do not foresee this changing in the short-term. Spending on large projects may also be driving this positivity.

Among the 16% of employers less confident about the economic outlook, this uncertainty primarily arises from the UK's impending exit from the EU which, in turn, has caused a degree of faltering in investment levels.

Confidence levels of employers are similar across the country, although slightly lower in London, where 47% of surveyed firms are generally favourable about the outlook.

"Things are going well for the sector. We had a quiet start to the year but there are a lot of bigger projects starting now and in the pipeline."

"Uncertainty around Brexit has given hesitation to fresh investment. No particular outcome will sway it, it's just uncertainty."

A small sample of FE/HE providers to the industry were also, on the whole, relatively positive about the long-term economic outlook, with new infrastructure projects predicted to create growth. On the other hand, it was expected that in the short and medium term, Brexit uncertainty would result in a temporary stagnation in the industry to be followed by further growth. One respondent highlighted that the continuing uncertainty regarding the construction of a new nuclear power plant at Moorside was making the outlook worse.

²³ Infrastructure and Projects Authority (2018) Analysis of the National Infrastructure and Construction Pipeline

Figure 26 Confidence in business outlook (next 3-5 years)



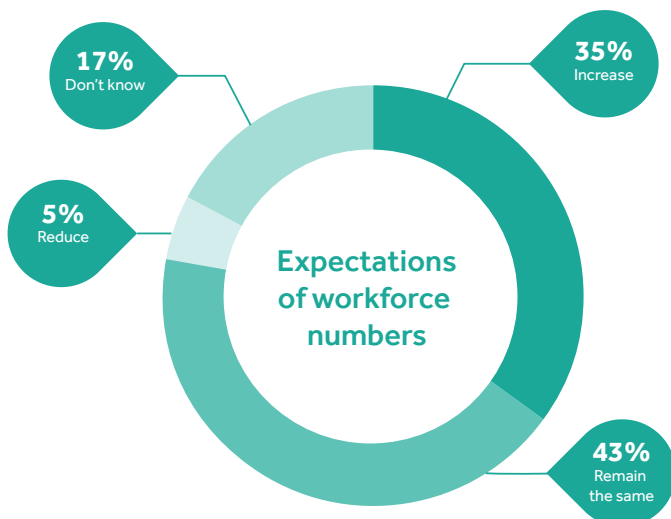
Base: 827. Pye Tait Survey, 2018.

The majority of companies of all sizes are very or quite confident about the general business outlook. Interestingly, the highest proportion of companies in the 'not very or not at all confident' category is found among micro businesses (however, the base for this question was small). On the basis of more robust numbers of respondents, the confidence of small, medium and large companies is around the 62% level, with around one fifth to a quarter, however, being unsure.

Perhaps in line with companies' exposure to international business and trade it might be expected that larger companies would be less confident than smaller ones about the impacts of Brexit, but this is clearly not the case in this survey.

Employers are largely divided as to whether they expect the size of their workforce to increase (35%) or remain the same (43%). Some 17% could not answer the question and only 5% expect the workforce to reduce in size.

Figure 27 Expectations of workforce numbers



Base: 827. Pye Tait Survey, 2018.

A higher proportion of the larger companies expect workforce numbers to grow over the next three to five years, with over 40% of large companies expecting an increase compared to 30% of small companies. Around three quarters of all companies foresee workforce numbers either staying the same or increasing. Expectations concerning workforce numbers appear to support an overall impression of confidence going forward.

Analysis of anticipated future workforce change by geography reveals no clearly discernible differences in the results.

2.7.3 Business challenges

The most widely anticipated driver of change in the next three to five years mentioned by employers in in-depth interviews is the UK's imminent departure from the EU. Irrespective of any final deal, companies are currently facing uncertainty, and in the future will have to adapt to new legislation and regulations following Brexit. In addition, they may also have to cope with non-UK employee losses.

The next most commonly-cited driver of change is technological innovation, with the potential introduction of new processes and ways of working, and the almost inevitable transition to more automation.

Skills shortages are noted by a large minority of employers as driving change in the industry, with only a finite pool of skilled, technical workers available and in high demand.

Employers interviewed as part of the qualitative research also mentioned a range of other drivers that are having an impact on their business. These include the impact of government targets and policies on their business, the availability of finance, manufacturers moving overseas, environmental pressures, and the price of oil.

"Brexit and EU: not just free movement of staff and access to markets but regulation and technical standards – will we still stick to EU directives or will we adopt others?"

"Finding skilled staff – any reduction in the pool of labour caused by Brexit will be bad for the industry."

"Technology is a big driver. New technology has come into the industry, but it's hard to say whether it will create jobs or take away some due to automation."

2.7.4 Brexit

Employers are taking a cautious approach to the future and appear to be reigning in investment plans. At the time the survey was undertaken (July to October 2018), UK-EU negotiations were still ongoing. Around one fifth to one quarter of companies said they were pessimistic about the outlook for recruiting and retaining workers post-Brexit, while four in ten employers expected no impact at all. Further information from the survey regarding Brexit is in Appendix 4.

2.8 Support for the industry

In the in-depth employer interviews, we asked a number of questions probing thoughts on how industry and professional bodies could better support the skills needs of the industry, and any general comments on the issue of skills and the industry.

2.8.1 Managing change

Employers are extremely aware of the challenges facing them and were thoughtful and forthright about them. The comments we received focused on four key areas: the ageing workforce, educational courses and routes, the impact of technology, and embracing change.

The Ageing Workforce

As noted earlier, the engineering construction industry is facing a problem with experienced older workers retiring or coming up to retirement age. The issue is not as bad as that facing some other sectors, but it is being made much worse by the difficulties being faced in recruiting younger staff. Note that this picture varies slightly by region, with the North East, North West and Yorkshire and Humber regions offering more apprenticeships and seeing greater uptake of these than other English regions²⁴.

The issue of the ageing workforce is a complex one. There is no doubt that keeping older workers for longer is a sensible way of retaining experience and skill while solutions are found for attracting younger people. Several employers we spoke to believe that both individual companies and the industry generally do not deal with this issue very well. One told us that it is a long-standing problem and another felt that not enough is being done by companies to ensure older leavers are passing on the knowledge.

Courses and Routes

A number of respondents in the in-depth interviews mentioned what they see as either too little focus on apprenticeships or too much focus on degrees. One respondent referenced a perceived drive to send as many 18-year-olds to university as possible rather than giving due consideration to vocational routes:

"Teachers don't understand technical and practical careers therefore they send them [pupils] to universities to get degrees of little long-term value."

Employers see the impact as being two-fold, recruitment of school-leavers into apprenticeships is low and the industry is struggling to "manage the [unrealistic] expectations of graduates". It was said on several occasions in the in-depth interviews that work ethics and practical experience are vitally needed:

"Young people require more practical experience, more willingness and more awareness that they have to work hard."

Technology and Recruitment

Most respondents and interviewees were well aware that the increasing use of new technology and digital systems will inevitably replace human employees, but several were concerned about the public relations effect of such reductions.

One respondent raised the possibility that, while some of the technology is improving efficiency, it is also reducing the need for certain types of staff. This, in turn, may lead to an impression of the industry as getting smaller and therefore less attractive to young people.

On the other hand, another respondent highlighted the positive impact technology is having in terms of attracting young people into the industry. He said that the more the industry could promote its use of advanced technologies and digital approaches, the more it would attract school and university leavers interested in IT, digital design, and systems.

Embracing change is, on the whole, seen as positive by all employers. It is recognised that 'the industry never stands still for long'. However, a number of respondents to the depth interviews asked for more help for the industry – especially SMEs – in understanding where change is happening and how to cope with it. An employer said:

"Change is happening faster and faster and not only can't I keep up with it, I can't see how I can use it all."

A stakeholder summing up this question of change and challenge for the ECI stated:

"It's a catch 22. Without the work in the UK, employers will not recruit in the UK. But they need to recruit to do the work. There is a future for Engineering Construction in the UK but we need to protect it."

²⁴ Education Policy Institute, 2017, *Apprenticeships for Northern Growth*.

Part III:

Discussion



3.1 Discussion of Findings

This research has been unique in that it does not just represent a solid proportion of the core ECI (circa 60%), but, additionally, over 600 companies which classified themselves as being involved in engineering construction to a greater or lesser extent. The findings therefore present a view of the 'constituents' of the ECI, workforce characteristics and skills issues that are somewhat different to other ECITB primary research. It builds on the information base presented in the Economic Footprint of Engineering Construction, published by the ECITB in November 2017.

What this research reveals is a large and somewhat amorphous base of supporting companies which, because they involve an extensive group of Tier 2 to 4 members of the supply chain, are hard to define without significant additional research. Core companies are still relatively straightforward to identify and define, but economic and technological change has meant that, the further one travels from the core companies, the more generic and cross-sectoral these other 'supply chain' companies become.

More crucially, from the point of view of the industry's skills body, change in the make-up of the industry has created a much greater degree of overlap between job roles. Therefore, there is greater difficulty in defining precisely what an ECI job is as compared to one in construction, engineering or a related sector.

This situation has made the conduct of the present research challenging in terms of identifying those companies and activities which make up the ECI, many of which are not in-scope to the ECITB.

The Industry

As mentioned earlier in this report, the Engineering Construction industry is divided into the following nine core sectors:

- Nuclear
- Oil and gas - downstream
- Oil and gas - upstream
- Power generation
- Renewables
- Chemicals
- Pharmaceuticals
- Food and drink
- Water treatment

A large number of skills considered key in the ECI - such as project management, heavy steel and pipe-work - are also used by other industries such as rail and shipbuilding. These are often carried out by generic construction or engineering companies.

The ECI retains some very specific – almost unique – job roles, but many are heavily impacted by change. These include jobs affected by increasing automation, by the

nascent use of robots, and by the expanding influence of digitalisation (see the ECITB's separate technology report).

The core industry employs or supports around 190,000 people working in some of the nation's most important sectors. The question now is whether the industry needs to do more to promote itself in order to ensure that its broader workforce needs are met. This will help with future consideration of what job roles it needs to focus on now and into the coming decades, and what skills these job-roles require.

The Labour Force Conundrum

Recruitment is one of the most pressing issues facing the industry. Every year, losses from retirement average more than 9,000 engineers and almost 3,000 engineering technicians across engineering sectors, in addition to retirements among managerial and related professionals. Annual losses to other industries must be added to these figures.

Skills shortages and skills gaps also affect the industry. Approximately one third of companies in the industry are unable to find suitable applicants with appropriate skills and many others require upskilling training for their existing workforces.

The difficulty in attracting and recruiting younger entrants from college and university adds to the difficulty of resourcing ECI activities with skilled staff and contributes to the relative lack of diversity in the workforce.

The labour force conundrum afflicts almost all UK enterprises across all sectors, but it impacts most severely on the industries which need highly skilled staff and particularly those with high level engineering and digital skills.

Automation, digitalisation, and robotics will almost certainly reduce the need for some types of human workers and will certainly change the skills-profile of many other job-roles. However, it is doubtful that this will be an immediate process or even one which can be measured over a matter of a few years.

Instead, the ECI will need highly qualified people well into the future and will certainly need to retain and upskill its existing workforce in order to alleviate the pressures of the wider job market. Challenges include:

1. recruitment of younger workers;
2. retirement of older workers;
3. skills gaps in the existing workforce;
4. skills shortages in the general pool of applicants.

Skills Shortages

The ECI needs to maintain and enhance its links with FE/HE providers in order to ensure that teaching and qualifications are not only fit for current purposes, but also for future needs - driven by rapidly-changing technology. However, this is of lesser immediate concern than recruitment, retirement and the skills gaps.

Other industries, such as construction and the electro-technical industry, are looking at industry-wide initiatives to help companies retain older staff. The established retirement age of 65 could be extended through carefully constructed policies on retaining and retraining older workers. Research conducted for other organisations in other industries suggests that companies – especially smaller and medium sized enterprises – are keen to receive assistance and guidance on how to accomplish this at an early stage – for example when workers are in their thirties and no later than their forties²⁵.

Recruitment and retention of young people

Similarly, the recruitment of younger people is a global issue but has significant impacts on the ECI. There are two aspects to this problem:

1. a general shortage of young people in comparison to earlier years (possibly compounded by increased competition in terms of wages and conditions from other industries), and;
2. a dissatisfaction regarding the work-readiness and skills of current recruits (including those from universities).

Again, the problem is a national one, affecting all economic sectors; one which has led to high levels of competition in salary terms for high-skilled job-roles.

A further issue connected with this recruitment problem is that of cultural change and expectations. Some employers are already noting a general unwillingness to relocate for work and, when in a job, to travel distances for jobs.

Cultural issues, comparative increases in wages, perceived inconveniences in types of work (e.g. relocation, travel, outdoor work), work ethics and behaviours, perceptions of high demands in certain occupations have all been linked to problems faced by employers in recruiting younger staff.

Promoting ECI careers is clearly one of the main options, but there is very little research available on the impact and the characteristics of cultural change from which to extract potential ways forward.

Skills gaps

There are immediate concerns for the engineering construction industry – mainly around the skills gaps in the current workforce – and there is also the need for the industry to be adequately prepared for the future.

As stated earlier in this report, employers in general believe that the skills that are important now will also be the skills that are important in three to five years' time. This may be true over that relatively short period, but their view, when stated like this, is potentially misleading. Technology is changing the industry rapidly and, even though its impact may take longer than five years to fully develop, if nothing is done, the industry may well be ill-prepared to meet the radical skills changes arriving over the longer-term (five to ten years' time).

Understandably, ECI employers are looking to improve soft skills in areas such as leadership and management, project management, languages, and exporting. However, BEIS and Innovate UK's attention on future skill needs is heavily focussed on the impacts of digitalisation, automation, robotics, and associated fields. These will undoubtedly affect all sectors and their impact on the ECI needs to be evaluated.

It is arguable, notwithstanding the importance of technological change, that other developments are of equal importance to future skills needs. For example, the ever-increasing focus on environmental damage and climate change will drive a massive reshaping of how the industry operates and the skills its people need. Corporate success will depend upon innovation in materials and design, minimising environmental impact (including travel and supply chains), and in spotting novel business opportunities.

One of the fundamental problems concerning future skills needs is that employers are unable to predict the future with any accuracy. For the most part, they can only work with what they already know and that tends to mean extrapolating trends that are already visible and underway. Change which affects skills needs is not merely technological, and the industry will also need to be prepared for very rapid, revolutionary shifts in areas such as the political environment, global economic change, environmental regulation, and even social and cultural evolution.

The ECI will be impacted by the same overarching technologies as other industries, as well as by developments of those technologies specific to the industry. As well as technological progress, social and cultural change will have implications for skills.

²⁵ <https://www.gov.uk/government/publications/fuller-working-lives-evidence-base-2017>

Skills provision

Employers in this research expressed a degree of concern about education and training provision, saying that providers, through no fault of their own in many cases, are not as up to date in technology and skills as the employers would wish.

A full third of in-depth interviewees said they were dissatisfied with education and training provision. Providers, for their part, argued that employers need to be more aware of the need for placements and to react more positively to apprenticeships, including degree and higher apprenticeships.

The differences of opinion between employers and providers are not unique to the ECI but both points of view contain more than a grain of truth. Employers can point to failings in provision and teaching, and providers can list numerous examples of employers failing to take apprentices and side-stepping the clear need for students to gain experience through placements.

While not a new issue, this continuing polarisation of views is not helpful and the ECI would undoubtedly benefit from a more collaborative approach, particularly across the wider supply chain, on both sides based on firmer understanding and a greater willingness to change.

Careers

Finally, employers are concerned not only with an ageing workforce and the loss of experience and skills which that might represent, but with the difficulties they are facing at present in attracting a more diverse workforce – especially female recruits and those from BAME communities.

There is clearly an urgent need for further work to:

- link engineering construction employers to schools and colleges;
- enhance awareness of the industry among school and college teachers and tutors;
- improve the image of engineering construction;
- find ways of establishing safe and insured work-experience programmes for the forthcoming T levels.

Appendix 1: Scope of Survey

This survey was targeted at the circa 270 to 300 employers 'in scope' of the ECITB as well as the wider engineering construction industry, including supply chain organisations and asset owners.

The survey introduction stated:

"This survey is open to employers (contractors/sub-contractors), based in Great Britain, in which at least some of the total workforce undertakes principal or related engineering construction activities."

The survey description went on to clarify the scope as follows:

"This survey is open to employers where at least some of the workforce undertakes activities relating to the design, engineering, procurement, project management, construction, maintenance, repair, replacement, testing or decommissioning of any chemical, electrical or mechanical apparatus, machinery or plant, to be used on or installed on a process site. It includes all such activities in relation to the oil and gas, renewables, nuclear, petrochemicals, pharmaceuticals, food and drink, waste and water sectors."

The full scope statement is set out below (taken from the ECITB's website) and potential respondents were directed to this web-page where they were in any doubt as to their potential qualification for the survey.

The following is a summary of the activities which are described as engineering construction activities. Establishments which are wholly or mainly undertaking principal and/or related activities are leviable so long as the activities are carried out in Great Britain (England, Scotland and Wales) or its offshore waters. A full definition of engineering construction activities is shown at Schedule 1, paragraph 1. of the 1991 Board Order. A copy of the Order is available at the Download documents section.

Principal activities

- 1 Assembly, construction, dismantling, erection, fabrication, fitting, inspection, installation, maintenance, repair, replacement or testing on site of any chemical, electrical or mechanical apparatus, machinery or plant of a chemical works, gas making or gas treatment works, nuclear or thermal power station, nuclear waste reprocessing site, hydro-electric station, oil refinery or oil terminal or of other apparatus, machinery or plant concerned with the exploration for or exploitation of oil or gas, metal smelter, steel mill, paper mill or brewery, the processing and production of human or animal food, pharmaceutical, cosmetic and petrochemical products, cement, concrete bricks, distilling alcohol or other products, glass, paper and sewerage and any other installation involving the processing of any product.*
- 2 Planning, designing, commissioning or procuring by way of contract or otherwise of any apparatus, machinery or plant mentioned at 1 above carried on in association with any activity mentioned at 1 above or in association with any project for such an activity.*
- 3 Supervision of the assembly, construction, dismantling, erection, fabrication, fitting, inspection, installation, maintenance, repair, replacement or testing of any apparatus, machinery or plant mentioned at 1 above when carried out on site.*
- 4 The erection and/or dismantling of the main framework of a building or other structure that is made of steel or other metal where the building or structure is erected or dismantled on any site (not necessarily on a site where a product is processed). Types of structures erected or dismantled could include, for example, supermarkets, warehouses, stadiums, agricultural buildings, office blocks, etc.*
- 5 The hiring out by an employer of individuals in his employment to employers who are engaged in any of the activities listed above where the individuals being hired out will be engaged in such activities.*

Related activities

The following activities are related activities provided they are incidental or ancillary to the principal activities of the engineering construction industry.

- 1 *Research, development, design or engineering construction drawing (either created by hand or by computer related software) or dynamic simulation*
- 2 *Buying, selling, hiring out, testing (including NDT), advertising, packing, distribution, transport or any similar operations*
- 3 *Operations of a kind performed at office premises or laboratories, or at stores, warehouses or similar places*
- 4 *Cleaning, washing or garaging vehicles or carrying out running repairs or minor adjustments thereto*
- 5 *Training of employees or apprentices*

Other activities

Provided an establishment is wholly or mainly engaged in the principal and related activities of the engineering construction industry, the following activities are also engineering construction activities.

- 1 *Any activities undertaken in the administration, control or direction of an establishment or establishments.*
- 2 *Any activities of industry or commerce.*

Wholly or mainly engaged in engineering construction activities

When considering whether an establishment is wholly or mainly engaged in principal and related engineering construction activities, the ECITB will primarily give consideration to the balance of activities of the establishment's workers.

If 50% or more of the establishment's total workforce is engaged in principal and related engineering construction activities, then the establishment is mainly engaged in engineering construction activities and ALL workers in the establishment are required to be declared to the ECITB and may be subject to the levy.

Full time equivalent

When looking at any workers who are engaged in more than one activity, the ECITB will calculate the Full Time Equivalent. For example, if there are 10 workers each engaged for 60% of their time in welding pipework on a power station and 40% of their time fabricating in a workshop at the establishment's own premises, the full time equivalent will be that 6 workers are engaged in principal engineering construction activities and 4 workers are engaged in other activities of industry or commerce.

Appendix 2: ECI Sectors

Figure 28 Respondents by sector and size

	Nuclear	Upstream oil and gas	Downstream oil and gas	Conventional power generation	Chemical
Micro (1 to 9)	-	1.90%	1.90%	0.90%	1.00%
Small (10-49)	29.20%	37.00%	36.40%	31.50%	35.40%
Medium (50 to 249)	51.00%	42.60%	42.10%	50.00%	46.50%
Large (> 249)	19.80%	18.50%	19.60%	17.60%	17.20%

	Pharmaceutical	Food and drink	Renewables	Water and waste treatment	Other
Micro (1 to 9)	1.60%	2.60%	9.80%	2.40%	6.10%
Small (10-49)	40.60%	48.10%	42.30%	48.80%	52.90%
Medium (50 to 249)	43.80%	40.30%	31.70%	39.20%	30.50%
Large (> 249)	14.10%	9.10%	16.30%	9.60%	10.50%

Pye Tait Survey, 2018.

1. Nuclear

The UK currently has 15 nuclear reactors, which generate approximately 21% of the country's electricity. Existing power stations require repair and maintenance; other plants are undergoing decommissioning and meanwhile there are new nuclear projects in the pipeline.

Demand for engineers is expected to grow in the coming years, although skills shortages are predicted in the following roles²⁶:

- Safety case preparation
- Control and instrumentation
- Reactor operation
- Site inspectors
- Project planning and control
- Commissioning engineers
- Electrical engineers
- Emergency planners
- Quality assurance staff
- Chemists

The nuclear sector appears to be undergoing significant expansion, not least due to the construction of Hinkley

Point C. Recent estimates predict that the nuclear sector will require an annual inflow of 3,300-8,600 engineers²⁷, peaking in the early 2020s. Hinkley Point C will employ 20,000 staff with a further 20,000 skilled workers required across the sector.

Sellafield Ltd, whose main responsibility is to manage the decommissioning of the Sellafield site, employs over 13,000 workers. Until 2016 it was operated under licence by a third party but it is now a subsidiary of the Nuclear Decommissioning Authority (NDA). This site at Sellafield is evolving from energy production to new functions. The first function, nuclear reprocessing of spent fuels in the local Thermal Oxide Reprocessing Plant (Thorp), ceased in November 2018²⁹. The second function concerns the so-called legacy management, namely the storage of nuclear waste. In this context, Sellafield is the only site that can store all types of nuclear waste for up to 100 years. Sellafield Ltd. is also active in training, having launched a degree apprenticeship with Rolls Royce, BAE Systems and other companies for project managers that can be employed in any industry in 2018³⁰.

²⁶ https://www.cogentskills.com/media/76523/nwa2017_public.pdf

²⁷ Nuclear Workforce Assessment 2017, Nuclear Skills Strategy Group, July 2017.

²⁸ Nuclear Energy Skills Alliance, 2015, Nuclear Workforce Assessment

²⁹ <https://www.gov.uk/government/news/new-era-at-sellafield-as-thorp-reprocessing-ends>

The construction of a deep geological disposal facility (GDF) to store radioactive waste for hundreds of thousands of years is still at the planning stage at Sellafield³¹. The site is projected to generate £5.7bn in income between 2018 and 2028. There is no clear-cut plan for the full decommissioning of Sellafield, but the nuclear provision estimate by the NDA envisages nuclear decommissioning operations over the next 120 years³².

Magnox Ltd is responsible for safely managing 12 nuclear sites. Although currently owned by the Cavendish Fluor Partnership, it will come under the control of the NDA in 2019.

Horizon Nuclear Power was established in 2009 as a joint venture between EON and RWE npower. It was bought by Hitachi in 2012 and electricity generation was anticipated to begin in the mid-to-late-2020s at two new power stations; however, work at Wylfa has currently been suspended due to funding concerns.

EDF Energy owns and operates eight existing nuclear power stations and is building the new Hinkley Point C power station in Somerset, due online in 2025. EDF has also invested in extending the life of reactors at Hunterston and a 10-year extension of the Dungeness plant, agreed in 2014 to run now until 2028. More recently in 2016, extensions were also announced for Heysham I and II, Hartlepool and Torness. EDF spends around £600m each year on upgrades and maintenance of its eight plants.

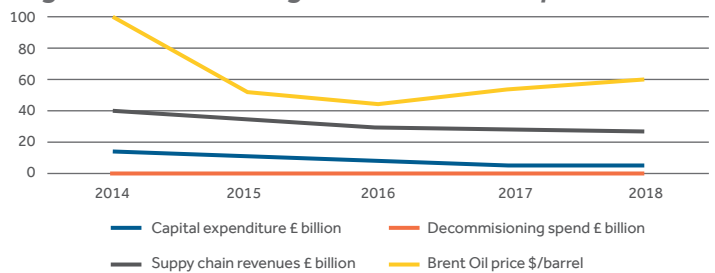
2. Oil and gas

In 2017, capital investment in the UK offshore oil and gas sector was £5.6 billion. The sector spent £7 billion operating its assets and supports over 280,000 jobs in the UK³³. Nearly 60% of jobs in the sector are in England and around 40% are in Scotland.

The UK oil and gas sector is regarded as a technology leader in subsea operations and deep water experience. Examples of technological innovation include advanced techniques used in seismic surveys and extending drilling capabilities to develop marginal fields.

Relatively low oil prices since 2014 have slowed or halted investment in oil and gas projects; the sector remains cautious, and capital investment has lagged behind any movement in oil prices. Decommissioning spend increased from approximately £1.1 billion in 2014 to £1.8 billion in 2017 and is expected to remain at £1.7 to £2 billion per year through to 2020. After three years in decline, supply chain revenues appear to be stabilising. In the face of lower oil prices, average unit operating costs have halved from around \$30/barrel of oil equivalent (BOE) in 2014 to \$15/BOE in 2017.

Figure 29 UK oil and gas revenue and expenditure



Source: Oil and Gas UK

The sector has seen several mergers and acquisitions as the fall in oil prices led to a 'survival of the biggest' situation. For example, in October 2017 Wood Group completed a £2.2bn takeover of Amec Foster Wheeler, following the sale of the majority of Amec Foster Wheeler's upstream oil and gas division to Worley Parson. At the time of the merger Wood Group employed 29,000 people while Amec had 35,000 workers. The takeover created a company with a combined value of approximately £5bn. Other significant takeovers and mergers include the January 2017 merger between Technip and FMC Technologies, which created a company with a value of £10bn, and July 2017 Cape, the UK oil and gas services company, agreed a £332m takeover by Altrad.

Onshore oil and gas processing and production has largely followed the trends of the offshore sector. There are six major oil refineries in the UK each owned and operated by a different company. In refining and marketing these companies employ around 7,000 people.

In 2017, the UK consumed around 74 bn cubic metres of gas of which 47% came from European and Russian sources, 44% from UK sources and 9% from Liquefied Natural Gas (LNG). The UK has three main connections for gas from Europe and there are three import facilities for LNG.

3. Power generation and Renewables

The UK energy landscape is undergoing a seismic shift in the face of climate change and the requirement to shift to lower/zero emission energy generation. The energy sector as a whole contributed 2.3% of the UK's GDP in 2016 and employed 178,000 people directly, with an estimated 152,000 more supporting UK Continental Shelf (UKCS) production³⁴.

While the traditional 'Big Six' energy suppliers still hold 80% of the domestic supply market, this has fallen from 99% in 2012, and there are now 73 active licensed suppliers. While, collectively, these smaller suppliers have poached a large

³¹ <https://www.gov.uk/government/collections/geological-disposal-facility-gdf-for-high-activity-radioactive-waste>

³² <https://www.gov.uk/government/publications/nuclear-provision-explaining-the-cost-of-cleaning-up-britains-nuclear-legacy/nuclear-provision-explaining-the-cost-of-cleaning-up-britains-nuclear-legacy>

³³ Oil and Gas UK 2018 Economic contribution

³⁴ BEIS, 2017, UK Energy in Brief

chunk of the market, few have taken a sizeable portion for themselves. First Utility, one of the leading small suppliers, were acquired by Shell in 2018 in a deal worth between £200m and £300m.

In terms of energy production, Britain reported its first coal-free day in April 2017 and twelve months later reported this for three consecutive days. Gas powered generation has been expanding rapidly and now produces around 32GW of power in total. The attraction of using a fossil fuel – gas – for producing electricity is that, on average, its carbon emission levels are half of those for coal or oil.

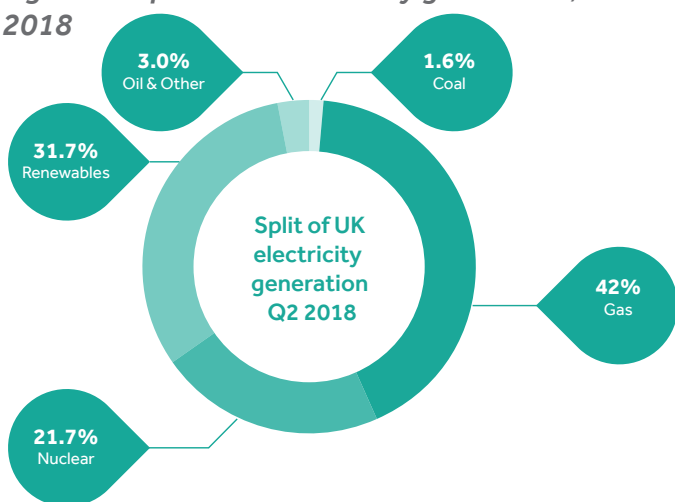
In September 2016, the gas-fired Carrington Power Station became operational. The plant provides 880MW of capacity for Greater Manchester. Further plants are approved for Eye, Suffolk, and Aberdare in South Wales.

Electricity generation from renewables has reached a record high, with government statistics showing that over 30% of UK electricity generation was from renewables in Q2 2018³⁵. 2017 was the greenest summer ever recorded with more than half of the UK's electricity coming from low carbon sources, helping the government to meet its long-term climate change commitments.

Wind power

The UK has the largest total offshore wind capacity in the world, and in October 2018 was the sixth largest producer of wind power³⁶. As Britain's wind power capacity has expanded, so has investment. For example, the industry giant Siemens announced in 2014 that it planned to build a \$264m facility to make offshore wind turbines resulting in the creation of 1000 jobs. Construction of the Beatrice offshore wind farm has begun and will add 588 MW of capacity to the grid when complete in 2019.

Figure 30 Split of UK electricity generation, Q2 2018



Source: National Statistics, 2018, Energy trends: Electricity generation, trade and consumption

³⁵ National Statistics, 2018, Energy trends: Electricity generation, trade and consumption

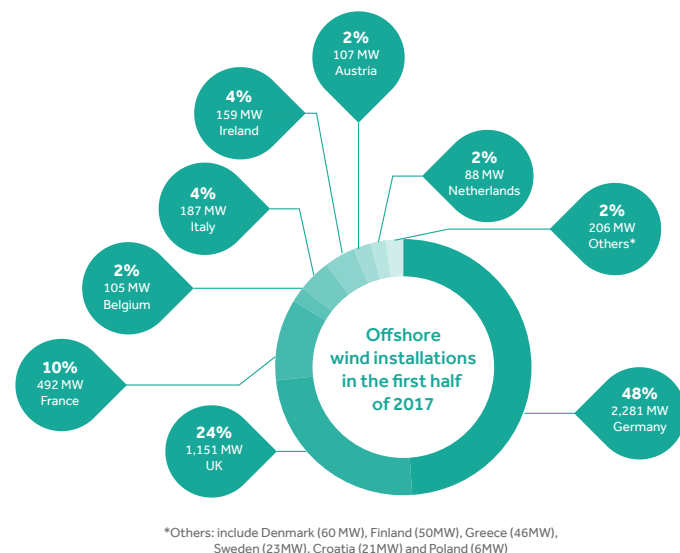
³⁶ Renewable UK, 2018, Offshore Wind Project Intelligence

³⁷ https://s3-eu-west-1.amazonaws.com/16058-drax-cms-production/documents/180514_Drax_Q1_Report.pdf, p.8

³⁸ Wind Europe 2017 Wind energy in Europe: Outlook to 2020, p.11

In the first quarter of 2018, energy production by wind power superseded nuclear for the first time³⁷. It has, however, not been established to what extent this a continuing trend. In total, 24% of all wind power installation constructions in 2017 were undertaken in the UK³⁸.

Figure 31 Offshore wind installations in the first half of 2017



Source: WindEurope

At present, the UK has consented to projects involving almost 1,300 offshore wind turbines which will generate another 12GW of power, and over 2,000 onshore turbines with a combined capacity of 4.5GW. These will be added to over 7,000 onshore turbines generating around 12GW, and 1,900 offshore turbines generating around 7.8GW, thus in total producing around 36GW of power.

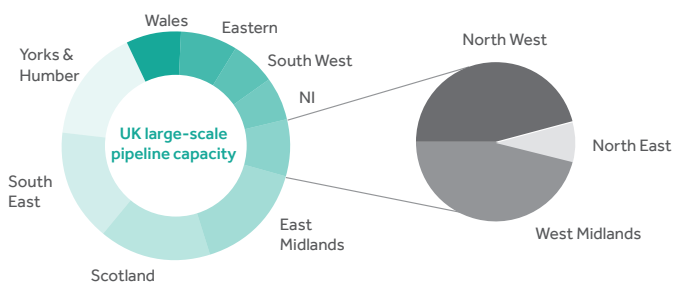
A record of £11bn was invested in UK offshore wind energy in 2016 and a further £11.5bn is projected to be invested from 2017-2021. According to Wind Europe, between 2017 and 2020, between 2.6 and 5.1 GW of additional wind power capacity may be installed in the UK.

Solar power

Solar power has also experienced considerable investment. 2011 saw the construction of the (then) largest solar park in the country in Nottinghamshire with 4.9 MW capacity system in just seven weeks. This has been dwarfed by new arrays such as Lyneham (69MW), and another twenty or so that can generate more than 20MW. The planned Cleve Hill project in Kent could generate up to 350MW.

The UK Solar Power sector presently faces uncertainty, as government subsidies are due to be phased out by 2019 after already significant reductions from 2016 onwards. Nevertheless, the sector remains optimistic, expecting 500MW of large solar farm capacity to be constructed in 2019. The below figure shows the current capacity of solar power by region, with about half of the capacity consisting of projects either completed or having submitted a planning application. The other half is comprised of projects that are not at this stage yet. Taking into account the predictions, this would mean that by the end of 2019, the total production capacity could be reaching approximately 1.75GW.

Figure 32 UK large-scale pipeline capacity (total 2.5GW) by region



Nevertheless, the Solar Power Europe Global Market Outlook 2018-2022 forecasts that the compound annual growth of UK solar energy will be the lowest of the Top 20 global solar markets, at 3%. Highest is Saudi Arabia at 227% followed by Egypt at 171%.

There is also great potential to generate electricity from wave power, and trial farms have been implemented by Ocean Power Technologies off the coast of Scotland and Cornwall. One of the largest proposed projects – the Swansea Tidal Lagoon – was due to begin construction in 2018 to produce around 350MW but was officially rejected by central Government in June 2018 due to funding concerns.

While renewable technologies have enjoyed a surge in interest, controversy has surrounded the UK's efforts to obtain fossil fuels using hydraulic fracturing i.e. fracking. This method may reduce the UK's dependence on a network of cross-border pipelines in the medium-term, but production has not yet reached a commercial scale.

4. Chemicals and Pharmaceuticals

In 2016, the chemical and pharmaceutical sector was the UK's second largest sector, generating nearly £50bn in revenue and contributing £17.8bn in added value to the country's GDP⁴³. According to recent research by Cefic, the UK chemicals sector comprises around 3,500 companies and directly employs approximately 140,000 people (2016)⁴⁴. This marks a significant increase in the two-year period since 2014, when the Chemical Industry Association (CIA) reported there to be 105,000 directly employed staff⁴⁵. Most chemicals companies exist as very small firms, with over half employing fewer than five people. Only 3% can be classed as 'large' companies employing over 250 staff⁴⁶. These are based in the North of England at traditional bases such as Teesside or Runcorn.

Billingham Chemical Plant on Teesside is one of the most well-known plants in the UK. ICI owned the plant until 2015 when it was sold to Terra Nitrogen – a US company which itself is a subsidiary of CF Industries and Terra Nitrogen LP. CF Fertilisers now operates out of Billingham, and its original use, to manufacture fertilisers, is still maintained. The plant is now undergoing a £40m upgrade.

Research and development in the pharmaceutical sector is experiencing a particularly strong surge in interest in the UK. While the CIA reported there to be 53,000 directly employed staff in 2014, latest figures show that this has risen to 73,000.

The UK is home to pharma giants GlaxoSmithKline and AstraZeneca, and foreign companies also have a major presence here, with organisations including Pfizer, Novartis and Eisai all having bases. The last ten years have seen significant changes in investment and restructuring by these firms. In 2009, GlaxoSmithKline and Pfizer announced that they would be combining their separate AIDS research division into one London-based company, ViiV Healthcare. In 2011, Pfizer closed its entire research and development facility in Sandwich, Kent, leading to the loss of 2,400 jobs. In 2013, AstraZeneca announced a major restructuring of its UK business, involving the investment of \$500m to build new R&D facilities in Cambridge – opening in stages from 2018 - for 2,000 staff.

⁴³ Global Market Outlook for Solar Power 2020-2022

⁴⁴ Cefic, 2018, Landscape of the European chemical industry (UK)

⁴⁵ Chemical Industry Association 2015 bulletin

⁴⁶ a) GDP(O) Low Level Aggregates National Accounts, ONS, 2017 and b) Chemicals Sector Report 2017 with estimates based on calculations from National accounts, Regional gross Value Added and Regional Annual Business Survey ONS

⁴⁷ Chemical Industry Association 2015 bulletin

⁴⁸ Association of the British Pharmaceutical Industry (ABPI), 2016, Delivering value to the UK: The contribution of the pharmaceutical industry to patients, the NHS and the economy

5. Water treatment

The UK water sector, privatised in 1989, manages more than 16 billion litres of wastewater a day. There are a smaller number of water companies, now than at the time of privatisation, due to mergers. The companies in England and Wales are privately financed; in Scotland and Northern Ireland, water and wastewater remain Government owned. Drainage functions are shared between the sewerage companies and others (Environment Agency, Drainage Boards, Local Authorities, Highways Agency).

The sector is facing several challenges. All the main impacts of climate change – temperature change, more intense rainfall, and sea level rises – directly affect water company activities.

The sector is heavily regulated on issues such as water quality, prices, and the environment. Regulatory bodies include: the Consumer Council for Water, the Drinking Water Inspectorate, the Environment Agency, and the Water Services Regulation Authority (Ofwat).

The UK population is set to increase by over 7% by 2025 (ONS) with high predicted increases in areas of water scarcity e.g. the population of London is predicted to increase by 19% by 2025, and the south and south-east of England are areas particularly susceptible to water shortage. The sector will also be under increased pressure to cut its carbon footprint to reduce energy and resource impacts.

The water sector's infrastructure is ageing; for example, a third of London's water pipes are more than 150 years old. Changes to the water services infrastructure have a long lead time but the sector collectively plans to invest £5bn per year over the next 5 years⁴⁹. Ofwat's Water 2020⁵⁰ regulatory framework promotes new markets in bioresources (a product of the treatment of sewage) and pushes companies towards opening up high value infrastructure schemes to competition from third parties.

⁴⁹ Water UK

⁵⁰ Ofwat 2016 regulatory approach for water and wastewater services in England and Wales

⁵¹ Food and drink federation 2018

⁵² Grant Thornton 2017 FDF economic contribution

⁵³ OECD R&D statistics

6. Food and drink

The UK food and drink manufacturing sector has a turnover of £97.3bn and accounts for 19% of total UK manufacturing; greater than automotive and aerospace combined. In 2017, total food and drink exports were worth more than £22bn⁵¹, and there were just over 6,800 active food and drink manufacturing companies in the UK⁵².

The sector has 146 fast growing businesses against 54 in the automotive sector. These are businesses that meet the scale up definition of: over 3 years old; more than 10 employees at start up; and growth rate of 20% year on year from either turnover or employees.

Like the pharmaceutical sector, food and drink depends on advanced production facilities chemically-limited within narrow tolerances. The engineering construction industry provides the expertise to design, build, and equip such high-tech units.

The UK food and drink sector also has a strong R&D base driven by multinational organisations. R&D expenditure grew by 27% between 2010 and 2014⁵². More than nine in ten food and drink businesses are SMEs. Limited resources and uncertainty with short-term retail contracts makes financing of automation technology difficult for food and drink SMEs but a 2017 survey⁵³ found that over 70% of surveyed companies were involved in automated manufacturing.

In its response to the 2017 Government Industrial Strategy White Paper the Food and Drink Federation proposed to:

"...seek out the opportunity of £55.8 billion potential value over the next 10 years for the food and drink sector through enhanced engineering and digitalisation".

Appendix 3:

Education and training landscape

Education and skills policy have been devolved policy areas across the four nations of the UK since 2010. Consequently, the policy landscape is discussed in three separate sections, below.

1. England

Since 2010, significant changes have been made to education in England including:

- rise of academies;
- creation of free schools and University Technical Colleges (UTCs);
- expansion of grammar schools;
- a new National Curriculum;
- reforms to SATs tests, league tables, GCSEs and A Levels; and
- the removal of thousands of vocational courses and qualifications from school league tables.

As a result of the *Browne Review*⁵⁴, higher education (HE) has experienced major changes to funding and student support, including a push to widen participation in HE among students from more diverse background. Further Education (FE) has seen a heavy reduction in funding and a consequent decrease in the number of colleges due to mergers or closures. Consequently, FE interviewees often perceive their sectors as the “poor relation” to HE.

GCSEs and A levels

The government recently reformed GCSE and A levels, including decoupling the AS – Advanced Subsidiary – from A levels.

English and Maths

Recognising that other qualifications offer other unique selling points (e.g. Functional Skills) a review of other English and maths qualifications was undertaken in 2014 – including by employers – to ensure they were meaningful. Work on Functional Skills is ongoing.

Apprenticeships

Since Professor Alison Wolf's review in 2011, attention was turned to improving and delivering high quality vocational education with training relevant to employers' needs. Subsequently, the development of new apprenticeship

standards was put in the hands of employers⁵⁵.

Fast forward to 2017 and apprenticeships become an increasing focus as a result of the government's target to achieve three million new starts by 2020.

Under a new system, apprentices are assessed via an externally quality assured End Point Assessment (EPA) process. Apprenticeships are now the domain of a new body - the Institute for Apprenticeships and Technical Education (IfATE) – which also has a role as a quality assurance organisation.

Total apprentice starts in England in the category of 'Engineering and Environmental Technologies', have moved from 74,100 in 2014/15, to 78,500 in 2015/16 before dipping slightly to 74,900 in 2016/17. The proportion of Engineering Construction is a small proportion of the above category but are illustrative of the general trend.

Apprenticeship Levy

The UK-wide apprenticeship levy came into force in May 2017 and requires all UK public and private sector employers with an annual wage-bill of £3 million or more to invest in apprenticeship training through a compulsory levy. The aim of the Levy is give employers greater control over funding for apprenticeship training.

The Government now allows Apprenticeship Levy paying firms to pass their levy down the supply chain, regarded as a welcome move. From April 2019, employers can transfer a maximum of 25% of their annual levy funds. The levy is expected to raise £2.5 billion a year by 2020, which can only currently be spent on apprenticeship training⁵⁷.

In 2017, total apprenticeship starts were 43,600, down from 113,000 in the previous year - a drop of 61%⁵⁸. Anecdotal feedback suggests this was due to the new levy system settling in and that numbers will pick up going forward.

During the in-depth interviews several levy-paying respondents made reference to the Apprenticeship Levy, commenting that they find it hard to use for a variety of reasons: oil and gas industry employers find it difficult due to the specifics of their sector; and, businesses in Scotland say they struggle to access the funds. Many call for greater flexibility, particularly in respect of the 20% off the job training element which acts as a barrier since some employers say they cannot spare the time to release staff.

⁵⁴ *Securing a sustainable future for higher education - an independent review of higher education funding & student finance; (Browne review), 2010*

⁵⁵ *BIS, The Future of Apprenticeships in England: Implementation Plan, October 2013, p.23*

⁵⁶ *Department for Education (2018) Apprenticeship starts by SSA, gender, geography and age*

⁵⁷ <https://www.gov.uk/guidance/transferring-apprenticeship-service-funds>

⁵⁸ <https://www.gov.uk/government/statistics/announcements/further-education-and-skills-october-2017>

⁵⁹ *UK Digital Strategy, March 2017: https://www.gov.uk/government/publications/uk-digital-strategy/uk-digital-strategy*

Digital Apprenticeships

The 2017 UK Digital Strategy⁵⁹ emphasises the ambition for the UK to be a world-leading digital economy that works for everyone. Digital apprenticeships extend beyond information technology, encompassing software development, data analytics and cyber security skills.

T levels

The Independent Panel on Technical Education, led by Lord Sainsbury, was commissioned by the government in 2015 to review technical education (England and overseas), and advise Ministers on how the system in England could be improved. The Panel identified over 13,000 competing 16-18 qualifications offering limited preparedness for employment. A need was identified to nurture a more highly-skilled workforce possessing high-quality technical qualifications recognised and valued by employers. The Panel concluded that the best international systems begin with a broad curriculum, before specialising as individuals progress to higher levels. It proposed a new system based on this approach, comprising industry-focused routes.

New 'technical' qualifications (T levels) are intended to be on a par with A levels and to provide young people with a choice between technical and academic education. A total of fifteen T level routes have been proposed – each linked to a major industry sector and consisting of several specialist pathways. They will be two-year, college-based programmes suitable from the age of 16 with close alignment to the new apprenticeship standards.

Every 16 to 18-year-old on a college-based technical education programme will be entitled to a 'work placement' of circa 50 days. This is somewhat controversial because ways of providing work-experience placements for such lengths of time have yet to be designed and agreed and many employers point to barriers around supervision and insurance in what might otherwise be seen as a laudable attempt to integrate young people into the world of work prior to leaving school/college.

The first T level pathways likely to be relevant to the ECI are to be delivered in 2020 and 2021. These are within the Construction pathways of Design, Surveying and Planning, Onsite Construction, and Building Services Engineering. A consultation by the Department for Education on the draft content for all of these pathways is now complete. The Institute of Apprentices and Technical Education consulted on the occupational maps to ensure they captured the relevant occupations in each route and that these were coherently grouped. An engineering and manufacturing T level route is due to be available from 2021/2022.

From the in-depth interviews, a number of respondents acknowledged the broad nature of the current courses provided by engineering construction training providers

and stated that 'specific skills can only be learned by experience'. The structure of the new T levels seeks to address this with 20%-50% of the total time spent on broad core knowledge and skills and 50%-80% developing knowledge, skills and behaviours specific to the chosen occupational specialism. A minimum of 45 working days will also be spent in industry on placement with an employer.

STEM Education and key subjects

In the context of STEM (Science, Technology, Engineering and Maths) education, A level results in 2018 showed small increases in entries in maths and science subjects (all up 3%) continuing a general trend in recent years. In computing, there was a very large percentage increase in computing entries, albeit still from a relatively low base. Gatsby, the charitable foundation, which, among other organisations, champions STEM education in England, points out the imperative behind the technical education reform:

"Currently, over 1.5 million technicians are employed in the UK. The majority of these technicians are employed in engineering roles but there are also significant numbers working in science, health and technology. However, an aging workforce means that 50,000 of our best technicians are retiring every year, and forecasts show we will need as many as 700,000 more technicians in the next decade to meet demand from employers."

In short, there have been a relatively stable number of HE undergraduates achieving degrees in engineering over the past five years (approx. 14,000 awards per annum).

2. Scotland

Since 2007 across Scotland there has been a consistent approach to evaluating public sector outcomes; education in Scotland is guided by the 2008 Curriculum for Excellence⁶⁰.

By 2016, a policy paper titled 'Delivering Excellence and Equity in Scottish Education – A Delivery Plan for Scotland' was published, outlining the steps the Scottish Government intended to take to achieve key improvements in education. This built on the 2016 National Improvement Framework and addressed the recommendations of the OECD review 'Improving Schools in Scotland'.

There is currently a strong focus on closing the attainment gap in Scotland with associated investment of £100 million over four years targeting the most deprived primary schools. This focus on younger school learners is set to increase the proportion of students from deprived areas who ultimately access FE, apprenticeships and/or attend HE⁶¹.

⁶⁰ Curriculum for Excellence: Building the Curriculum 3: A Framework for Learning and Teaching, 2008

⁶¹ Delivering Excellence and Equity in Scottish Education – A Delivery Plan for Scotland, 2016

⁶² Developing the Young Workforce: annual report 2016-2017

The Developing the Young Workforce (DYW) seven-year programme to reduce unemployment has yielded some positive results. The overall percentage of school leavers attaining vocational qualifications at SCQF 5 or above rose to 9% in 2014/15 (from 7.3% in 2013/14), and the forecast for college enrolments over the next three years is 110 percent in 2017/18 from the 2016/17 figure⁶². Vocational education is becoming more common in Scotland as the curriculum in college courses expands⁶³.

Skills Development Scotland (SDS) leads on work-based learning and apprenticeships through its Scottish Apprenticeship Advisory Board. It has focused on apprenticeship demand assessments which includes 57 Apprenticeship Frameworks, including 12 Scottish Modern Apprenticeships.

SDS, in partnership with local authorities and industry, developed a new qualification: the Foundation Apprenticeship, presenting a further vocational learning option. Almost 2,000 young people enrolled in this in 2016/17, an increase from 480 in 2015/16. This is in line with the overall expansion in Scottish Apprenticeships, with SDS reporting that apprenticeships (including Foundation, Modern and Graduate) will likely reach the Scottish Government's target of 30,000 by 2020⁶⁴.

Generally, improved access in HE has been a focus for Scotland for a few years. The government has set a target that by 2030, 20% of students entering university in Scotland will be from 20% of the most deprived backgrounds⁶⁵. The Higher Education Governance (Scotland) Act 2016 put in place measures to modernise and streamline the governance of HE institutions, encouraging greater openness and transparency.

3. Wales

Education in Wales largely resembles the structure in England with schooling compulsory from the ages of five to 16 and most schools following the National Curriculum. There are currently 14 FE colleges and institutions following a number of mergers in response to the Welsh Government's Transformation Agenda⁶⁶. There are also eight universities and around 172,000 learners studying at FE institutions each year⁶⁷. Wales' gross school expenditure in 2018/19 was £2.6bn.

Unique to Wales is the Welsh Baccalaureate which helps prepare students between the ages of 14 and 19 for employability and further study. At the heart of the Welsh Bacc is the Skills Challenge Certificate - an innovative skills-

based qualification which incorporates GCSEs in English or Welsh and maths, plus a choice of supporting qualifications, which can be GCSEs, A levels or vocational qualifications.

Following an independent review⁶⁹ of the national curriculum and assessment arrangements in Wales a new curriculum is being developed to cover state school provision. Of some relevance to the ECI is the introduction of a new GCSE and A level in the Built Environment, which is hoped to widen the appeal of careers in the built environment to young people. It is currently planned to be available from January 2020 but taught from September 2022.

A technical consultation on proposed reforms to the post-compulsory education and training (PCET) sector was undertaken in 2018, seeking views on a significant shake-up to planning and funding across all aspects of post-16 education in Wales. Legislation is currently being drafted in light of the evidence gathered.

Concurrently, Qualifications Wales (QW) is also reforming vocational qualifications⁷⁰. QW have completed a Construction and the Built Environment Sector Review⁷¹ which has led to the development of new qualifications, and plan to conduct a Sector Review in engineering, advanced manufacturing and energy. Prime importance is being placed on engaging extensively with key sector bodies, work-based learning providers, FE colleges and employers. QW are commissioning an awarding body or consortium to develop and award a new suite of Foundation, Progression and Apprenticeship qualifications to provide clear pathways between further education, apprenticeships and employment. The qualifications are intended to be future-proofed to be responsive to the changing needs of the sectors in question.

STEM education was prioritised by the Welsh Government and in 2016 they set out their strategic objectives for its provision for 3- to 19-year-olds in Wales⁷¹. Priorities included: increasing interest and participation, particularly among girls; evolving the learning and teaching of STEM undertaken in schools, colleges and universities to meet their own, and employer needs; and equipping young people with career management skills and knowledge of the options available to them in STEM.

⁶³ Vocational education gaining popularity in Scottish Schools, report finds, <https://www.tes.com/news/vocational-education-gaining-popularity-scottish-schools-finds-report>

⁶⁴ <https://www.skillsdevelopmentscotland.co.uk/what-we-do/apprenticeships/>

⁶⁵ <https://www.gov.scot/policies/universities/>

⁶⁶ <https://gov.wales/docs/dcells/publications/100301transformationpolicyen.pdf>

⁶⁷ <https://wales.com/education-system>

⁶⁸ <https://gov.wales/statistics-and-research/local-authority-budgeted-expenditure-schools/?lang=en>

⁶⁹ Successful Futures (Donaldson, 2015) Available from: <https://gov.wales/docs/dcells/publications/150225-successful-futures-en.pdf>

⁷⁰ <https://www.qualificationswales.org/english/qualifications/qualification-reform/vocational-qualification-reform/vocational-qualification-reform-oct-2018/>

⁷¹ <https://www.qualificationswales.org/media/3176/building-the-future.pdf>

Appendix 4: The impact of Brexit

Employers were asked about the impact of Brexit on their company. They gave the following responses:

Figure 33 Expected impact of Brexit



Base: 816. Pye Tait Survey, 2018.

Geographical analysis reveals that employers in London are more prone to the view that Brexit will make it harder to recruit workers (40%). Two thirds of employers in Wales (66%) are of the view that Brexit will have no impact. We were also able to break down the expected detailed impacts of Brexit by size of company.

This analysis illustrates some of the main concerns and highlights the areas of greatest concern – particularly for larger companies. Over a third of large companies believe that Brexit will make it harder to recruit workers and almost a third that it will increase their problems in retaining skills. Only a quarter of this group of companies believe that Brexit will have no impact at all (compared to around four in ten companies in the micro to medium categories).

Table 3 Detailed impacts of Brexit (by size)

	Micro (1-9)	Small (10-49)	Medium (50-249)	Large (250+)
Make it easier to recruit workers	2.60%	5.40%	1.40%	8.80%
Make it harder to recruit workers	20.50%	22.10%	26.30%	36.80%
Make it easier to retain skills	-	5.10%	4.00%	12.30%
Make it harder to retain skills	12.80%	17.50%	20.50%	30.70%
Encourage us to train up more young people	2.60%	6.70%	10.40%	21.10%
No impact	46.20%	44.70%	42.80%	24.60%
We have developed a plan for different eventualities from Brexit	-	1.30%	4.00%	11.40%
Don't know	30.80%	25.60%	25.50%	23.70%

Base: 816. (multiple responses) Pye Tait Survey, 2018.

Appendix 5: Employer Survey

Questionnaire

Commissioned by ECITB, this important research will provide long-awaited and up-to-date evidence on the size and characteristics of the ECI workforce, skills shortages and gaps, as well as the market opportunities and business challenges that contractors face. The findings will inform ECITB's strategy and where the industry training levy is reinvested for the benefit of the sector. ECITB expects to publish the findings in early 2019.

Who should complete this survey?

This survey is open to employers (contractors/sub-contractors), based in Great Britain, in which at least some of the total workforce undertakes principal or related engineering construction activities. These activities span all aspects of design, engineering, procurement, project management, construction, maintenance, repair, replacement, testing or decommissioning of any chemical, electrical or mechanical apparatus, machinery or plant, to be used on or installed on a process site. It includes all such activities in relation to the oil and gas, renewables, nuclear, petrochemicals, pharmaceuticals food and drink and water sectors.

Further detail about these activities can be found on ECITB's website by clicking [HERE](#). Your organisation does not need to be an ECITB levy-paying company to take part.

Where your organisation has a separate business, subsidiary or establishment dealing with engineering construction work that is part of a wider parent company, please answer at the business, subsidiary or establishment level and not the parent company level. From this point forward, we have used the term 'business' for ease.

If you are a client organisation (asset owner/operator), please contact Miranda Pye at the email address below to register your interest in taking part. A separate client questionnaire is being developed and will be available in due course.

Data protection

Your responses will be treated confidentially by Pye Tait Consulting and cannot be used by the ECITB for levy gathering purposes. Responses will be reported anonymously to ECITB in line with General Data Protection Legislation (GDPR) and the Market Research Society (MRS) Code of Conduct. Any Personal Data you choose to provide (where asked) will be on a voluntary basis, treated in the strictest confidence by Pye Tait Consulting, and only used for the purpose(s) stated in the questionnaire.

PART 1: About your business and workforce numbers

Please only complete this survey if at least some of your organisation's total workforce undertakes at least some of the principal and related engineering construction activities listed [HERE](#).

For questions that ask for numbers or percentages, please round up to the nearest whole number and do not insert commas or symbols.

1. Firstly, where is your business based or headquartered?

<input type="checkbox"/>	East Anglia
<input type="checkbox"/>	East Midlands
<input type="checkbox"/>	London
<input type="checkbox"/>	North East England
<input type="checkbox"/>	North West England
<input type="checkbox"/>	South East England (excluding London)
<input type="checkbox"/>	South West England
<input type="checkbox"/>	West Midlands
<input type="checkbox"/>	Yorkshire and the Humber
<input type="checkbox"/>	Scotland
<input type="checkbox"/>	Wales
<input type="checkbox"/>	Other

If Other – please specify:

2. How many full time equivalent (FTE) staff does your business employ in total?

Please include directly employed staff and labour only subcontractors

GB-based staff	<input type="text"/>
Non-GB-based staff	<input type="text"/>
Auto-total:	<input type="text"/>

3. How many of your GB-based staff currently undertake engineering construction work?

Please provide breakdowns for those working mainly onsite (i.e. on an engineering construction site), and those working mainly offsite (e.g. in a head office environment), as well as directly employed and labour only contractors.

	Onsite	Offsite
Directly employed engineering construction staff		
Non-directly employed, such as agency and subcontractor staff		

4. Approximately what percentage of your GB-based engineering construction workforce (as defined from the previous question) currently works in new build, decommissioning and/or repair and maintenance projects?

Please take into account directly employed, subcontracted and other agency-sourced staff.

New build projects	%
Decommissioning projects	%
Repair and maintenance projects	%
Other	%

If Other – please specify which:

5. How many of your engineering construction staff work on projects in each of the following ECI sectors in Great Britain?

Please provide current numbers per sector. For individuals working on projects in more than one sector, please count them more than once. Please take into account directly employed, subcontracted and other agency-sourced staff.

Nuclear	
Upstream oil and gas	
Downstream oil and gas	
Conventional power generation, including coal and gas fired plants	
Chemical	
Pharmaceutical	
Food and drink	
Renewables	
Water & waste treatment	
Other sectors	

If Other – please specify which sectors:

6. Which of the following types of work do you undertake? (Tick all that apply)

<input type="checkbox"/>	Engineering, Construction and Project Management (ECPM)
<input type="checkbox"/>	Mechanical Engineering (including Welding/Pipe fitting)
<input type="checkbox"/>	Design and draughting
<input type="checkbox"/>	Electrical Engineering
<input type="checkbox"/>	Steel Erecting
<input type="checkbox"/>	Fabric Maintenance
<input type="checkbox"/>	Chemical and Process Engineering
<input type="checkbox"/>	Scaffolding

7. How confident are you about the economic outlook for your industry in Great Britain over the next three to five years?

<input type="checkbox"/>	Very confident
<input type="checkbox"/>	Quite confident
<input type="checkbox"/>	Not very confident
<input type="checkbox"/>	Not at all confident
<input type="checkbox"/>	Don't know

8. What impact do you think Brexit might have on skills availability for your organisation? (Tick all that apply)

<input type="checkbox"/>	Make it easier to recruit workers
<input type="checkbox"/>	Make it harder to recruit workers
<input type="checkbox"/>	Make it easier to retain skills
<input type="checkbox"/>	Make it harder to retain skills
<input type="checkbox"/>	Encourage us to train up more young people
<input type="checkbox"/>	No impact
<input type="checkbox"/>	We have developed a plan for different eventualities from Brexit
<input type="checkbox"/>	Don't know

9. Do you expect your engineering construction workforce numbers to increase, remain the same or reduce over the next three years?

<input type="checkbox"/>	Increase
<input type="checkbox"/>	Remain the same
<input type="checkbox"/>	Reduce
<input type="checkbox"/>	Don't know

PART 2: Workforce characteristics

The following questions relate only to your engineering construction workforce based in Great Britain. Please include directly employed, subcontracted and agency workers.

10. What proportion of your GB-based engineering construction workforce is:

Male	%
Female	%
Auto-total (must add up to 100%)	%

11. What proportion is aged:

16-17	%
18-24	%
25-34	%
35-49	%
50-64	%
65-74	%
75+	%
Auto-total (must add up to 100%)	%

12. What proportion of your directly employed workforce is:

Full-time	%
Part-time	%
Auto-total (must add up to 100%)	%

13. What proportions are UK citizens, EU citizens and Non-EU citizens?

UK Citizens	%
EU Citizens (non-UK)	%
Non-EU Citizens	%
Auto-total (must add up to 100%)	%

14. What percentage of your workforce are employed:

On a permanent contract	%
On a fixed term contract	%
Zero hour or flexible contract	%
Auto-total (must add up to 100%)	%

15. If fixed term contract or temporary contract > 0%:
What is the average length of fixed term contracts you operate (in weeks)?

PART 3: Graduates and apprentices

16. Approximately how many **graduates** (employed in their first full time job) has your organisation taken on in Great Britain over the past three years? Please provide approximate breakdowns for males and females

Male	
Female	
Auto-total	

17. Approximately how many apprentices has your organisation taken on over the past three years? Please provide approximate breakdowns for males and females

Male	
Female	
Auto-total	

18. Which of the following barriers have you encountered, if any, relating to the recruitment of graduates and apprentices into engineering construction roles in Great Britain? (Tick all that apply)

	Graduates	Apprentices
Cost to the business		
Insufficient work to justify taking on these entrants		
Insufficient availability of candidates		
Entrants lack awareness of the ECI		
The ECI is not perceived by these entrants as an attractive industry		
Entrants lack sufficient knowledge or practical skills		
Entrants lack the right attitude or behaviours		
Lack of suitable training provision for apprentices		

19. What is the average annual starting salary of engineering construction graduates and apprentices within your organisation? (If unsure, question 20 asks for a banding)

Graduates (annual gross salary)	£
Apprentices (annual gross salary)	£

20. Please select the average annual starting salary band for engineering construction graduates and apprentices in your organisation:

	Graduates	Apprentices
Less than £15,000		
£15,000 to 17,999		
£18,000 to 20,999		
£21,000 to £24,999		
£25,000 to 29,999		
£30,000 +		

PART 4: Workforce and skills mobility

21. Which of the following industry sectors has your organisation recruited from in the past 12 months? (Tick all that apply)

<input type="checkbox"/>	CORE ECI - Nuclear
<input type="checkbox"/>	CORE ECI - Oil and gas
<input type="checkbox"/>	CORE ECI - Conventional power generation
<input type="checkbox"/>	CORE ECI - Chemical
<input type="checkbox"/>	CORE ECI - Pharmaceutical
<input type="checkbox"/>	CORE ECI - Food and drink
<input type="checkbox"/>	CORE ECI - Renewables
<input type="checkbox"/>	CORE ECI - Water treatment
<input type="checkbox"/>	Other construction/engineering - besides core ECI
<input type="checkbox"/>	Education
<input type="checkbox"/>	Financial and insurance activities
<input type="checkbox"/>	Information and communication
<input type="checkbox"/>	Manufacturing
<input type="checkbox"/>	Mining and quarrying
<input type="checkbox"/>	Public administration and defence
<input type="checkbox"/>	Transport and storage
<input type="checkbox"/>	Other

If Other – please specify:

22. How important to your business is the ability to recruit skilled workers from other sectors?

<input type="checkbox"/>	Very important
<input type="checkbox"/>	Quite important
<input type="checkbox"/>	Not very important
<input type="checkbox"/>	Not at all important
<input type="checkbox"/>	Don't know

PART 5: Skill levels and gaps

Please answer the following questions openly and honestly. Remember your answers will be treated anonymously and will help to identify where there are weaknesses in engineering construction skills that need to be addressed.

	23. On a scale from 1 to 10, how would you rate the current skill level of your engineering construction workforce relating to each of the following?	24. On a scale from 1 to 10, how would you rate the future importance of that skill over the next three years?
	1 = skills completely lacking 10 = perfectly skilled	For example: 1 = not at all important 10 = extremely important
Role categories		
Engineering and science professional roles		
Designers and Draughtspersons		
Engineering-related technician roles		
Other business professional roles		
Craft supervision roles		
Skilled metal trades		
Electrical trades		
Electronic trades		
Construction operative roles		
Plant/process operative roles		
Transferrable skills		
Problem solving		
Team working and communication		
Management and leadership		
Risk and safety management		
Project and time management		

25. Where you have provided any ratings of less than 10 out of 10 for current skill level, what would you say are the reasons for the skills gaps you have experienced?

(Skills gaps refer to deficiencies in the skills of your existing workforce? (Tick all that apply).

<input type="checkbox"/>	Aging and retiring workforce
<input type="checkbox"/>	Inability to retain staff
<input type="checkbox"/>	Use of new digital technologies not utilised before
<input type="checkbox"/>	Use of new materials
<input type="checkbox"/>	New methods of working
<input type="checkbox"/>	Staff need refreshing in current methods
<input type="checkbox"/>	Client requirements, e.g. safety, competence and card schemes
<input type="checkbox"/>	Use of new equipment from manufacturers
<input type="checkbox"/>	Staff are reluctant to undertake additional training
<input type="checkbox"/>	Training is too expensive
<input type="checkbox"/>	Training is too time-consuming
<input type="checkbox"/>	We're unable to access suitable external training to meet our needs
<input type="checkbox"/>	Other

If Other – please specify:

26. Over the next three years, how do you expect the prevalence of skills gaps within your organisation to change?

<input type="checkbox"/>	Increase considerably
<input type="checkbox"/>	Increase to some extent
<input type="checkbox"/>	Stay about the same
<input type="checkbox"/>	Decrease to some extent
<input type="checkbox"/>	Decrease considerably

PART 6: Technological Change

27. Which of the following types of technologies and processes does your organisation currently use?

<input type="checkbox"/>	Digital technologies – such as big data, data visualisation, Augmented Reality and Virtual Reality
<input type="checkbox"/>	Automation – such as robotics and Artificial Intelligence
<input type="checkbox"/>	Modularisation processes – such as offsite manufacture and miniaturisation
<input type="checkbox"/>	Working with advanced materials – such as alloys, polymers, advanced composites, graphene, transparent aluminium and nano-technologies
<input type="checkbox"/>	Building Information Modelling (BIM)
<input type="checkbox"/>	3D and 4D printing
<input type="checkbox"/>	Low carbon technology – such as carbon capture and storage and geothermal technology
<input type="checkbox"/>	Other including industry specific technologies

If Other – please specify:

28. Thinking of these technologies and processes, please rate each of them from 1 (no impact) to 10 (significant impact) to reflect the expected impact on your business over the next **three years and the next ten years**

	Next 3 years	Next 10 years
Digital technologies – such as big data, data visualisation, Augmented Reality and Virtual Reality		
Automation – such as robotics and Artificial Intelligence		
Modularisation processes – such as offsite manufacture and miniaturisation		
Working with advanced materials – such as alloys, polymers, advanced composites, graphene, transparent aluminium and nano-technologies		
Building Information Modelling (BIM)		
3D and 4D printing		
Low carbon technology – such as carbon capture and storage and geothermal technology		
Other including industry specific technologies		

If Other – please specify:

29. Thinking of the item you scored highest over the next three years, please indicate which of the following impacts, if any, you expect to see? (Tick all that apply)

<input type="checkbox"/>	Improved business efficiency
<input type="checkbox"/>	Increased profit margin
<input type="checkbox"/>	Improved precision
<input type="checkbox"/>	Improved overall quality of products and services
<input type="checkbox"/>	New business opportunities
<input type="checkbox"/>	Reduced business opportunities
<input type="checkbox"/>	Increased headcount
<input type="checkbox"/>	Reduced headcount
<input type="checkbox"/>	Enhanced business reputation

30. For each of the following job roles, please state whether you expect demand for these roles to increase, remain the same or reduce, as a direct result of new technologies and processes over the next three years:

	Increase	Remain the same	Reduce
Directors and managers of business functions			
Project personnel, including expeditors, estimators, cost engineers and planners			
Engineering and science professionals			
Design and Draughtspersons			
Engineering-related technicians			
Business professionals			
Skilled mechanical, electrical, instrumentation and electronic trades			
Construction operatives			
Plant/process occupations			

31. What challenges, if any, does your organisation face in adopting these types of new technologies and processes? (Tick all that apply)

<input type="checkbox"/>	Lack of finance/resources
<input type="checkbox"/>	Lack of time to make big changes
<input type="checkbox"/>	Lack of information/awareness
<input type="checkbox"/>	Workforce lacks the skills to adopt them
<input type="checkbox"/>	Dependent on other organisations in the supply chain adopting them
<input type="checkbox"/>	Lack of readily available training courses
<input type="checkbox"/>	Training courses are not at the cutting edge of industry needs
<input type="checkbox"/>	Don't see as immediately relevant to our business
<input type="checkbox"/>	Prefer to research new technologies and processes according to client demands
<input type="checkbox"/>	No challenges (no other boxes can be ticked)
<input type="checkbox"/>	Other

If Other – please specify:

PART 7: Recruitment difficulties and skills shortages

32. Over the past 12 months, please tell us your organisation's approximate number of:

Engineering construction job vacancies	
Engineering construction job vacancies that proved hard to fill because there were not enough applicants	
Engineering construction job vacancies that proved hard to fill because applicants lacked appropriate skills	

33. If 32b or Q32c >0: Which of the following occupational areas do you generally find hard to recruit due to a shortage of available skills in the labour market?

	Directors and managers of business functions
	Project personnel, including expeditors, estimators, cost engineers and planners
	Engineering and science professionals
	Design and Draughtspersons
	Engineering-related technicians
	Business professionals
	Skilled mechanical, electrical, instrumentation and electronic trades
	Construction operatives
	Plant/process occupations

34. If 32b or Q32c >0: Which of the following reasons would you say are behind the recruitment difficulties that you have experienced? (Tick all that apply)

	Not enough applicants
	Applicants do not have the right knowledge, skills or experience
	Applicants do not have the right qualifications
	Engineering or related apprenticeships do not meet business needs
	The school curriculum does not encourage students into engineering construction careers
	Potential applicants accept jobs in other companies working in engineering construction'
	Potential applicants accept jobs in a different industry sector from ours
	Potential applicants leave Great Britain to go to other countries
	Not able to meet salary demands of applicants
	Other

If Other – please specify:

35. Thinking ahead, which of the following do you believe will make it harder to recruit and retain staff? (Tick all that apply)

	Any restrictions on freedom of movement resulting from Brexit
	Competing infrastructure projects
	Competitors paying higher salaries
	Lack of confidence in the market
	Not enough graduates/apprenticeship completers with the right qualifications
	Staff not being prepared to travel/move for work
	Other

If Other – please specify:

36. What actions do you think are needed, if any, to tackle recruitment problems and skills shortages in engineering construction?

	More action by professional bodies
	Government action need to ease immigration rules for key staff
	More courses offered by universities and colleges
	Greater promotion of engineering construction careers
	More training provision for apprenticeships
	Improve technical education
	Other

If Other – please specify:

PART 8: Additional comments

37. Do you have any other comments in relation to the engineering construction workforce?

38. Thank you very much for taking the time to complete this survey. Please let us know if you are willing to be re-contacted by us for one or both of the purposes set out below:

	Yes	No
To clarify any of the information you have provided in this survey		
To invite you to take part in a follow-up telephone interview to explore your views on this subject in more detail?		

39. If Yes to Q38a or b: Thank you. Please provide your contact details below.

Any Personal Data you provide will be separated from your other responses and retained for a maximum of six months from the date of project completion. You can request that your Personal Data is removed from our system at any time.

Name:	
Organisation:	
Telephone number:	
Email address:	

PART 9: Optional section: Ethnic Groups and Background

The following two questions have been included so that ECITB can better understand diversity in the engineering construction workforce.

If you do not wish to answer these questions, please leave blank and click SUBMIT at the bottom of the page to submit your response.

40. Over the past three years would you say the proportion of ethnic minorities working in engineering construction roles in your organisation has:

	Increased more than 20%
	Increased 1-19%
	Not changed
	Decreased 1-19%
	Decreased more than 20%
	Don't know
	Prefer not to say

41. Approximately what percentage of your engineering construction workforce identifies with each of the following ethnic groups and backgrounds?

Enter a whole value without the percentage (%) symbol. If your organisation operates internationally, please ONLY respond about your GB workforce.

English/Welsh/Scottish/Northern Irish/British	%
Irish	%
Gypsy or Irish Traveller	%
Any other White background	%
White and Black Caribbean	%
White and Black African	%
White and Asian	%
Any other Mixed / Multiple ethnic background	%
Indian	%
Pakistani	%
Bangladeshi	%
Chinese	%
Any other Asian background	%
African	%
Caribbean	%
Any other Black / African / Caribbean background	%
Arab	%
Any other ethnic group	%

PART 10: Internal Use Only

42. Standard Industrial Classification Code:

091: Support activities for petroleum and natural gas extraction
10: Manufacture of food products
11: Manufacture of beverages
17: Manufacture of paper and paper products
19: Manufacture of coke and refined petroleum products
20: Manufacture of chemicals and chemical products
21: Manufacture of basic pharmaceutical products and pharmaceutical preparations
22: Manufacture of rubber and plastic products
23: Manufacture of other non-metallic mineral products
24: Manufacture of basic metals
36: Water collection, treatment and supply
3320: Installation of industrial machinery and equipment
3511: Production of electricity
3521: Manufacture of gas
3530: Steam and air conditioning supply
3821: Treatment and disposal of non-hazardous waste
3822: Treatment and disposal of hazardous waste
3832: Recovery of sorted materials
4221: Construction of utility projects for fluids
4222: Construction of utility projects for electricity and telecommunications
Other
None listed



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