EngineeringUK

Trends in the engineering workforce

Between 2010 and 2021

Contents

1. Executive summary

In this report we explore the overall trends in employment from 2010 to 2021, for both engineering industries and occupations. In the first section, we explore the trends over time including by region and occupation group. In the second, we look more closely at the characteristics of employees in engineering occupations, by gender, ethnicity, age, country of birth and socio-economic group.

Our analysis shows clear changes in the industrial composition of engineering, with a shift away from manufacturing and construction to more service-based industries such as information and communications and professional services. Over the last decade, the composition of the engineering workforce has also become increasingly diverse, though some groups such as women remain significantly underrepresented compared to the wider labour force.

Overall employment trends in engineering industries and occupations]

Engineering industries

- The overall number of employees in the engineering industry was around 6.6 million in 2010, increasing to 7.6 million by 2019 and then seeing a downturn to 6.9 million by 2021.
- More than 40% of people working in engineering worked in manufacturing industries and a further 24% worked in construction at the start of this period, equalling around 4.4 million employees. The percentage working in both declined over the decade, as did the number of employees to around 4 million, while the share of employment in information and communication industries and professional services grew over the decade, together accounting for 27% of employment in 2021 with 1.8 million workers, up from around 1.3 million in 2010.
- The share of engineering in total employment was highest in the East and West Midlands and the north-east in 2010, but employment shares in the peripheral regions to these fell over the decade. In the meantime, the share of engineering in employment in London and the East of England increased. This apparent geographical shift in the industry reflects its changing industrial composition.

Engineering occupations

- Employment in engineering occupations (including engineering jobs in non-engineering industries) grew by 8.5% between 2010 and 2021. The number of people working in engineering occupations increased from 5.4 million in 2010 to 5.7 million in 2021, with a peak of 6.3 million in 2019.
- Between 2018 and 2019, engineering occupations grew by 6.1% before falling back by 10.2% in 2019 and 2021, during the Covid-19 pandemic. In comparison, other occupations grew by 3.7% in the year leading up to Covid-19 before falling by 8.1% between 2019 and 2021.

The changing socio-demographic characteristics of those working in engineering occupations

- Over the last decade, the proportion of engineering workers who are female has increased, rising from 10.5% in 2010 to 16.5% in 2021. Although results vary by

individual occupation and sector, in general we found that women were more likely to be in related – rather than core – engineering roles and working in industries outside of what is traditionally deemed to be 'engineering'.

- Likewise, the ethnic diversity of the engineering workforce has also risen over the last decade, increasing from 7.6% in 2012 to 11.4% in 2021. The rate of change is similar to that observed among those in non-engineering occupations up to 2019, but was faster than the overall workforce between 2019 and 2021.
- The percentage of workers born outside the UK increased in both engineering and non-engineering occupations between 2012 and 2021, with engineering jobs more likely to be filled by workers from the EU than other jobs during this period. As of 2021, 9% of engineering workers were born in the European Union (EU) and 10% in the rest of the world (RoW), slightly higher than for non-engineering workers (8% and 11%, respectively).
- The age profile of the engineering workforce has also changed over the last decade, with the percentage of both the youngest and oldest age groups increasing. Meanwhile, the share of workers aged 35 to 44 declined, falling from 26.7% in 2010 to 24.5% in 2021.

2. Introduction

In Summer 2021, EngineeringUK commissioned the Institute for Employment Research at the University of Warwick to explore how the engineering industry and workforce has changed since 2010. This report contains a summary of those findings and supplementary analysis carried out by EngineeringUK on the changing pattern of employment in engineering between 2010 to 2021, a period that encompasses 2 major events: the UK formally leaving the EU at the end of 2019 and the onset of the Covid-19 pandemic. In recognition of their significance, in addition to exploring the long-term trends across the entire period, we use quarterly annual rolling averages to examine changes from 2018 in more detail.

The report is divided into 2 parts, the first of which outlines the characteristics of total employment in the engineering 'footprint' (as defined by EngineeringUK, the Royal Academy of Engineering and the Engineering Council). We then turn our focus to explore how the engineering workforce has changed over time with regards to age, gender, ethnicity and country of birth.

3. Methodology

3.1 Data sources

The majority of the analysis in this report is based on data from the Labour Force Survey (LFS) using the EngineeringUK engineering footprint[1], though in some instances we also draw from the Business Register and Employment Survey. A summary of these data sources can be found below.

[1] For a complete list of the SOC and SIC codes included in the engineering footprint, visit: www.engineeringuk.com/media/1572/engineering_uk_2018_annex.pdf

3.1.1 Labour Force Survey

The LFS is a continuous household survey run by the Office of National Statistics (ONS). Respondents are interviewed for 5 successive waves at 3-monthly intervals and 20% of the sample is replaced every quarter. Datasets are published quarterly and each contains 5 waves of data.

For each of the data points shown throughout this paper, 4 quarters of LFS data have been collated to create an annual dataset with only waves 1 and 5 of the data used (to avoid counting respondents who would appear in more than one quarter of the data in different waves). This is a standard approach, as using the full calendar year of data (4 quarters) allows for any seasonality within the data to be accounted for, while using just one quarter of data may produce different results depending on which quarter is selected.

For the most part, trends are presented for individual calendar years (quarter 1 to quarter 4) between 2010 and 2021. However, to provide a more detailed look at the period from 2018, quarterly rolling averages are used. These are calculated from annual datasets which are compiled as 4 consecutive quarters of data beginning from each of the quarters from calendar year 2018 to calendar year 2021.

The sample selected to complete the LFS is designed to be representative of the entire population and a weighting is applied throughout our analysis which aims to account for differences between the sample and the true population values.

Changes in mode to the LFS

Due to the Covid-19 pandemic, from 2020 the mode changed from mainly face-to-face to online and telephone data collection.

It is possible that this has had an effect on the sample demographics due to non-response biases, or on responses given. Whilst ONS have made adjustments to the person weighting to account for some of these differences, we must be aware of these changes when interpreting the data.[2]

3.1.2 Business Register and Employment Survey

Though our analysis is primarily based on the LFS, on occasion we present data from the Business Register Employment Survey (BRES). While not directly comparable to the LFS, these figures nevertheless are used to illustrate the change of location of employers over time. Note, however, that the BRES does not include self-employed, HM Forces and government supported trainees and therefore does not have the same coverage as the LFS.

3.2 The engineering footprint

Recognising the need for a consistent definition of engineering, in 2017 EngineeringUK, the Royal Academy of Engineering and Engineering Council established a standard engineering footprint. This was developed by agreeing on a set of criteria regarding the level of qualifications and skills deemed to be required for engineering roles, undertaking

[2] Office for National Statistics. Coronavirus and its impact on the Labour Force Survey (webpage). Accessed 21 February 2021. www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/coronavirusanditsimpactonthelabourforcesurvey/2020-10-13

an extensive review of standard occupational classification (SOC) and standard industrial classification (SIC) codes, and agreeing the list that fulfilled the criteria.

Our analysis makes use of this footprint to explore both the occupational and industrial dimensions of engineering.

The engineering workforce/those working in engineering roles: Those we refer to as working in engineering jobs (or the 'engineering workforce') are the people who work in the Standard Occupational Classifications (SOC) that meet the footprint's criteria for 'engineering'. Where appropriate, we have further disaggregated this according to the footprint's definition of 'core' and 'related' engineering:

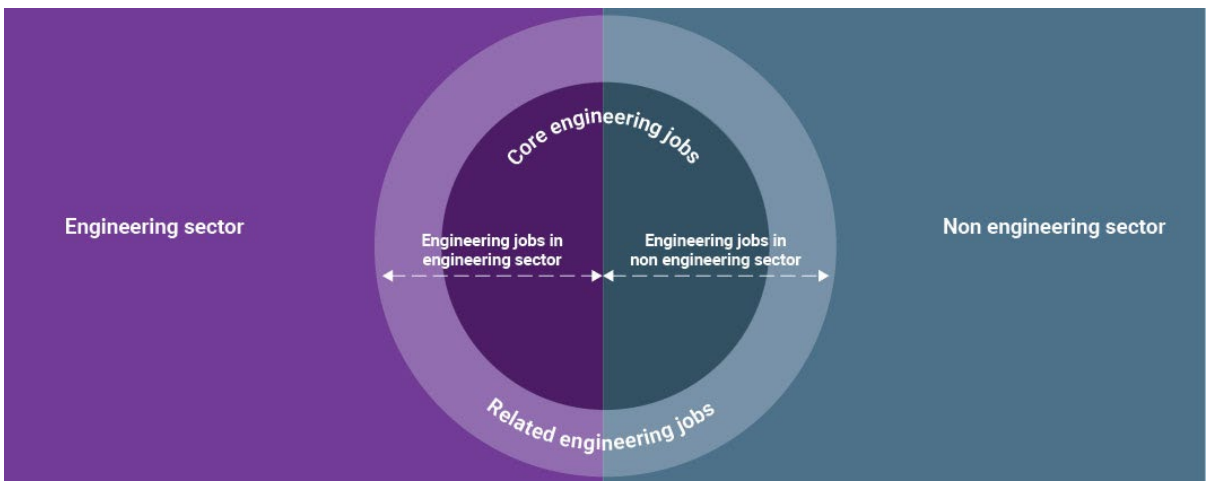
- **Core**: roles that are primarily engineering-based and require the consistent application of engineering knowledge and skills to execute the role effectively (for example, civil engineers, mechanical engineers, electrical engineers, science, engineering and production technicians, machine operatives and so on)

- **Related**: roles that require a mixed application of engineering knowledge and skill alongside other skill sets, which are often of greater importance to executing the role effectively (for example, quantity surveyors, architects, IT operations technicians, web designers and developers and so on)

The engineering sector/those working in engineering industries: Those we refer to as working in the engineering sector (or those 'working in engineering industries') are the people who work in the Standard Industrial Classifications (SIC) that meet the footprint's criteria for 'engineering'.

It is worth noting, as the below illustration depicts, that these concepts are inter-related. One can work in an engineering job (SOC) within or outside of the engineering sector (SIC). This has important for our understanding of where progress is – and isn't - being made.

Figure 1. The occupational and industrial engineering footprint



4. Overall employment trends in engineering industries and occupations

In this section of the report, we explore trends in engineering employment both in terms of industries (defined by SIC codes) and occupations (defined by SOC codes). The first part briefly outlines the characteristics of total employment in the engineering industrial 'footprint'. This provides the context for the second part of the report by highlighting the changing industrial composition and geographical distribution of the engineering sector. The key changes identified are the shift of employment towards engineering activities classified as falling within the service sector (in terms of the SIC), and the consequent shift of employment towards part-time working and a location in the south-east of England.

4.1 Employment in engineering industries and occupations

We define the 'engineering footprint' in terms of both industrial sectors and occupations.[3] The narrowest definition of the sector is people working in engineering occupations within industries defined as 'engineering'. There are, however, people working in engineering occupations in other industries and people working in non-engineering occupations in industries defined as engineering. Figure 2 shows how this has changed since 2010, up to the second quarter of 2021 for the UK. Over this period the number of people employed in the engineering footprint in its widest sense - that is, all those employed in engineering industries as well as all those working in engineering occupations, be they in engineering industries or not - increased from 8.1 million in 2010 to 8.8 million in 2021.

Employment in engineering occupations (including engineering jobs in non-engineering industries) grew by 8.5% between 2010 and 2021. While most employment in engineering occupations is found in industries defined as 'engineering', the percentage of people in engineering occupations who worked in engineering industries fell from 72% to 68% between 2010 and 2021. This illustrates the increasing ubiquity of engineering skills across all industries.

[3] This 'footprint' includes all occupations and sectors classified as engineering. See EngineeringUK (2018) State of Engineering 2018: Annex (www.engineeringuk.com/media/1572/engineering_uk_2018_annex.pdf) for details

Figure 2: UK Employment in engineering industries and occupations, 2010 to 2021

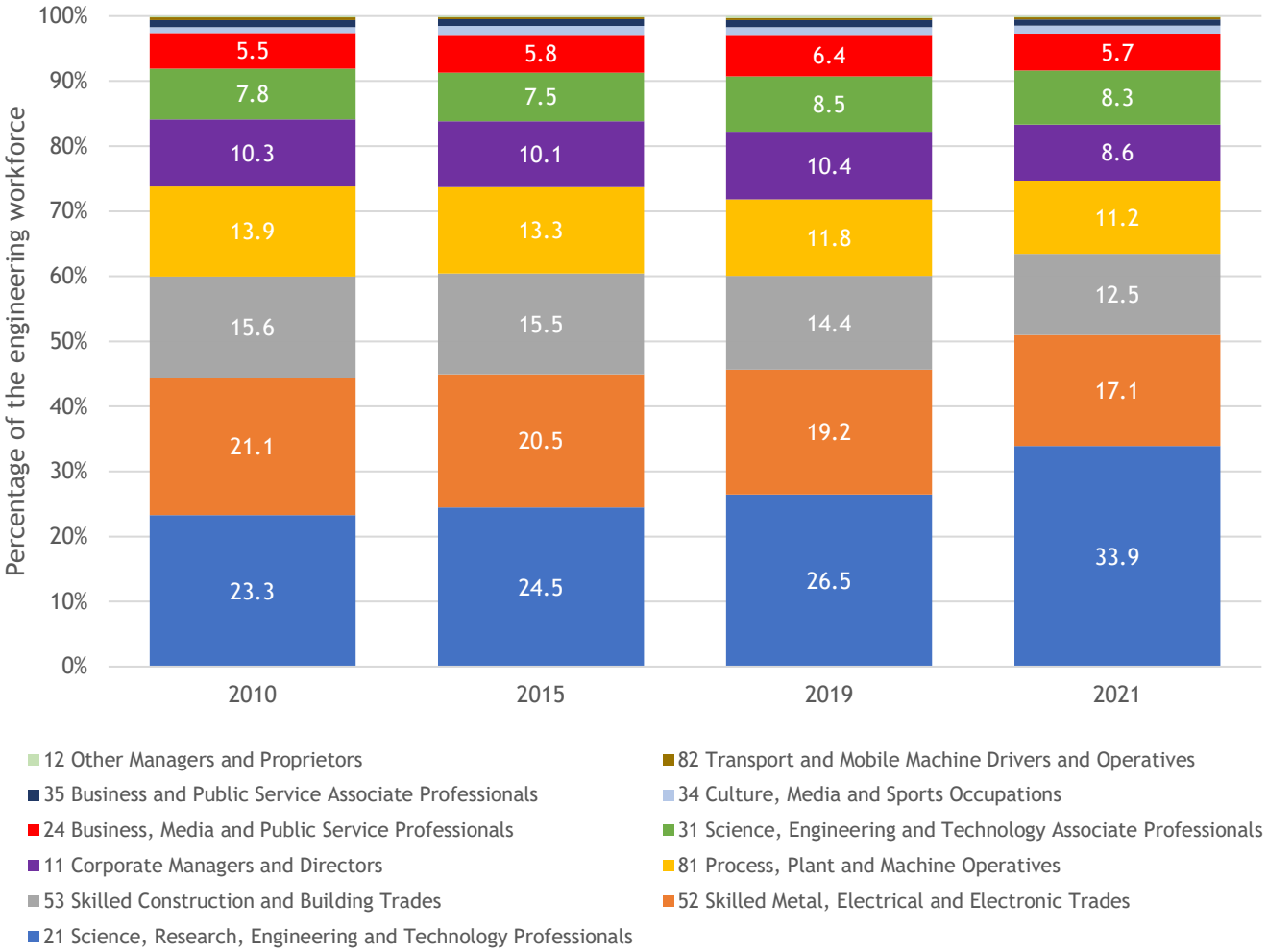
		Number of employees ('000s)			Percentage of employees (%)		
		2010	2021	Change 2010-2021	% share of 2010	% share of 2021	% Change 2010-2021
Engineering industries	Engineering occupations	3,887	3,765	-122	13.7	12.7	-3.1
	Non-engineering occupations	2,762	3,169	407	9.7	10.7	14.7
	All jobs	6,649	6,934	285	23.5	23.4	4.3
Non-engineering industries	Engineering occupations	1,488	1,895	407	5.3	6.4	27.4
	Other jobs	20,196	20,824	628	71.3	70.2	3.1
All engineering occupations		5,375	5,661	286	19.0	19.1	5.3
All engineering (industries or occupations)*		8,137	8,829	692	28.7	29.8	8.5
Total employment		28,333	29,654	1321	100	100	4.7

Source: ONS Labour Force Survey.

*'the engineering footprint in its widest sense - that is, all those employed in engineering industries as well as all those working in engineering occupations, be they in engineering industries or not

If we focus only on those working in engineering occupations and which industries they work in (figure 3), we see that the share of skilled trades and semi-skilled workers in engineering industry employment fell between 2010 and 2021 (groups 53 and 81 shown in colours grey and yellow), though the number employed in these sub-major groups grew slowly. In contrast, the share of Science, Research, Engineering and Technology Professionals increased as employment increased by a third (from 23% to 34%) over the period 2010 to 2021. This indicates that there has been somewhat of a shift away from manufacturing towards services and professional occupations involved in IT and engineering consultancy.

Figure 3: Breakdown of engineering occupations for workers in the engineering industry, 2010 to 2021 UK



Source: ONS Labour Force Survey.

Figure 4 shows the percentage changes in the number of employees at different time points between 2010 and 2021. Overall, there was an increase of 5.4% in the numbers of engineering employees during the entire period, despite a decrease over the Covid-19 pandemic period (2019-21) of 10.2%, which saw a decrease in employee numbers in every group except Science, Research, Engineering and Technology Professionals. Skilled workers were some of the hardest-hit in terms of employee numbers during the Covid-19 period, losing around a fifth of employees in both Skilled Metal, Electrical and Electronic Trades and Skilled Construction and Building Trades, negating the gains made in the preceding periods.

Figure 4: Percentage change in the number of employees in engineering occupations, 2010 to 2021, UK

SOC sub-major group	Percentage change in number employed				Total number employed 2021 ('000s)
	2010-15	2015-19	2019-21	2010-21	
21 Science, research, engineering and technology professionals	10.9	19.9	15.1	53.1	1,921
34 Culture, media and sports occupations	61.4	-4.1	-8.5	41.6	69
31 Science, Engineering and Technology Associate Professionals	0.9	26.4	-12.0	12.2	471
12 Other managers and proprietors	32.9	44.1	-42.4	10.4	10
24 Business, media and public service professionals	11.8	22.7	-20.1	9.6	323
35 Business and public service associate professionals	-2.1	21.1	-20.4	-5.6	54
11 Corporate managers and directors	4.2	13.6	-25.2	-11.5	488
82 Transport and mobile machine drivers and operatives	-14.7	-6.5	10.1	-12.2	19
52 skilled metal, electrical and electronic trades	2.7	4.1	-20.2	-14.7	967
81 Process, plant and machine operatives	0.9	-0.9	-14.8	-14.8	636
53 Skilled construction and building trades	5.1	3.2	-22.2	-15.6	706
Total	**5.7**	**11.0**	**-10.2**	**5.4**	**5,664**

Source: ONS Labour Force Survey.

4.2 Employment in engineering industries

Figure 5 shows how employment within the engineering sector, as defined by the EngineeringUK industrial footprint (that is, the Standard Industrial Classifications (SIC) that meet the footprint's criteria for 'engineering'), has changed over time. The overall number of employees in the engineering industry was around 6.6 million in 2010, increasing to 7.6 million by 2019, and then, perhaps unsurprisingly given the Covid-19 pandemic, seeing a downturn to 6.9 million by 2021.

More than 40% of people working in engineering worked in manufacturing industries and a further 24% worked in construction at the start of this period, equalling around 4.4 million employees. The percentage working in both declined over the decade, as did the number of employees to around 4 million, while the share of employment in information and communication industries and professional services grew over the decade, together accounting for 27% of employment in 2021 with 1.8 million workers, up from around 1.3 million in 2010.

Figure 5: The industrial breakdown of engineering industry employment in the UK

Industry group	Employment ('000's)				Share of employment (%)			
	2010	2015	2019	2021	2010	2015	2019	2021
Mining and quarrying	104	138	121	119	1.6	2	1.6	1.7
Manufacturing	2,756	2,846	2,898	2,507	41.5	40.5	38	36.2
Electricity	133	138	156	142	2	2	2	2
Water supply	152	171	187	183	2.3	2.4	2.5	2.6
Construction	1,621	1,618	1,778	1,510	24.4	23	23.3	21.8
Professional, scientific and technical activities	644	696	850	811	9.7	9.9	11.2	11.7
Information and communication	643	825	969	1,044	9.7	11.7	12.7	15.1
Repair, vehicles and transportation	273	271	304	243	4.1	3.9	4	3.5
Administrative and public sector	254	258	277	314	3.8	3.7	3.6	4.5
Other service activities	68	69	82	61	1	1	1.1	0.9
Industry-based definition of engineering	6,649	7,031	7,622	6,934	100	100	100	100

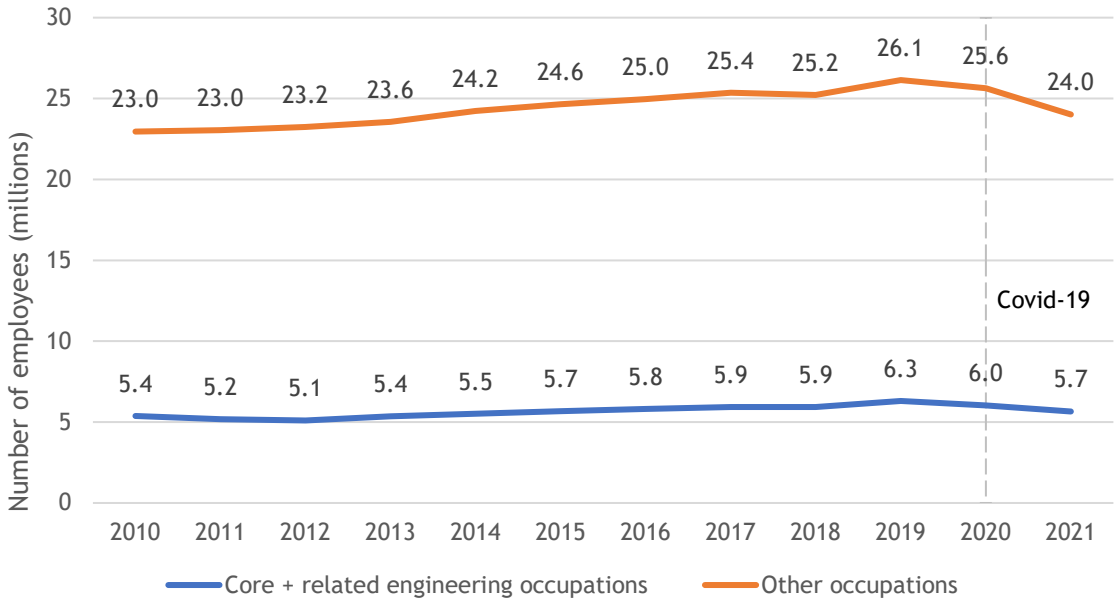
Source: ONS Labour Force Survey

4.3 Employment in engineering occupations

Figure 6 shows that the growth rates for both engineering and all other sectors are almost identical over the period as a whole, but engineering occupations grew more quickly than other occupations, particularly over the period 2012 onwards.

The number of people working in engineering occupations increased from 5.4 million in 2010 to 5.7 million in 2021, with a peak of 6.3 million in 2019. The main industries employing people in engineering occupations in 2010 were manufacturing (37.8%) and construction (29.7%), the share of each of which fell by 2019, while adding 78.8 and 48.4 thousand jobs respectively and continued to fall thereafter into 2021. There was a shift towards service sector industries over the decade, in which percentage rates of increase were high.

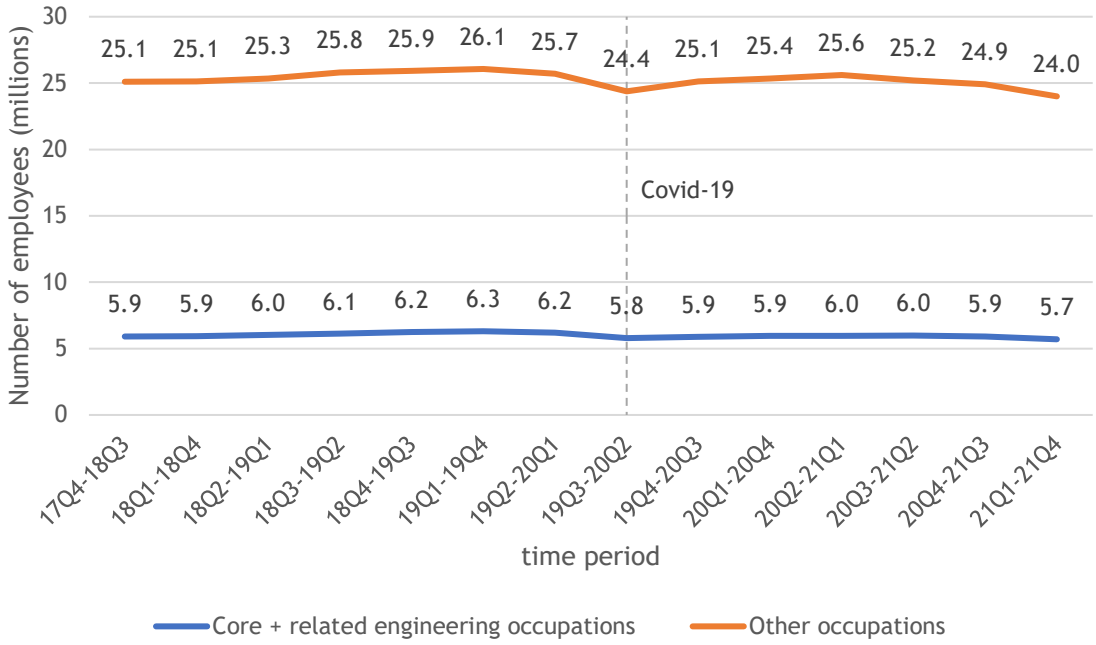
Figure 6: Employment in engineering occupations, 2010 to 2021



Source: ONS Labour Force Survey.

Exploring the period from 2018 to 2021 in more detail using quarterly rolling averages from the LFS (Figure 7), we can see that the number of employees in engineering occupations had been increasing up until the first quarter of data that includes the national lockdown for Covid-19 (shown by the dashed line on the chart). At this point there was a dramatic decrease in employees both in all occupations and engineering occupations. Recovery from this has been slow with Covid-19 restrictions in place and uncertainty around employment continuing.

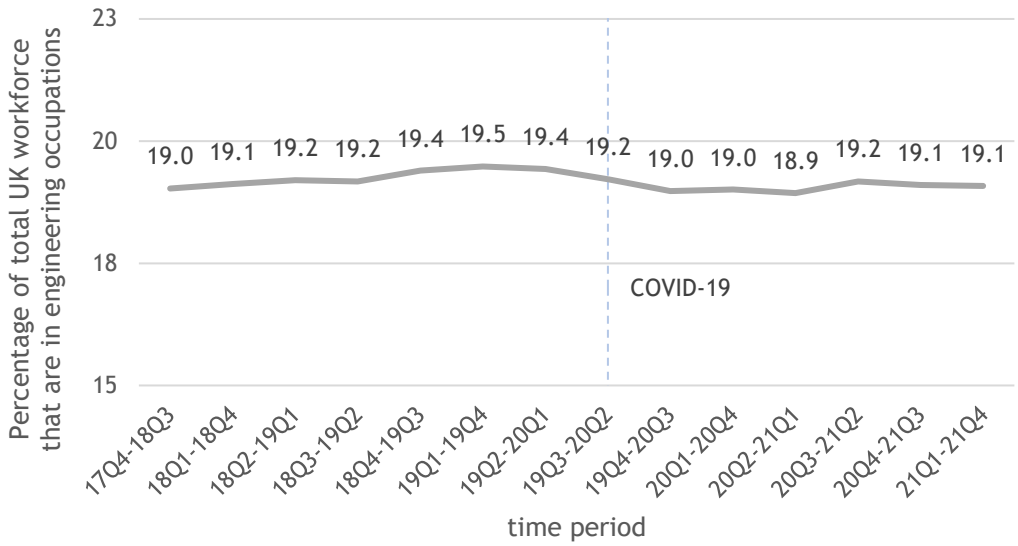
Figure 7: Total employment in engineering and non-engineering occupations, 2018 to 2021 quarterly rolling averages, UK



Source: ONS Labour Force Survey

Figure 8 shows the number of individuals in engineering occupations as a proportion of individuals in all occupations (the sizes of the changes over this short period are amplified by the choice of scale for the vertical axis). We see that share of engineering in the UK workforce increased initially up to 2019, but that from the start of the Covid-19 period (denoted by the dotted line on the chart), the share shrank and is yet to get back to pre-Covid-19 levels.

Figure 8: Proportion of engineering employment within all occupational groups



Source: ONS Labour Force Survey

Figure 9 sets out the percentage point changes over the pre-Covid-19 period (2018 to 2019) and the Covid-19 period (2019 to 21). In the first of these periods, growth in engineering occupations outpaced that of growth in non-engineering occupations (6.1% increase compared to 3.7%). However, engineering occupations were also more affected during the second period, (10.2% compared to 8.1%), so that overall between 2018 and 2021 there was a similar net decline between engineering and non-engineering occupations.

Figure 9: Changes pre-Covid-19 and during Covid-19

	Pre-Covid-19 2018 to 2019		Covid-19 2019 to 2021		Entire period 2018 to 2021	
	Number	%	Number	%	Number	%
Engineering occupations	364	6.1	-642	-10.2	-277	-4.7
Other occupations	924	3.7	-2,121	-8.1	-1,198	-4.7
Total	1,288	4.1	-2,763	-8.5	-1,475	-4.7

Source: ONS Labour Force Survey.

4.4 Changes in the geographical distribution of employment in the engineering industry

In this section of the report, we explore the location of employment and the changes that have occurred between 2010 and 2019. To do so, we use the Business Register and Employment Survey (BRES), which provides data from a representative sample of employers rather than from the general population as per the LFS.

In 2010, the share of engineering in total employment for individual regions was highest in the East and West Midlands, but employment shares in the regions surrounding these fell over the decade. Meanwhile, the share of engineering in London and the East of England increased. By 2019, employment in the engineering industry was largest in the south-east, followed by London and lowest in north-east England (Figure 10).

In the first part of the decade (2010-15), the fastest rate of increase in engineering employment in England was in the East (14.6% change between 2010 and 2015) and the North-East (12.6%), though of the countries in Great Britain, Wales saw the biggest increase (13.8%, compared with 6.5% in England overall and 4.2% in Scotland). In the period 2015-19, employment grew much faster in London than elsewhere, followed by Yorkshire & Humber, the north-west and south-east, while employment fell in north-east England.

Figure 10: Geographical pattern of change in employment in engineering, Great Britain 2010 to 2019

Country/Region	Employment (000s)			Change 2010-15		Change 2015-19		Change 2010-19	
	2010	2015	2019	000s	%	000s	%	000s	%
England	4,591	4,888	5,259	297	6.5	371	7.6	668	14.6
North-east	223	251	226	28	12.6	-25	-10	3	1.3
North-west	578	608	667	30	5.2	62	10.2	89	15.4
Yorkshire & Humber	449	473	528	24	5.3	57	12.1	79	17.6
East Midlands	443	475	479	32	7.2	9	1.9	36	8.1
West Midlands	507	547	560	40	7.9	10	1.8	53	10.5
East of England	480	550	591	70	14.6	40	7.3	111	23.1
London	629	664	789	35	5.6	127	19.1	160	25.4
South-east	812	810	891	-2	-0.2	68	8.4	79	9.7
South-west	470	510	528	40	8.5	20	3.9	58	12.3
Wales	232	264	267	32	13.8	1	0.4	35	15.1
Scotland	476	496	520	20	4.2	26	5.2	44	9.2
Great Britain	5,299	5,647	6,047	348	6.6	389	6.9	748	14.1

Source: Business Register and Employment Survey (N.B. Survey does not cover Northern Ireland).

Note: The engineering sector is defined as all those working in the industries encompassed by the EngineeringUK industrial engineering footprint, using the 2007 UK Standard Industrial Classification.

As can be seen in Figure 11, during the pre-Covid-19 period, all English regions saw an increase in the number of engineering employees working there, with the biggest increases seen in the East Midlands and West Midlands at over 10%.[4] Wales also saw an increase during this period of 8.1%, though both Scotland and Northern Ireland saw decreases of around 3%. In contrast, and perhaps not surprisingly, all areas saw a decrease in the number of employees between 2019 and 2021, with the Midlands, London and the north-west fairing worst with decreases over 12%. England overall saw a 10.4% decrease, which compares to a 14.2% decrease in Wales, 7% in Scotland and 2.5% in Northern Ireland.

If we look at the period between 2018 and 2021 as a whole, there is a mixed picture across the regions. Whilst in the north-east the losses in the second period were of a similar magnitude to the gains in the first, equalling just a 0.2% decrease in employees, London saw a moderate increase in the first period (7.8%) and a large decrease in the second (12.8%) meaning an overall decrease of 5% across the period.

[4] Note that this is not directly comparable to the previous regional data as the former presents data from employers (BRES) while Figure 11 is drawn from the LFS – that is, information from employees themselves.

Figure 11: The initial impact of Covid-19 on the location of employment in engineering occupations, English regions

Country/ Region of employment	Pre-Covid-19	Covid-19	Entire period
	% change 2018-2019	% change 2019-2021	% change 2018-2021
England	7.0%	-10.4%	-3.4%
North-east	9.8%	-10.0%	-0.2%
North-west	9.6%	-12.7%	-3.2%
Yorkshire & Humber	2.0%	-4.9%	-2.8%
East Midlands	12.5%	-15.3%	-2.8%
West Midlands	10.5%	-12.7%	-2.2%
East of England	3.0%	-5.6%	-2.6%
London	7.8%	-12.8%	-5.0%
South-east	5.9%	-8.8%	-3.0%
South-west	4.2%	-9.2%	-4.9%
Wales	8.1%	-14.2%	-6.1%
Scotland	-2.9%	-7.0%	-10.0%
Northern Ireland	-3.2%	-2.5%	-5.7%

Source: ONS Labour Force Survey

5. The changing socio-demographic characteristics of those working in engineering occupations

This section presents trends in the composition of employment in engineering occupations. Previous reports on the engineering industry have highlighted the under-representation of women and people from minority ethnic groups in engineering[5][6] as well as those with a disability and from lower socio-economic groups. Whilst we do not cover all of these in this report, our analysis here explores inequality in terms of gender, ethnicity, age group and country of birth. We cover the period 2010 to 2021, which encompasses a time of significant policy impetus to increase diversity in STEM and engineering, but also major global events such as Brexit and the Covid-19 pandemic. We explore the overall trends and where possible comment on the possible effects of major events on the overall composition of the engineering workforce.

[5] EngineeringUK 2018: The State of Engineering

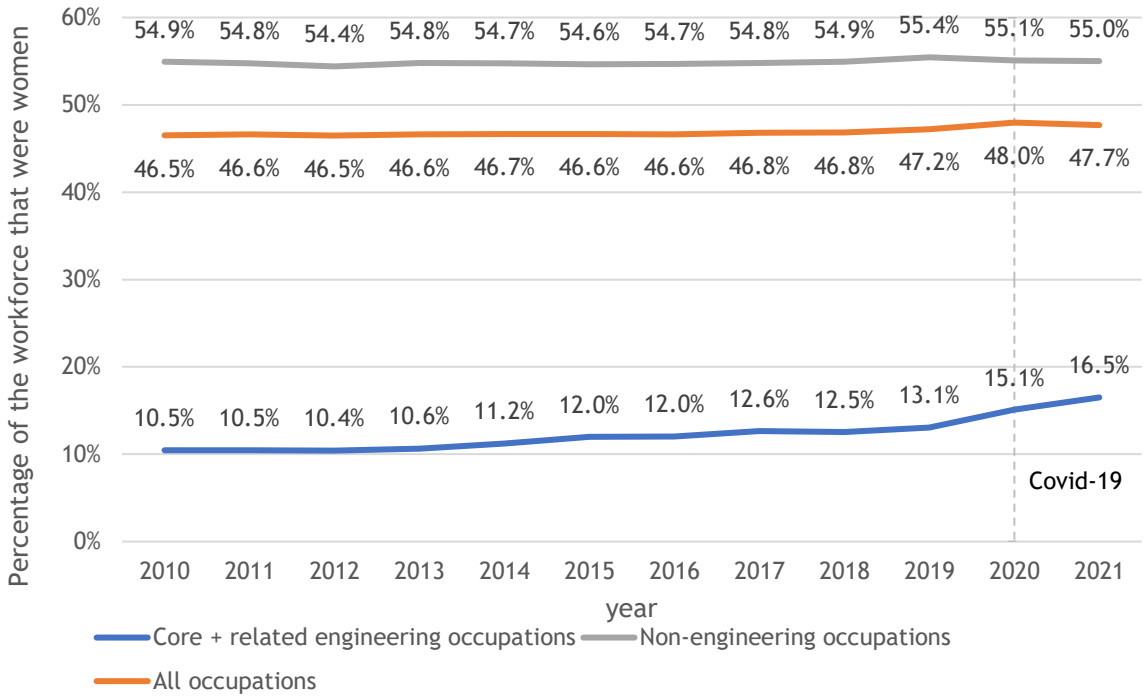
[6] EngineeringUK 2022: Women in Engineering

5.1 Gender

Figure 12 demonstrates that the percentage of workers in engineering occupations who were women was much lower than in the remainder of the economy during 2010 to 2021. Women, however, formed an increasing percentage of engineering workers, rising from 10.5% in 2010 to 13.1% in 2019, continuing to increase to 14.5% mid-way through 2020 and up to 16.5% by 2021, for 'core and related' engineering occupations (as defined by the EngineeringUK footprint[7]).

Notably, as Figure 13 shows, the percentage of female workers in 'core' engineering occupations is lower than in 'related' engineering occupations (15.2% compared with 19.0%) – and this is even lower when considering only those working in engineering occupations within the engineering sector where it stands at 12.5%. In contrast, 24.4% of engineers working outside of the sector were women, suggesting that industries not traditionally associated with engineering – such as health, arts, entertainment and recreation – are more successful in attracting female engineers into the workforce. Meanwhile the overall female share of employment in all occupations in the UK remained at the much higher rate of 47%-48% throughout the whole period.

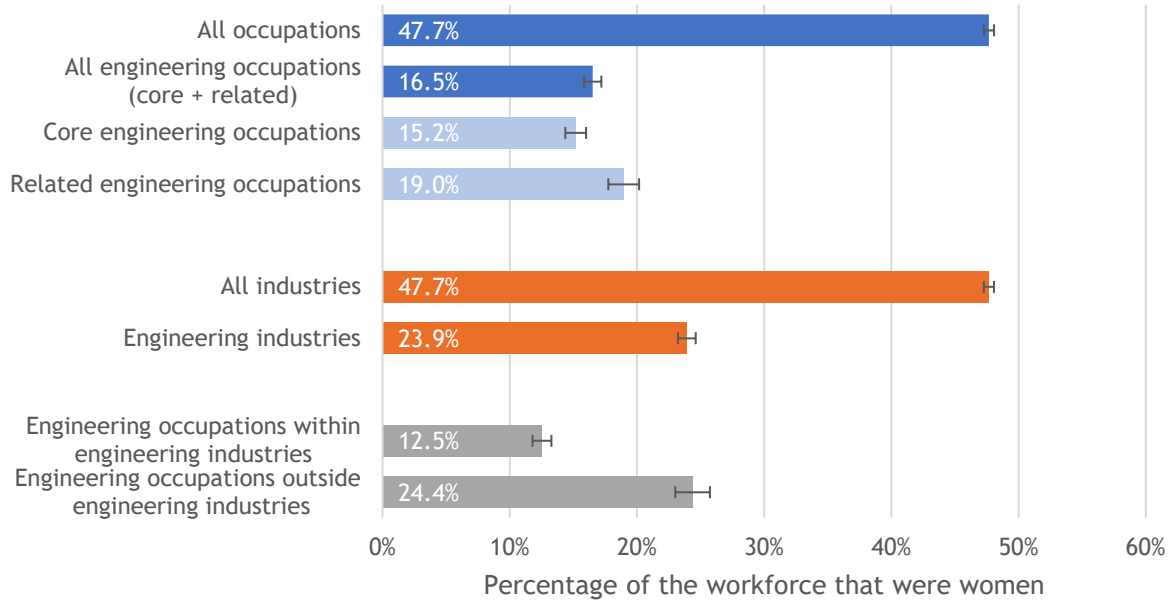
Figure 12: Female employment in engineering occupations, 2010 to 2021



Source: ONS Labour Force Survey.

[7] EngineeringUK 2018: The State of Engineering - Annex

Figure 13: Percentage of women in engineering occupations (various definitions) and all occupations, UK, 2021



Source: ONS Labour Force Survey.

There is also substantial gender specialisation in jobs within the engineering industry, with men dominating manual occupations and the share of women being highest for those jobs providing a service. Figure 14 presents the pattern of female employment in engineering (defined by occupation) and employment change by SOC major group for the period 2010 to 2021. Female employment grew by 46.5% over this period, with the number in both professional occupations and skilled trades occupations increasing by more than 70%. Women were most strongly represented in associate professional and technical occupations, comprising almost a third of workers in 2021. Women also made up around a fifth of those in professional occupations and process, plant and machine operatives in 2021. The female share of employment increased in all major groups, to the greatest extent in professional and skilled trades occupations (though in the latter, women formed less than 2.5% of workers in both 2010 and 2021).

Figure 14: Female employment in engineering occupations, 2010 to 2021 UK

SOC Major Group	Percentage of engineering jobs female				Percentage change in employment			
	2010	2015	2019	2021	2010-15	2015-19	2019-21	2010-21
1 Managers, directors and senior officials	11.2	11.3	12.8	15.3	5.9	29.6	-8.7	25.3
2 Professional occupations	13.8	16.9	17.6	22.1	36.1	25.2	34.8	129.7
3 Associate professional and technical occupations	23.8	27.3	26	31.9	21.9	15.9	8.1	52.7
5 Skilled trades occupations	1.4	1.6	2.3	2.5	16	46.8	-12.8	48.5
8 Process, plant and machine operatives	17.2	17.9	19.4	20.3	4.4	7.3	-9.9	0.9
All engineering occupations	10.5	12	13.1	16.5	21.1	21	13.7	66.5

Source: ONS Labour Force Survey.

A more detailed breakdown of engineering occupations by gender is available in the EngineeringUK 'Women in Engineering' report[8]. In the report we note that more than half of the engineering occupation groups have seen an increase in the percentage of female workers between 2010 and 2021 (61 out of 97). In all but 7 of these 61 roles, the increase has been both in proportional and absolute terms – and for 27 of these, it has coincided with an expansion of roles overall in that occupation. However, for 13 of the roles included in the engineering footprint, the proportion of women has remained at 0%, and for 23 occupation groups there has been a decrease in female employees over this period. This demonstrates that there is still more work to be done to attract more women into engineering roles and improve retention rates amongst women once they are in those roles.

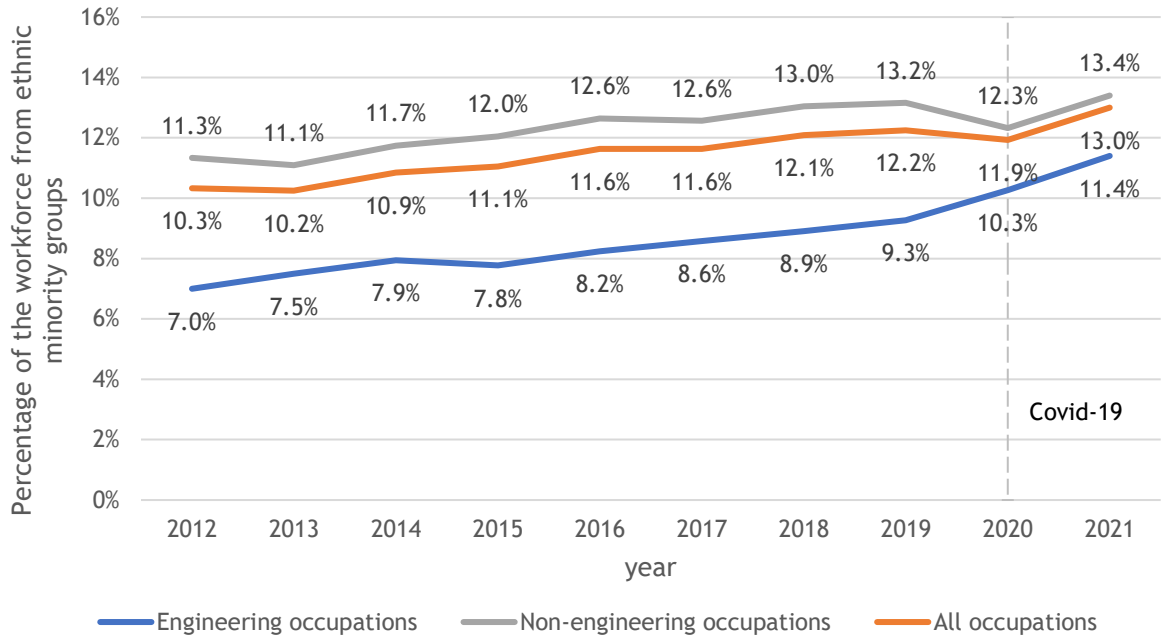
5.2 Ethnicity

The representation of people from minority ethnic groups in engineering occupations is increasing, but their percentage share of employment was lower than that for both all jobs and non-engineering jobs throughout the period 2012 to 2021[9]. Figure 15 compares the percentage of people from minority ethnic groups working in engineering and non-engineering occupations with all occupations. The percentage of minority ethnic workers in all occupations increased from 10.3% in 2012 to 13.0% in 2021. In engineering occupations, minority ethnic groups formed 7.6% of all workers in 2012, but this percentage rose to 11.4% in 2021. This represented a similar increase of around 2 percentage points to that experienced in non-engineering occupations up to 2019, but a bigger increase between 2019 and 2021.

[8] EngineeringUK 2022: Women in engineering

[9] The period considered is 2012 to 2021 because the 2011 Census ethnic group classification for the whole UK (used here) was only introduced to the LFS in 2012.

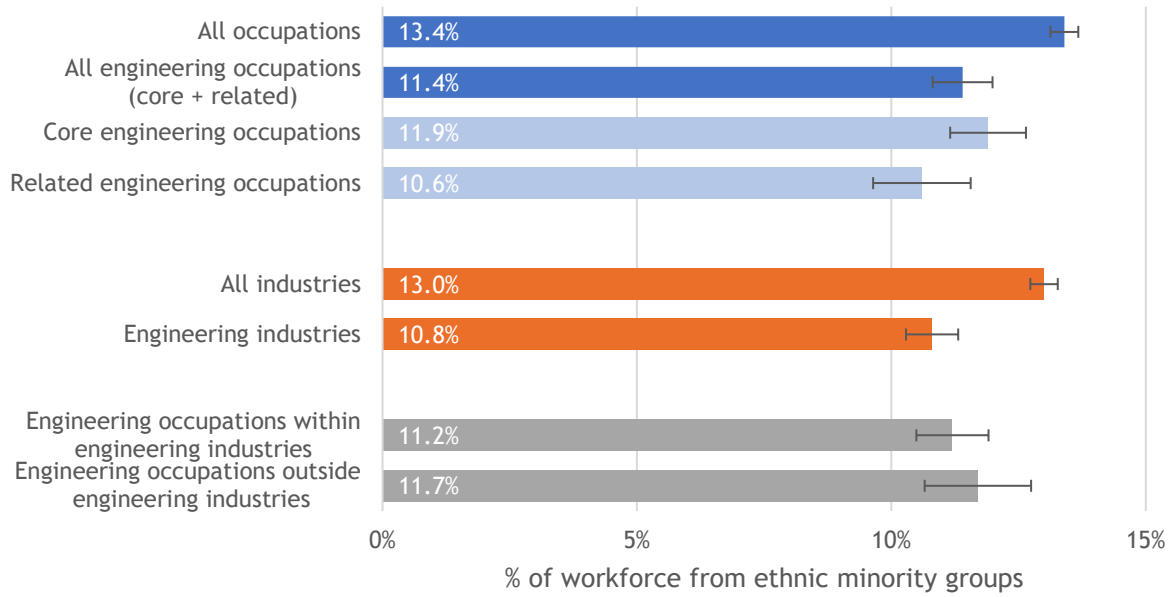
Figure 15: Percentage of employees from minority ethnic groups by occupation, UK, 2012 to 2021



Source: ONS Labour Force Survey.

As of 2021, 11.4% of the core and related engineering workforce were from minority ethnic groups (though if examined separately it is slightly higher for core at 11.9% than for related, at 10.6%) (Figure 16). For engineering occupations within engineering industries, 11.2% of the workforce were from minority ethnic groups, similar to the 11.7% outside of engineering industries.

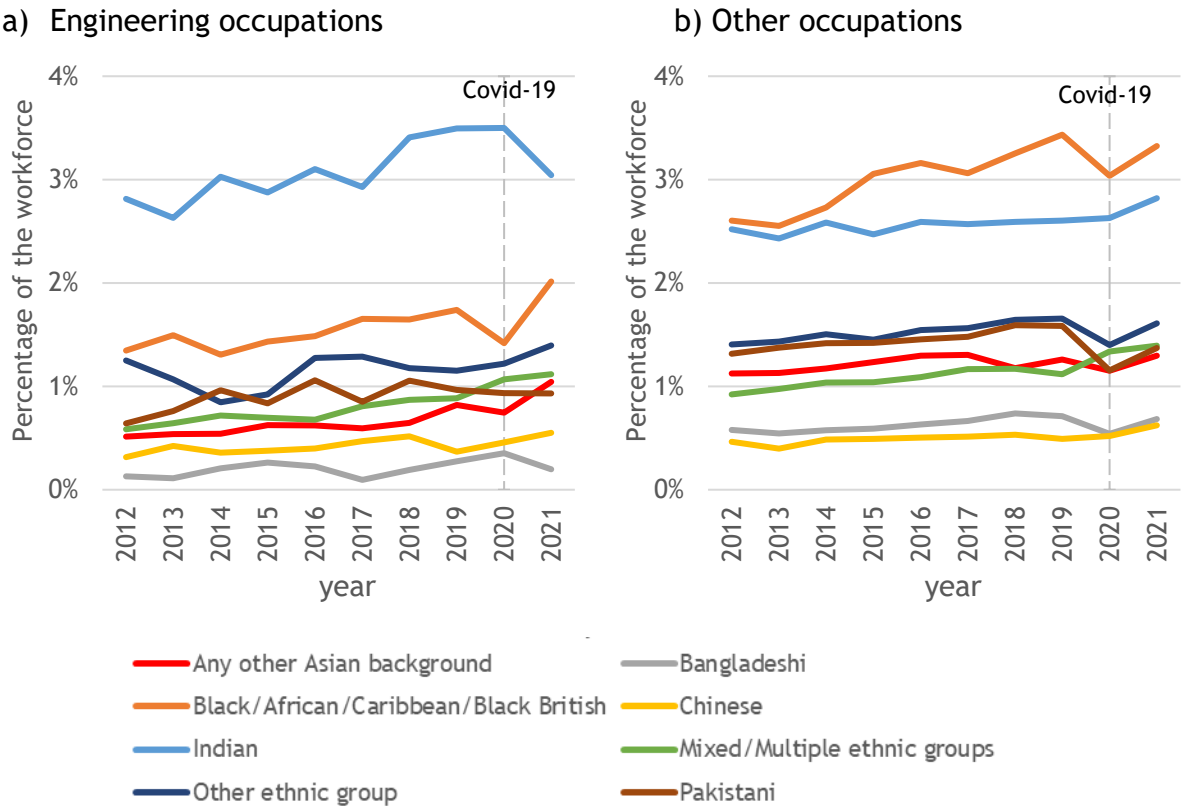
Figure 16: Percentage of employees from minority ethnic groups in engineering occupations (various definitions) and all occupations, UK, 2021



Source: ONS Labour Force Survey.

Figure 17 looks at the share of employment from each of the minority ethnic groups individually for engineering occupations compared with other occupations. We see there are some differences between occupation groups with engineering having a higher percentage of employees of Indian ethnicity, most noticeably in 2019 and 2020 with 3.5% of engineering employees compared with 2.6% in other occupations, though the difference has reduced in 2021. Meanwhile, other occupations have higher percentages of Black employees over the entire period ranging from 2.6% in 2010 to 3.4% in 2019 (and at 3.2% in 2021) compared to 1.3% in engineering occupations in 2010 increasing to 2.0% in 2021.

Figure 17: Percentage of employees from minority ethnic groups in engineering occupations and other occupations, UK, 2012 to 2021



Source: ONS Labour Force Survey.

5.3 Country of birth

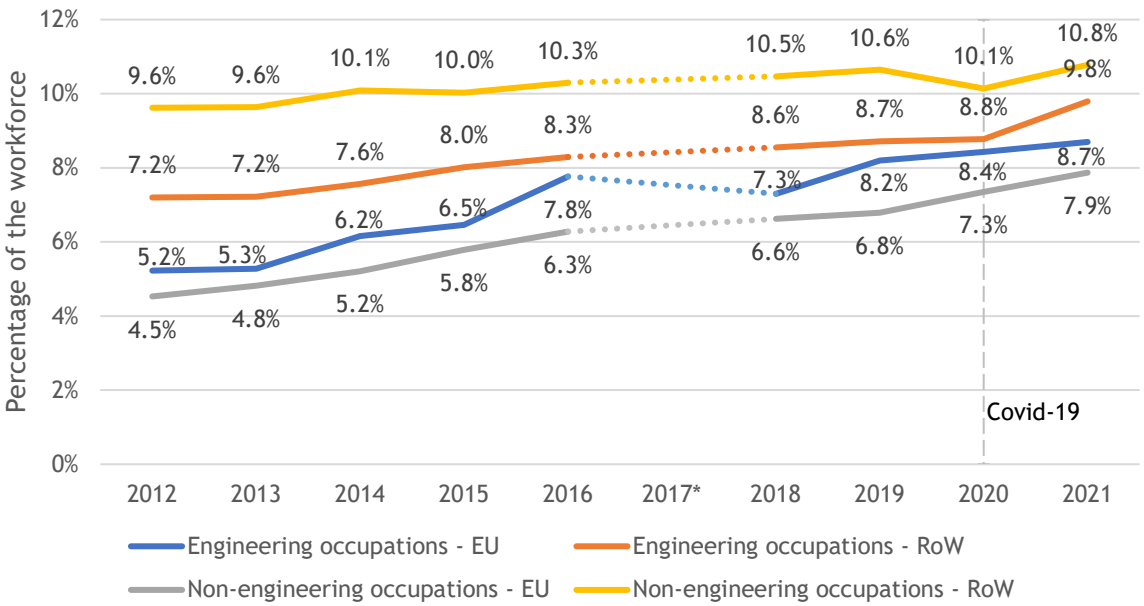
International students make up a good proportion of those studying engineering in higher education, particularly at postgraduate level, and it is therefore important to understand whether they remain in the UK once they progress to employment.

We see that a similar rate of those working in engineering versus the overall workforce were born in the UK. The percentage of workers born outside the UK increased in both engineering and non-engineering occupations between 2012 and 2021 (see Figure 18). The percentage of UK workers born in the rest of the world[10] (RoW) was higher than the percentage born in the European Union (EU) in both engineering and non-engineering

[10] Which includes Europe outside the EU, Asia, Africa, the Americas and Oceania.

occupations, with the gap larger for non-engineering occupations. Engineering jobs were more likely to be filled by workers from the EU than other jobs during this period. There was a marked increase in the share of EU workers in both engineering and non-engineering occupations between 2012 and 2016, with a slower increase between 2016 and 2021 (coinciding with the period of debate over the nature of Brexit during which total net migration from the EU fell). Note also that the number of employees from RoW working in non-engineering occupations declined in the first year of the Covid-19 pandemic (2020), but this was not seen in engineering. This would suggest that engineering may well be more vulnerable to changes brought on by Brexit than other industries but was not as affected by the pandemic in terms of losses in overseas-born workers.

Figure 18: Country of birth of overseas-born workers in engineering and non-engineering occupations in the UK by over the period 2012 to 2021

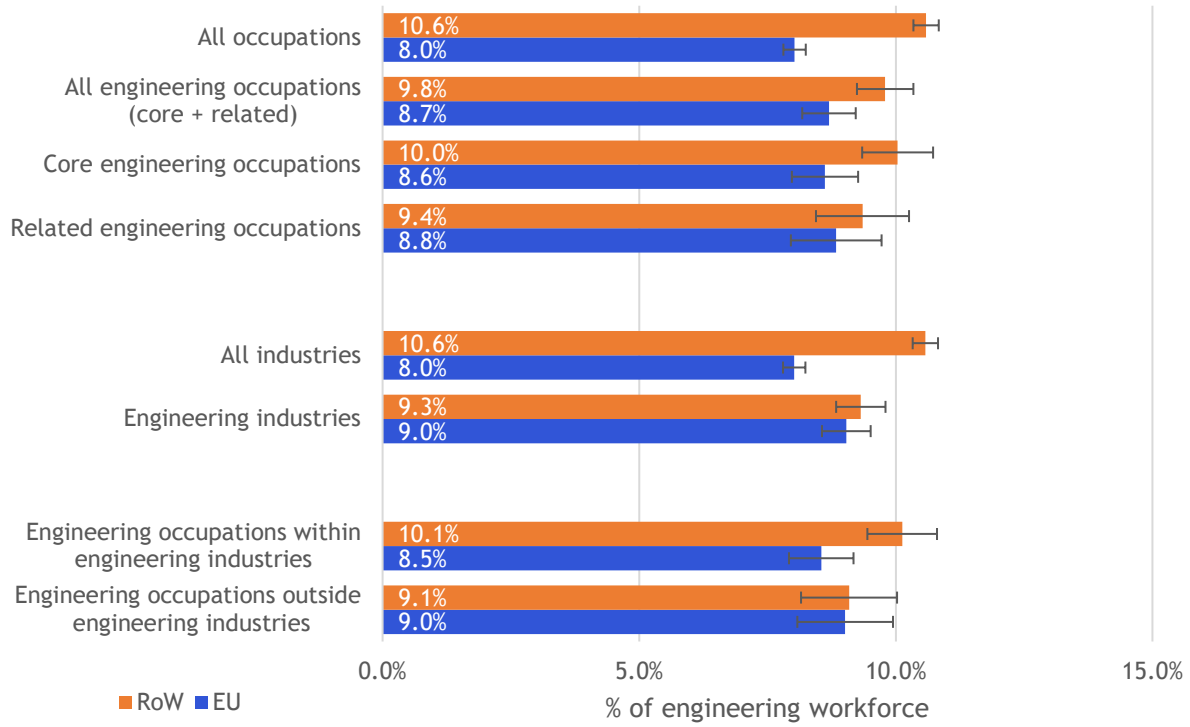


Source: ONS Labour Force Survey.
* Please note, no data is available for 2017 due to issues associated with the ONS changing the way the country of birth variable is coded in the LFS.

Employment of EU workers in engineering occupations nearly doubled between 2012 and 2021, but the growth of EU workers in non-engineering occupations was slower. The growth in employment share from the rest of the world was slower for both engineering and non-engineering occupations.

As of 2021, 81.5% of the total employees working in engineering occupations were born in the UK, similar to 81.4% of the overall workforce (Figure 19). For core engineering, there was a higher percentage of workers from the rest of the world compared to the EU (10.0% compared with 8.6% respectively). Similarly, there was a higher percentage of employees born in the RoW than the EU when looking only at engineering occupations within engineering industries (10.1% compared with 8.5%), but for other areas there was no significant difference seen between country of origin for non-UK born workers.

Figure 19: Percentage of employees in engineering occupations (various definitions) and all occupations, by country of birth, UK, 2021

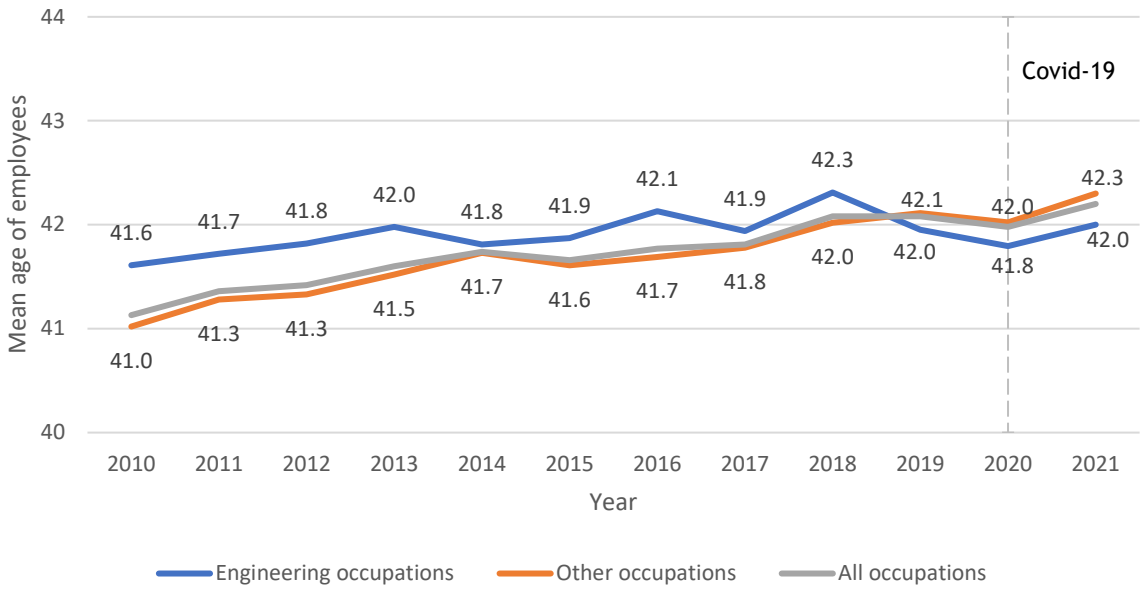


Source: ONS Labour Force Survey

5.4 Age

At the start of the period, people working in engineering occupations tended to be older than the average worker in the UK. However, this differential narrowed over the period 2010 to 2019 and had reversed by 2020 and 2021.

Figure 20: Mean age of workers in engineering and other occupations, UK 2012 to 2021

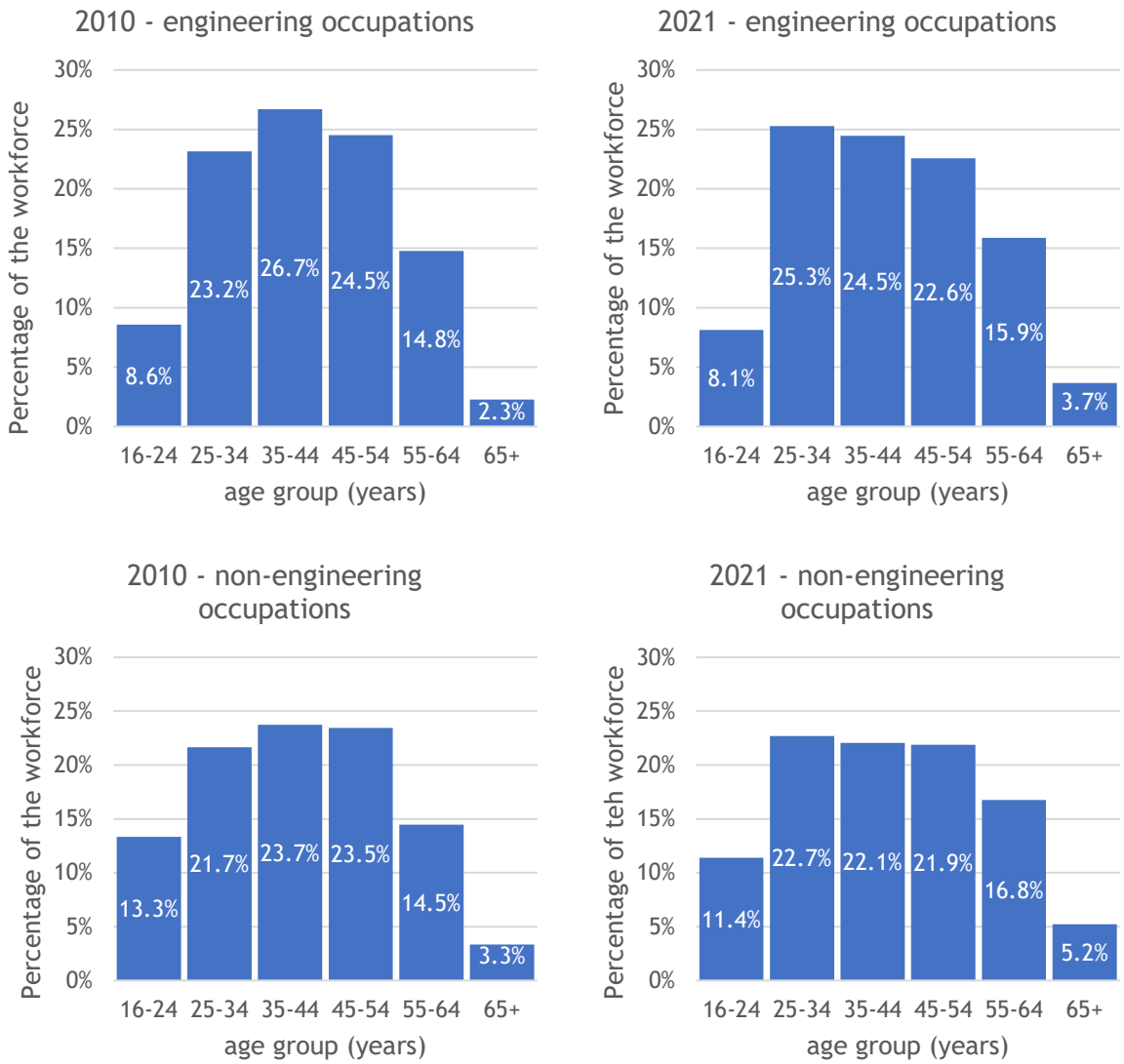


Source: ONS Labour Force Survey

The mean age of people working in engineering occupations hardly changed (from 41.6 in 2010 to 42.0 years in 2021 - see Figure 20), while the mean age of all those in work increased from 41.1 to 42.2 years over the same period. The mean age for those working in non-engineering occupations was similar to the average for all occupations, increasing from 41.0 in 2010 to 42.3 years in 2021.

Looking at the age distribution of the engineering workforce versus the non-engineering workforce (Figure 21), we see that notably the shape of the age distribution has changed between 2010 and 2021 for engineering occupations, with an increase in workers aged 25 to 34 years and over 55 years, corresponding with a decrease mainly seen in the groups for age 35 to 54 years. If we compare this to non-engineering occupations, both in 2010 and 2021, there was a lower proportion of workers in the youngest age group (16 to 24 years) in engineering than non-engineering roles, and also in the over 55's, with workers more concentrated in the middle age groups.

Figure 21: Age distribution of workers in engineering and non-engineering occupations, 2010 and 2021, UK



Source: ONS Labour Force Survey

6. Conclusion

The evidence presented in the report demonstrates that employment in engineering has continued to grow over the recent past. We have seen that the characteristics of engineering jobs have changed, as has the composition of the workforce. This is reflected in the increasingly diverse socio-demographic characteristics of the engineering workforce. The trends over the 2010 to 2021 period clearly signal that the workforce is an increasingly diverse one. In becoming more diverse, engineering is making more use of the talent pool potentially available to it (though women remain under-represented in engineering occupations). But in certain areas the pace of change has been slower than in the workforce as a whole.

While employment has continued to grow over the recent past, the decision of the UK to exit the European Union would appear to have contributed to the slowdown in employment growth, possibly as a consequence of the uncertainty this caused and its resulting impact on investment decisions. Covid-19 then led to a rapid loss of employment in engineering. The speed with which the economy bounces back from Covid-19 and accommodates the changes which resulted from the UK leaving the European Union will determine in large measure whether the long-run trends in engineering employment – and the changes in the socio-economic and demographic characteristics of its workforce – will be re-established.

In thinking about the long-run trends it is worth considering 2 further features of the changes taking place in the structure of engineering employment:

- engineering as an increasingly service oriented activity, as opposed to a production based one (for example, providing services related to design and consultancy, computing services and so on)
- a shift in which employment growth in engineering is becoming increasingly prominent in the south-east of England. Employment growth has fared less well, other things being equal, in what might be considered its traditional industrial heartlands of the Midlands and the north. That said, there remain large concentrations of employment in the north and Midlands.

The above findings have implications for the levelling up agenda. Regional development plans often stress the need to stimulate high wage, high productivity employment with engineering playing a leading role, especially those which have particular concentrations of engineering activity.

In thinking about the future of engineering there is a need to consider amongst other things:

- What will the engineering workforce look like in 10 or 15 years ahead given current trends?
- Are current trends immutable or is there the capacity to change them and, if so, in what way and why?
- What are the critical changes still to be fashioned on the supply-side to improve the provision of skills?
- Are there lessons which can be learned from within the UK or other countries about effectively supporting the supply of skills to engineering?

There are, no doubt, many questions besides these to be answered about the future of the engineering workforce and the skills it will need. By thinking now about the future of engineering, the chances of being prepared to meet future skill challenges will be improved. The questions posed above and the issues that have been raised all point to having a system in place that is able to identify the emerging skill needs of engineering across a wide range of sub-sectors so that the education and training system can respond in a timely manner. It is always likely to be the case that activities such as engineering, which have companies operating at the cutting-edge of technological development, will face skill shortages or gaps of one kind or another. The key issue is to ensure that supply is not so far short of demand that it limits the development of key areas of activity, and increasing the diversity of the engineering workforce will be key to meeting this challenge.