# BRIDGING THE GAP

Socio-economic diversity in the engineering sector: access, pay and progression

The Bridge Group

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Bridge Group research action equality

THE SUTTON TRUST

About the Sutton Trust

The Sutton Trust is a foundation which improves social mobility in the UK through evidence-based programmes, research and policy advocacy.



About the Bridge Group

The Bridge Group is a non-profit consultancy that uses research to promote social equality. They do this by supporting organisations of all kinds with independent expertise, research and practical know-how to enable them to make real and lasting impact on socio-economic diversity and social equality.

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## Executive Summary

- Engineering is a diverse sector and vital to the UK economy. People in professional roles in engineering are more diverse by socio-economic background (SEB) relative to most other comparable sectors. A range of factors contribute to this diversity in professional roles, including: the geographical spread of roles; labour market demands; and individual perceptions of the profession.

- However, while these roles in engineering are relatively more diverse by SEB, the evidence highlights numerous issues in the talent pipeline that create barriers to entry and progression for those from lower SEB.

- For example, the split between students taking 'vocational' and 'academic' routes into the profession has created a two-tier system closely aligned with socio-economic divides, and the profession risks reflecting this stratification. This is because students from lower SEB are more likely to take a vocational route, which confers fewer opportunities for progression, while those from higher SEB are more likely to take academic routes into the profession, which are typically higher status (and often better paid).

- In relation to career progression and pay, while the 'class pay gap' is smaller compared with most other professional sectors, in professional engineering roles there remains a significant gap, and within engineering those from higher SEB are much more likely to progress to higher managerial and professional roles (as defined in the NS-SEC classifications).

- There are several reasons why the 'class pay gap' may be less pronounced in engineering compared with other skilled professions, such as accountancy or law. In the latter, for example, knowledge can be relatively subjective, and this means it can be harder to measure performance on an objective basis. This tends to place more weight on softer skills, such as 'polish', 'confidence' and 'gravitas', which act as proxies for expertise, and which map to social class.

- In contrast, engineering is a relatively technical area. On this basis it can be relatively meritocratic because performance is assessed in relation to more neutral measures of ability and effort. In addition, engineering has perhaps historically been fashioned as less cerebral or 'gentlemanly' than, for example, law or financial services. While these constructions are somewhat wide of the mark, as engineering is a highly skilled profession, its association with 'hand' rather than 'head' can cast a relatively long shadow, continuing to influence perceptions of who 'fits'. This means that the profession has remained relatively open to people from lower SEB.

- However, while these and other factors shape a profession that is relatively socially inclusive overall, the effect of SEB is nonetheless very apparent. Aligned with our wider research on the professions, it is highly likely that early educational advantage along with the ability to develop networks and benefit from informal sponsorship is unevenly distributed, and favours people from higher SEB, the effect of which is amplified when class intersects with gender and ethnicity.

- Overall, this results in a complex situation, exacerbated because engineering is itself a highly diverse sector, with a great variety of job roles and entry routes. The engineering workforce has also been shaped by highly specific historical and geographical factors, and workforce demographics are often the result of tradition and history, as much as they are affected by specific recruitment or promotion practices.

- Our key findings and recommendations are outlined below, drawing on the evidence gathered for this study and considering it in the context of our wider work across a range of professional sectors. The methodology section explains in further detail how we define SEB and what we mean by the engineering 'profession'. We are careful throughout to distinguish between references to this area of the engineering workforce, and when the commentary relates to the whole engineering sector.

*Engineering is a large, diverse sector*

- The engineering sector consists of a wide range of industries, from machinery and equipment, to electronics, transportation, instruments, and related products. In the UK, the term 'engineer' is not protected by law and therefore anyone can use this title. The Engineering Council is the UK regulatory body for the engineering profession and holds the national register for almost 230,000 Engineering Technicians, Incorporated Engineers, Chartered Engineers and Information and Communications Technology Technicians.

- The sector represents a large proportion of the UK workforce, with: 18% of the UK working population based in engineering; at least 15% of the working population in every region in jobs that relate to engineering; and 27% of the 2.67 million registered enterprises in the UK in the sector.

- This report focuses primarily on those in higher managerial and professional roles in the engineering sector. Bridge Group research in other professions has found that this senior layer of the labour market typically has least diversity by SEB relative to working populations in general, and it is where challenges relating to recruitment are often compounded by issues of unequal progression and pay.

*Socio-economic background diversity in engineering and factors contributing to this*

- National datasets reveal aggregate levels of diversity among engineering professionals that are favourable compared with most other professional occupations. For example, recent data from the Labour Force Survey shows that 21% of those working professional jobs in engineering are from lower SEB, compared with just 6% of doctors, 12% of journalists, 13% of professionals in law, 15% of management consultants and 17% of accountants. However, these percentages all indicate low diversity compared with the wider workforce, where 29% are from lower SEB (considering the Labour Force Survey data when this data was compiled).

Several contextual factors contribute to the relatively higher levels of socio-economic diversity in engineering including:

- Geographical distribution: Organisations and opportunities for professional opportunities are more widely spread geographically (and, in particular, are less centred in London and the South East) compared with most other sectors offering highly skilled jobs. In considering the whole sector, for example, fewer than one in six (15%) of engineering jobs are in London, and a high proportion of businesses are located in areas of socio-economic disadvantage.

- The proliferation of Small and Medium Enterprises (SMEs) and the resultant effects on access and progress by SEB: Our earlier research has demonstrated that access and career progression in the professions is often influenced by social and cultural capital – for example networks of family connections, and familiarity with norms associated with language, behaviours and socio-cultural references. SMEs in engineering are geographically widely spread and more likely to be in areas of socio-economic disadvantage. Therefore, the extent of social preferentialism and the 'old school tie' network, that offer specific advantages to those from higher SEB, may be less commonplace.

- Labour market demand: The engineering workforce is vast (approximately one in five employees in the UK works in the sector), and, unusually for a sector this size, demand for labour significantly continues to outstrip supply. In theory this should create opportunities in absolute terms.

- Perceptions and the nature of engineering: As noted in the introduction, engineering is a relatively technical, and therefore potentially more meritocratic, profession compared to others such as law. This is because performance and progression may be less subjectively assessed, and softer signals of talent, often more available to those from higher SEB (such as signalling 'polish' and 'status') may be less relevant in this environment compared with other professional areas that we have researched.

- Initiatives in the sector to advance diversity: There is evidence of increased activity to diversify entry across the sector (and from the third sector and professional bodies), including some interventions focused specifically on SEB. Space here does not permit an exhaustive list, but we highlight work, for example, by the Engineering Academy, Education4Engineering and Inspire Engineering – and the work pioneered by the Sutton Trust through Pathways to Engineering. The outcomes of much of this activity are yet to be evaluated robustly, or are in the process of being evaluated, making definitive conclusions about impact problematic at this stage.

The factors outlined above help to explain why engineering is relatively diverse based on SEB. It is important though to underline that, in engineering, SEB remains an important determinant of career outcomes, and that the sector remains stratified by social class. People from lower SEBs are less likely to progress to the most senior roles.

We explore this in further depth, beginning with the role of educational and training pathways in relation to access.

*Access and educational pathways*

There are multiple routes into engineering, which vary between the four nations of the UK. Engineering careers can take many different routes, to the extent that professional bodies highlight in their advice that it can often be confusing for people to navigate the various options. This complexity amplifies the need for informed and timely careers information, advice and guidance, as highlighted in this section.

- Prior to entering the sector, people typically study at university (sometimes including a sandwich year in industry, with opportunities for sponsorship), or join a higher apprenticeship or degree apprenticeship programme with an employer after Key Stage 5 (learning and earning concurrently). These routes mostly require prior qualifications, at least in mathematics. T-Levels have been introduced as a new route from 2021. These are two-year programmes after GCSE studies, developed in collaboration with employers to prepare people for work, higher education, or an apprenticeship.

- Subsequently, many engineers choose to become professionally registered, meaning that a professional body certifies their skills and knowledge in the relevant job area. There are three different levels of professional registration: engineering technician; incorporated engineer; and chartered engineer.

- Engineering may be considered more accessible compared with other professions. In higher education, for example, engineering affords high average salary outcomes to graduates, and variation in outcomes among engineering graduates also appears to be less subject to socio-economic factors, when compared with other disciplines.

However, the pathway into the sector can still be rocky for those from lower SEB, especially when it comes to the academic route. Despite positive effects on social mobility following graduation, many engineering courses at competitive universities lack diversity by SEB. For example, the subject ranks 13$^{th}$ overall out of the 31 categorised subjects available at university, when considering the percentage of students admitted from lower SEB. There are several factors contributing to this, as outlined below:

- Disparities in GCSE attainment - accessing an engineering degree often requires high attainment at school, especially in numerate subjects. However, there are clear socio-economic differences here, with 44% of pupils eligible for FSM achieving A*-C GCSE in maths, compared with 71% of non-FSM pupils, and in physics, this figure is 8% for FSM pupils compared with 23% for non-FSM.

- Limited access to triple science at GCSE, which is more acute among schools in areas of socio-economic disadvantage, (and which can often be important for access to relevant, competitive university courses). This is compounded by the decline of Design and Technology (also more acute among schools in areas of socio-economic disadvantage) – a subject that is considered key to developing young people's skills and interests in this area.

- Subject choice and attainment gaps persist at A-level, where the availability of, for example, Physics, Design and Technology, and Further Mathematics, is far greater among independent schools and state schools in more affluent areas, and the attainment gap between pupils from different SEB continues at this level of study.

- There has been a significant reduction in resources for careers education, information, advice and guidance, which may have a disproportionate effect on aspirations and awareness relating to professional roles in engineering – particularly considering the diversity of occupations (and associated routes) in the sector, and that delivering short (as opposed to sandwich years, for example) workplace experiences for young people can be challenging in some engineering settings.

- Vocational courses, which offer an alternative pathway into engineering, attract a disproportionately high number of students from lower SEB. The split between students taking 'vocational' and 'academic' routes has resulted in a two-tier system, which is closely aligned with socio-economic divides. Vocational courses at Level 3 are less likely to facilitate entry to higher education, thus potentially limiting later career progression. The net effect is that these structures can often perpetuate, rather than combat, current inequalities by SEB.

- There have been 2,532,700 apprenticeship starts since May 2015 (to end of 2020/21). However, government funding has proved insufficient for the target rise in engineering apprenticeships. Furthermore, on average nearly three in ten (29%) of engineering apprentices do not complete their course (compared with just over a third, 35% of apprentices overall). Apprenticeships are also unequally accessible: widening participation to them is not seen as a deliberate government priority, compared with decades of effort widening access to higher education.

*Progression and pay by socio-economic background*

- Although the engineering profession compares favourably with some other professions with respect to overall diversity, there appears to remain a steep social gradient in career stages towards managerial and professional roles in engineering.

- Disparities in educational attainment are one important factor contributing to the 'class pay and progression gap' between those from higher and lower SEB in engineering, as people from higher SEB are more likely to have higher qualifications and access engineering via the academic route.

- However, there is also evidence of differences in pay after controlling for qualification. In engineering those from higher SEB earn on average £2,483 more per annum compared with those from other SEBs (when controlling for factors including education, geography, gender and ethnicity). This 'class pay gap' is lower compared with many other professions - for example among finance managers (£8,104), doctors (£6,996), and IT professionals (£3,973) - but is nevertheless present.

In considering progression, in engineering almost three quarters (71%) of people in their thirties from higher SEB are in managerial or professional roles, compared with just 39% from lower SEB. The effect of SEB on progression is apparent within groups of the same gender and ethnicity, and can also be exacerbated when combined with these other characteristics.

- Considering ethnicity, for example, White men from higher SEB are 28% more likely to hold a managerial or professional position by the age of 30 to 39, compared with the same group from lower SEB.

- Considering gender, the progression gap is not only more pronounced in engineering compared with many other professional sectors, but is also amplified by SEB, which has a stronger effect on women's progression compared to the effect on men's.

- The class progression gap is most marked in engineering for women who also identify as being from an ethnic background other than White. Those in this population from higher SEB are 70% more likely to hold a managerial or professional position, compared with the same group from lower SEB. This suggests that women from ethnically diverse backgrounds are less likely to progress to these positions and, if they do progress, they are much more likely to be from a higher SEB.

In summary, the overall pattern in the data and wider research indicates that while engineering compares favourably against most other professional sectors in relation to socio-economic diversity and inclusion, there are still inequalities in access, progression and pay – and intersections between identity categories are of great importance.

*What does new primary data tell us?*

Collecting data on SEB is vital to transparency in this area, and to inform and evaluate action – as we have demonstrated in previous studies exploring career progression in other professional sectors, such as law, real estate, technology, and financial services (see the Bridge Group website for research publications).

- The primary data collected for this report revealed that there are challenges encouraging engineering firms to collect and analyse data on SEB. These challenges are partly related to the pandemic (which set in at the beginning of this project and made data collection more challenging).

- Based on our research in diversity and inclusion, large organisations in engineering tend to focus their efforts more heavily on gender or sex-based inequalities. This is based on the perception that this is the most acute problem, and in comparison, there is a widespread belief that the sector has few challenges relating to SEB. There is increasing evidence to indicate that this is not the case, and we return to the central role of data collection in our recommendations.

- Despite challenges, we have collected workforce data from two engineering firms, consulted key sector bodies (6), and interviewed a small sample of the workforce (16), providing important supplementary information.

- It is relevant that one of these firms has a geographically diverse footprint and reflects the wider diversity in the engineering sector, in terms of SEB. In the other, which specialises in higher-end engineering products and has a narrower geographical spread, there is a larger difference between the workforce based on SEB and the national benchmarks. This reminds us once again of the complexity of the sector and of the need to consider organisational context when implementing localised recommendations.

- Across these organisations the patterning of workforce diversity by SEB varies considerably by seniority; at both organisations, people from higher SEB are much more likely to progress to senior roles.

- Additionally, across both organisations, women are more likely to be from higher SEB compared with men, and this is most pronounced in senior roles – where women are deeply underrepresented compared with men overall, but are around 55% more likely to be from a higher SEB (71% vs 46%).

## Recommendations

*For the engineering sector*

1. **Individual firms and engineering professional bodies should collect and analyse data on SEB.** This will enable firms to identify gaps and inequalities in applications, hires, progress and/or retention, allowing them to target initiatives accordingly and monitor progress over time.

   - All engineering firms are advised to follow the best practice guidance on the collection and analysis of socio-economic data in the toolkit published by the Social Mobility Commission, and included in the Sutton Trust's Employer's Guide.

2. Building on this, **regulators and sector bodies should work across the sector to establish a consortium of engineering firms with the main purpose of advancing socio-economic diversity and inclusion.** This approach has been effective in other professional fields, for example Access Accountancy and the alliance of law firms, PRIME. A similar group is being developed in real estate. These consortia bring firms together to standardise the collection (and benchmarking) of data, share and celebrate effective practice and develop collaborative work. There are examples of positive outcomes, including for example relating to work experience (targeting, delivery and evaluation) in Access Accountancy. Adopting a similar approach has the potential to be of great benefit to the engineering sector.

3. **Senior leaders in engineering firms should develop tailored strategic approaches to inclusion and progression in relation to socio-economic diversity.** Our evidence indicates that tangential 'initiatives' to advance socio-economic diversity can have minimal effect (for example, unconscious bias training and affinity groups) Rather efforts should be embedded within team leaders' responsibilities, and considered across an organisation's people strategy, including in processes relating to pay, bonus and reward, performance review, work allocation and client and customer management. The toolkits cited above offer a helpful strategic framework, and also consider where SMEs should focus more limited resources.

4. **Firms should explore in detail the typical progression routes in their workforce, and introduce clear pathways to support mid-career transition from technical/operational roles, to middle or senior level management roles for those from lower SEB.** This transition into senior roles often requires skills, attributes, and sometimes additional qualifications, that are quite distinct from those developed in technical roles. The attributes that begin to matter more as people progress into senior roles can often be more readily available to those from higher SEB, including confidence, gravitas, status signalling and networking.

5. **Strategies to advance socio-economic diversity should connect with efforts to support greater diversity in other areas, including gender and ethnicity.** People do not experience their diversity characteristics in isolation, and the evidence indicates that more

equal progression by SEB is highly likely to have a positive effect in other diversity areas. Understanding these connections in the quantitative data, and through hearing people's lived experiences, will enable engineering firms to adopt strategies for diversity and inclusion that are complementary and mutually reinforcing, rather than in competition.

6. **Engineering firms should look at ways to widen work experience opportunities and insight days for young people, especially for those from lower SEB**. This can be challenging in the sector, because of health and safety concerns (and exacerbated by the pandemic), but we know from research that giving young people a chance to gain workplace insights has a positive effect, especially among pupils from lower SEB, and particularly in sectors where the range of roles and entry routes are expansive. Firms should explore ways that they can engage young people digitally, to complement in-person activities (or substitute for these, where health and safety or other factors are a significant barrier). This would also overcome any geographical barriers (enabling greater access for young people in rural settings, for example) and offer a vital opportunity for sector bodies and regulators to compile, promote and encourage access to these opportunities on-line.

7. **Further research is needed to understand better where there are barriers to access and progression in engineering.** For example, policy changes should be informed by more detailed investigation of the comparative effect of differential access to school subjects among pupils by SEB, and differential attainment levels, on educational progression routes that lead to careers in engineering. Building on this study, more exploration is needed to understand how the geographical patterning of engineering jobs relates to progression rates and pay by SEB, including considering data that is specific to chartered status. The sector should also undertake further qualitative research to hear people's voices in sharing their experiences of working at the senior end of the profession, and the journey there, reflecting on whether, and how, SEB has affected this.

*Lessons from engineering for other sectors*

8. **Across the professions, organisations should identify and share definitions of 'talent' and 'effective performance', which are clear and as objective as possible.** The engineering sector typically benefits, especially at more junior levels, from clear, measurable benchmarks for performance. This precision and transparency is likely to support socio-economic diversity in recruitment and progression, since it reduces the reliance on (or bias towards) attributes that have been evidenced to have little correlation with job performance, but which have been shown in our wider research to be more readily available to those from higher SEB. This may well be challenging in some professions, but all sectors should look at ways to clarify what good performance means, and to ensure promotion and work allocation processes within their sector are carefully considered, transparent, applied consistently, and are fair.

9. **Other professions should look to challenge the perceptions and stereotypes the wider public hold of their sectors.** Engineering benefits from its perception as a more open, attainable, 'blue-collar' profession, despite including many professional roles. Highlighting

diverse routes into other sectors and showcasing where progress has been made on diversity could help to clarify the image of other sectors among young people and the wider population, in turn aiding diversity in recruitment and progression.

10. **Wherever practicable, the professions should look to provide opportunities that are more geographically spread throughout the UK**, to balance the prevailing trend of 'having to move to London or the South East' to get ahead. Engineering benefits from its roles being geographically well-distributed, allowing the sector to access a wider range of talent from across the country. It is highly likely that other sectors could improve their own socio-economic diversity by better distributing roles and opportunities to all parts of the UK, as has been demonstrated for example among leading television broadcasters over the last decade.

## Introduction

Engineering has a relatively strong reputation for social inclusion, compared with other broadly comparable 'highly skilled' professions. However, there remain some questions about the extent to which this inclusive reputation can be supported by evidence, and there are evidently areas where more could be done to address unequal access, progression and pay.

Learning more about socio-economic diversity and inclusion in the sector has two major benefits: first to improve our understanding of why engineering performs relatively well compared to other sectors, which could help efforts to improve inclusion elsewhere and shed light on why barriers to entry and progression persist; and second to help the engineering sector itself to further improve.

Engineering matters. It has a key role in driving economic growth and productivity, generating almost a quarter (21.4%) of the UK's turnover. Engineering constitutes a large proportion of the UK workforce: those working in relevant roles accounted for 19% of all UK employees in 2018.[1]

Socio-economic diversity and inclusion in the sector are also vitally important. In their 2015 analysis of efforts by the professions to improve social mobility, the Social Mobility Commission found that engineering and construction were the least active of large recruiters in this area. The analysis was based on the number of recruiters reporting targeted strategies to address socio-economic differences, and the number monitoring the social background of staff.[2]

The evidence indicates that demand outstrips supply in the sector. One recent study estimates an annual shortfall of 22,000 new engineers,[3] while another suggests a shortfall between 37,000 and 59,000 in meeting the annual demand for core engineers with Level 3+ skills.[4] These shortages are partly attributed by Engineering UK to a lack of awareness of the educational routes into engineering occupations.

One strategy to meet this demand is to encourage a wider pool of new entrants from all socio-economic groups. Such a pool might be better suited to developing creative solutions for the whole population, if the engineers developing those solutions are representative of a diverse cross-section of society.[5] Enhancing socio-economic diversity in engineering would also support the national

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1 Engineering UK (2017). Engineering UK 2017 – The State of Engineering. Available at: https://www.engineeringuk.com/media/1355/enguk-report-2017.pdf
2 Social Mobility Commission (2015). State of the Nation 2015: Social mobility and child poverty in Great Britain. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/485928/State_of_the_nation_2015__foreword_and_summary.pdf
3 Engineering UK (2018). Engineering UK 2018 – The State of Engineering. Available at: https://www.engineeringuk.com/media/156187/state-of-engineering-report-2018.pdf
4 Engineering UK (2019). Key Facts and Figures – Highlights from the 2019 update to the Engineering UK report. Available at: https://www.engineeringuk.com/media/156186/key-facts-figures-2019.pdf
5 Royal Academy of Engineering. (2015). Increasing Diversity and Inclusion in Engineering - A Case Study Toolkit. Available at: https://www.raeng.org.uk/publications/reports/increasing-diversity-and-inclusion-in-engineering

economy,[6] since filling these skills shortages could help to address a significant societal challenge with upward social mobility in the UK.

This report synthesises and analyses what is known about socio-economic diversity and inclusion in the engineering sector, and begins the necessary process of collating new primary data to exploring these matters in greater detail.

We have collected primary data via the surveying of two organisations' workforces (gathering demographic data relating to diversity characteristics using the best practice guides in relation to identifying SEB, and mapping this against location and seniority). We have also consulted key sector bodies and a small sample of employees to begin to understand the lived experiences of those working in the sector.

Our hope is that this study will provoke a wider conversation about access to, and progression, in the sector by SEB, to help identify where efforts could best be targeted to improve diversity and inspire other firms to embark on similar work. Additionally, while there are improvements to be made in the sector, given engineering's relatively high levels of access compared to many other industries, this report also highlights where lessons can be learnt from engineering to be applied elsewhere.

*PATHWAYS TO ENGINEERING*
*The Sutton Trust*

In 2020, the Sutton Trust launched Pathways to Engineering, a programme designed to open opportunities in the sector for young people from lower socio-economic backgrounds, run in partnership with the University of Liverpool and the University of Warwick.

During its pilot, which is ongoing, the programme is supporting 70 students a year through a comprehensive 2-year programme. It is targeted at high-attaining 16-18 year olds from lower SEB, focussing on supporting students to explore a career in engineering and identify the route best suited to their progression, either through a leading university or a degree-level apprenticeship. The programme activities are designed to help them to gain skills, advice and experience to access top jobs. These activities include academic taster sessions, application and admissions support, industry led projects, and insight sessions. This work, alongside other programme evaluation and research, will support the assessment and development of this programme.

6 The Boston Consulting Group (2017). The State of Social Mobility in the UK. The Sutton Trust. Available at: https://www.suttontrust.com/our-research/social-mobility-2017-summit-research/

## Methodology and Definitions

To identify SEB diversity in the engineering profession, and how access, progression and pay contribute to this, we have undertaken two distinct areas of research. The substantive part has been an extensive review of academic literature, policy publications and 'grey literature' relating to policy, practice and evidence. We have also considered national datasets, including Labour Force Survey data and school data, and drawn on previous, detailed research undertaken in this area by the Sutton Trust and the Bridge Group.

The review was prepared initially using keyword searches, and then developed iteratively to follow up on key themes, questions and areas needing further investigation. Our interviews with key colleagues among member bodies and regulators also helped to guide our research. Interviews were undertaken with a small sample of the workforce, using a topic guide that was shaped around the key themes highlighted in the research.

We have additionally collected for the first time anonymous workforce data in the following fields, with the results mapped between data sets to give parity of categorisation in relation to level of seniority.

- Occupational level (seniority)
- Parental occupation at age 14, as outlined in the Sutton Trust Employer's Guide
- School type
- Parental / carer experience of higher education
- Ethnic group
- Gender

In considering educational progression, the focus of this report is on the English system. In categorising people by socio-economic background (SEB) we use the NS-SEC categories as outlined in the Sutton Trust Guide for Employers.[7] In considering the roles that fall within the category of 'professional occupations in engineering', we use roles defined as 'higher managerial and professional' as outlined in the NS-SEC guidance. Information is available on the specific definitions, including a list of the roles within engineering that are within this category, and others, here.

In our work, we avoid where possible the conflation of groups of ethnicities and / or races into homogenised terms, including black and minority ethnic (BAME) or non-White. Where such conflation is apparent, this reflects the source material; or in our own analysis we share the reasons behind this use.

7 The Sutton Trust. (2020). Social Mobility in the Workplace, an Employers Guide. Available at: https://www.suttontrust.com/our-research/social-mobility-in-the-workplace-an-employers-guide/

## Socio-economic background in professional engineering roles and key factors affecting this

In this section, we highlight aggregate workforce data, and identify five key factors that contribute to this in engineering. These are: perceptions of the sector which relate to its historical development; labour market demand; regional distribution; social access; and initiatives in the sector that focus on improving diversity and inclusion.

In the subsequent section, we go on to examine these themes in more detail. We take a lifecycle approach to explore factors influencing access to, and progression in, engineering – and highlight that while engineering fares well in many areas compared with other professional sectors, there nonetheless remain sizeable barriers to those from lower SEB.

To provide an overview of workforce demographics, one historical study found that nearly 20% more engineering professionals come from higher-than-average-income family backgrounds, compared with those from lower-than-average backgrounds (from a cohort born in 1970); whereas the percentage difference for bankers was over 30%; for accountants and journalists it was over 40%; and, for doctors and lawyers over 60%.[8]

More recent studies exploring Labour Force Survey data also suggest the engineering profession is more diverse by SEB compared with many others.[9] For example, one has found that 21% of professionals in engineering identify as being from a lower SEB, compared with just 6% of doctors, 12% of journalists, 15% of scientists and 17% of accountants (see Figure 1 below).

While this may be encouraging, it is important to underline that these percentages indicate low diversity compared with the wider workforce, where at the time of this study 29% are from lower SEB. This is illustrated in the chart below.

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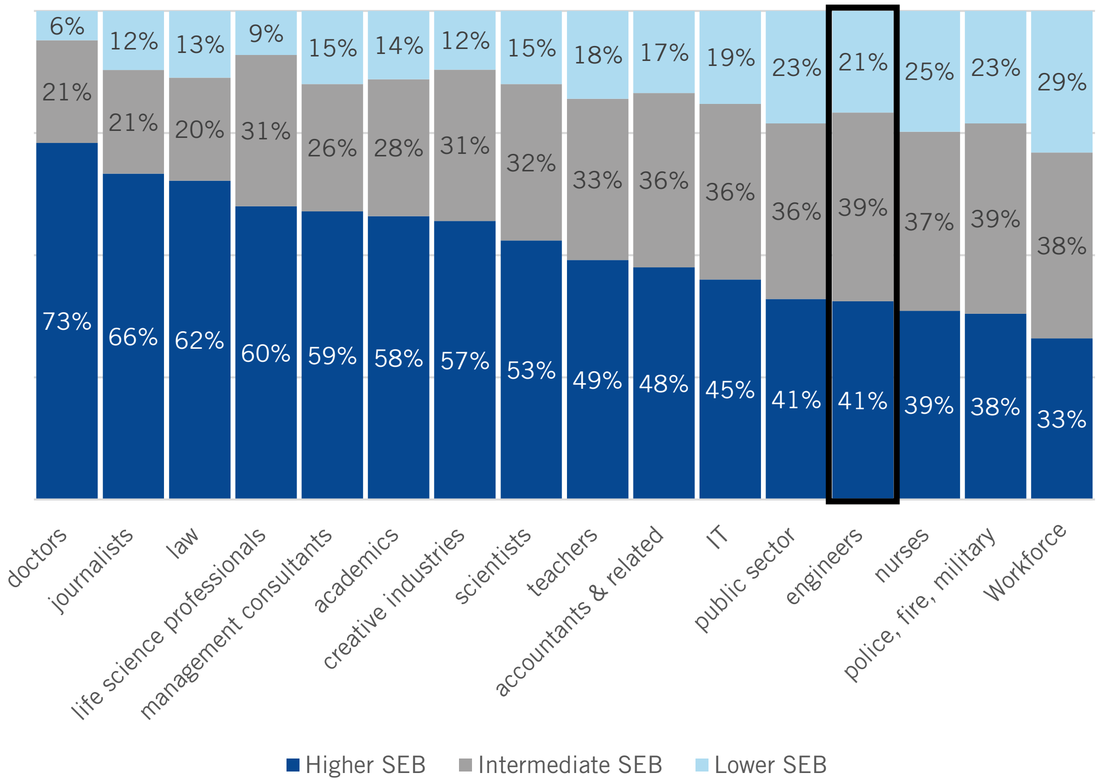
8 Perkin, H. (1990), *The Rise of Professional Society: England Since 1880*
9 Friedman, Laurison and Macmillan. (2017). Social Mobility, the Class Pay Gap and Intergenerational Worklessness: New Insights from The Labour Force Survey. Social Mobility Commission. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/596945/The_class_pay_gap_and_intergenerational_worklessness.pdf

**Figure 1: percentage of professionals by SEB and sector, Labour Force Survey (2017)**[10]




In the commentary that follows, we explore a range of factors contributing to this relative diversity, based on an extensive review of the literature and practice across the sector.

*Perceptions of engineering and the 'professional project'*

Engineering is not typically considered to be an 'elitist' field in the same way as other broadly comparable occupations and professions, such as medicine, law, or banking. There are many reasons why this is the case, but we begin with research that considers barriers to access and progression, originating in both demand-side and supply-side factors, which respectively refer to the decisions made by employers and those made by employees.

There is a vast sociological literature explaining how these factors interact. In brief, on the demand side, hiring managers enact a range of values when they choose who they appoint. In theory, jobs are allocated predominantly based on relevant skills and therefore according to the nature of the work, typically assessed based on qualifications. Given its technical nature, this is relatively likely in engineering and this is one factor making it more meritocratic relative to some other professions (although the notion of meritocracy is arguably undermined, given that access to educational opportunities is not evenly distributed, as outlined elsewhere in this report).

10 *Ibid*

In addition to these relatively neutral assessments of human capital, research demonstrates that jobs are also allocated to match supply with demand, and according to people's values – in other words, stereotypes around who has historically occupied key roles, which contributes to assumptions around who 'fits,' and which can also offer those occupations their status. These assumptions tend to reproduce the status quo but, depending on occupational history, can have variable effects.

For example, certain occupations designated as 'elite' have historically attached their status to 'gentlemanly' signals of respectability and prestige, which are coded as middle or upper-class. As these associations remain relevant today, this drives exclusive recruitment and promotion practices; one profession to which this would apply is the law.

Conversely, engineering has historically been constructed in different and less 'gentlemanly' terms, and while this has afforded it less status, it has on the other hand remained relatively socially inclusive overall. In other words, social class is less likely to be seen as a recruitment signal, and hiring managers in engineering may be less likely to apply preferences for individuals who are upper or middle-class.

In addition to these demand-side factors, on the supply-side, young people from lower SEB may be more likely to consider themselves a more suitable fit for engineering, compared with other professions.

This is because the public attitude towards engineering is that of a highly technical profession, associated with hard hats, construction, and machinery. As part of a study exploring perceptions of the engineering profession, a representative sample of the UK saw engineering as marginally "more 'blue collar' than 'white collar''. Although a distinction was made by the respondents between 'working class' manual work and 'upper class', degree-level, non-manual engineering, the two were seen as part of a continuum, rather than discrete areas of employment.[11]

Moreover, engineering is closely associated with the manufacturing industries that have employed generations of families and communities that are now lower SEB, and may be considered by aspirant engineers more open to socio-economic diversity than other occupations.

While these factors help to explain why engineering is relatively open in relation to SEB, it is important to underline that additional research would be required to test these assertions in further depth, and that there is considerable complexity within the profession, including as it changes over time. For example, earlier research has suggested that as engineering moved towards graduate entry it faced a dilemma in terms of whether to advance perceptions (and progression routes) that emphasise elite status (and thus become more exclusive), or remain open and accessible (and thus

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11 Marshall, McClymont and Joyce. (2007). Public Attitudes to and Perceptions of Engineering and Engineers. The Royal Society of Engineering. Available at: https://www.raeng.org.uk/publications/other/public-attitude-perceptions-engineering-engineers#:~:text=Positive%20attitudes%20towards%20engineering%20tended,problems%20in%20society%2C%20such%20as

risk undermining prestige);[12] We can observe similar debates in other professions, including in some health professions and technology routes. While these stereotypes might suggest engineering is relatively inclusive based on SEB, they may also be off-putting, for example, to women and those from minority ethnic groups.

There is considerable stratification in the sector, but sufficiently granular information is not available to describe this in detail. Notably, as few as 5% of all the estimated 5.5 million people working in engineering have chartered status,[13] and there has been little to no investigation about the SEB of this population.

Finally, it is also possible that young people from lower SEB consider the sector relatively open to them, but that these aspirations are not realised – for example, because subject choices and attainment are both heavily influenced by demographic characteristics. This may in turn limit the opportunities to enter engineering as a profession.[14] Low awareness amongst young people of the range of engineering careers while they are at school means they are less likely to select subject choices that facilitate entry, and they are less aware of the range of professional roles available in the sector.

These issues are considered in further detail below, in relation both to educational choices and to how there may be social stratification *within* the engineering sector.

### *Labour market demand*

Nearly one in five employees in the UK works in the engineering sector, and the demand for more people with engineering skills significantly outstrips supply.[15]

Currently, it is difficult to determine how this impacts the engineering sector. For example, the requirements of engineering for professional credentials may raise barriers for those from lower SEB. Geographic mobility within the UK may also prevent labour supply from meeting demand equitably. Similarly, international immigration may have enabled employers to reach a balance of the skills they need with the salaries offered.

These points require further research, but it is reasonable to assume that the labour shortage may offer one explanation for lower salary gaps based on SEB in engineering compared to other professions.[16]

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12 McCormick, K. (1985). Prestige versus Practicality - a Dilemma for the Engineering Profession. Proceedings of the Institution of Mechanical Engineers, Part B: Management and Engineering Manufacture. 199 (3): 139–44. Available at: https://journals.sagepub.com/doi/abs/10.1243/PIME_PROC_1985_199_059_02

13 Uff, J (2016) An Independent Review Led by Prof John Uff CBE, QC. UK Engineering. Available at: https://www.keatingchambers.com/wp-content/uploads/2017/05/UK-Engineering-2016.pdf

14 Codiroli, N. (2015). Inequalities in Students' Choice of STEM Subjects: An Exploration of Intersectional Relationships UCL Institute of Education. Available at: https://cls.ucl.ac.uk/wp-content/uploads/2017/04/CLS-WP-20156.pdf

15 Randstad. UK Engineering Facing Skills Crisis: Where Are the Jobs? Available at: https://www.randstad.co.uk/career-advice/job-skills/uk-engineering-facing-skills-crisis-where-are-jobs/

16 Crawford, Claire, et al. (2016) 'Higher Education, Career Opportunities, and Intergenerational Inequality'. Oxford Review of Economic Policy 32 (4): 553–75. Available at: https://academic.oup.com/oxrep/article/32/4/553/2236521

*Regional distribution*

In other comparable occupations, many elite organisations are concentrated in London and the South East of England. This requires young people to be physically mobile for them to become upwardly socially mobile. These requirements can be psychologically and practically difficult, such as requiring financial support, including from the 'bank of mum and dad'.[17]

In contrast, the labour shortage in engineering is more evenly spread geographically. Engineering opportunities are also not as concentrated in the affluent areas that other professions are. For example, a small proportion of engineering jobs are in London, which is the base for significant parts of the financial and creative sectors as well as many of the most highly paid roles in other professions such as law.[18] Further research is required to understand how the geographical patterning of engineering jobs relates to seniority and pay, and to prospects for progression.

This proximity of employment opportunities to areas of social deprivation means that engineering offers the potential for those from lower SEB to study and/or train close to home, to find work and affordable housing in the same region and progress professionally. In this way, engineering is potentially a driver of social mobility for whole regions, as well as for individuals.[19]

*Social access*

Access to professions and career progression is often influenced by an individual's social and cultural capital – their network of family connections, understanding of social structures, use of language, and their behaviours. Elitism fosters elitism, both through practiced norms and perceived exclusivity. Engineering may be less susceptible to these barriers than some other professions, as previously detailed.

Building on this, the engineering sector comprises many SMEs. In 2018, 27% of the registered enterprises fell within the "engineering footprint",[20] and these businesses employ 19% of the workforce. Engineering SMEs also constitute a particularly large proportion of the sector in some regions, especially areas of socio-economic disadvantage. As such, although SMEs may be more likely to use personal connections to recruit than larger enterprises, due to being in areas of socio-economic disadvantage, the extent of social preferentialism and the 'old school tie' network may be less commonplace.

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17 Friedman and Laurison. (2019). The Class Ceiling: Why it Pays to be Privileged : Policy Press
18 Bernick, Sandra, Davies. (2017). Industry in Britain - An Atlas : Centre for Economic Performance. Available at: https://cep.lse.ac.uk/pubs/download/special/cepsp34.pdf
19 Donnelly, and Gamsu. (2018). Regional Structures of Feeling? A Spatially and Socially Differentiated Analysis of UK Student Im/Mobility British. Journal of Sociology of Education 39 (7): 961–81. Available at: https://www.tandfonline.com/doi/abs/10.1080/01425692.2018.1426442?journalCode=cbse20
20 Engineering UK. (2019). At a Glance. Available at: https://www.engineeringuk.com/research/engineering-uk-report/at-a-glance-2019/

*Diversity initiatives in engineering*

Initiatives have been created to address the lack of socio-economic diversity in the sector. There is not the scope nor space to share an exhaustive list here, but for example, the Engineering Academy established a Diversity and Inclusion strategy to remove barriers to becoming an engineer. It also addressed the need to create more inclusive cultures that will attract, recruit, and retain more diverse people from a wider range of backgrounds. Such initiatives included setting up a Diversity Leadership group to support increasing inclusion across engineering employment, and the Engineering Diversity Concordat.[21]

Education4Engineering (E4E, a cross-industry group of professional bodies) has designed a 'Fair Access Escalator', which describes four overlapping stages (foundation years, school years, transition years and adulthood) across which corresponding barriers of motivation, education, communication, access, and standards occur. These initiatives are explored in more detail in the section that follows on access to the engineering sector.

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21 See link for more information - https://www.raeng.org.uk/diversity-in-engineering/professional-engineering-institutions/engineering-diversity-concordat

## Education and training routes

These overarching factors contribute importantly to the socio-economic patterning of engineering overall.

However, while the aggregate picture of diversity highlights engineering as favourable compared with other professional sectors, there remain significant challenges within engineering relating to access, pay and progression by SEB.

Key factors in the pipeline to engineering are outlined here, taking a lifecycle approach: beginning with early education, through to access to engineering. The section that then follows explores pay and progression in the labour market.

### *Science capital and the GSCE deficit*

Findings from ASPIRES suggest that those from lower SEB are more likely to show an interest in STEM subjects compared with most other subject areas.[22] However, this does not necessarily translate into appropriate qualifications for a STEM career, unless the child's 'science capital' is built and supported. The notion of 'Science capital' is developed from Bourdieu's ideas of 'social-' and 'cultural capital' as applied to STEM learning, and refers to familiarity with the scientific world, through qualifications, knowledge, interest, or social contacts with those in the field. [23]

Socio-economic disparities are observed in the early stages of GCSEs, particularly in maths and physics, two of the most important gateway subjects for an engineering career. For instance, only 44% of pupils eligible for free school meals (FSM) achieve an A*-C grade GCSE in maths compared with 71% of non-FSM pupils. For physics, which is not taken by all students at GCSE, the figures are 8% for FSM pupils compared with 23% for non-FSM.[24] Further research would help understanding of the relative effects of take-up (that is, the proportion of FSM pupils who study specific subjects) and attainment (that is, the average attainment rates of these pupils) on educational routes to careers in engineering.

### *Limited access to Triple Science*

Some school pupils do not have access to the typical engineering pathway in education. Most pupils who study physics at A-level have previously studied Triple Science GCSEs (Physics, Chemistry and Biology). However, Triple Science can sometimes be offered only to high-achieving pupils, which exacerbates the perceptions of STEM as 'brainy' and 'difficult', thus making them too unappealing to students without science capital.

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22 See link for more information and various reports relating to this research - https://www.ucl.ac.uk/ioe/departments-and-centres/departments/education-practice-and-society/aspires-research
23 Bourdieu (1984). Distinction: A Social Critique of the Judgement of Taste: Harvard University Press
24 Source: Engineering UK. (2018). Social Mobility in Engineering. Available from: https://www.engineeringuk.com/research/briefings/social-mobility-in-engineering/

For example, 58% of students taking GCSE Double Science reported that they were not given the choice of Triple Science nor which science subject they could study.[25] Some schools did not offer Triple Science to *any* pupils, with those not doing so mostly in deprived regions. A recent study highlights that in some areas where incidences of lower SEB are higher, such as North East Lincolnshire, half of secondary schools do not offer Triple Science; whereas in more affluent areas, such as the South-East, it is offered by every school. Only one in four pupils takes Triple Science and they are three times more likely to be from a higher SEB.[26]

### *The Decline of Design and Technology*

Design & Technology (D&T) is another potential pathway into engineering. As a Level 2 vocational school subject, it is sometimes considered the most closely associated with the work of a professional engineer. However, between 2010 and 2017, the numbers opting to study D&T at GCSE fell by 42%. There has been some investigation into this decrease, and the continuation of this trend. For example, the Royal Society of Engineers have advocated this as a vital subject, and there is wider exploration of these trends among Ofsted, and among commentators at the Nuffield Trust.[27]

These factors have led to a perceived decline in standards in the subject, which in turn, has led to a drop in its perceived value as a qualification for further study or employment. This means that the subject becomes a lower spending priority and a negative cycle ensues. As with Triple Science, the decline of D&T is more severe in schools in areas with socio-economic disadvantage where these factors have a disproportionate impact.

### *The narrowing pipeline*

Even though a fifth of all UK jobs are in the engineering sector, by the end of secondary education, the pipeline to fill many of them is diminished. The pool of potential engineers is less socio-economically diverse, and many other STEM careers compete to draw from the same pool. To widen this pool, it is necessary to attract students who may have a qualifications deficit into engineering through alternative pathways, although these non-academic routes are subject to socio-economic barriers of their own. We expand on this critical point in the commentary that follows.

### *Careers education, information, advice, and guidance*

The well documented decline in resources for careers education, information, advice and guidance is likely to have an especially profound effect on young people's awareness of and knowledge about roles in engineering.

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25 Archer, L et al. (2016) Stratifying Science: A Bourdieusian Analysis of Student Views and Experiences of School Selective Practices in Relation to "Triple Science" at KS4 in England' Research Papers in Education 32 (3): 296–315. Available at - https://www.tandfonline.com/doi/full/10.1080/02671522.2016.1219382

26 Archer, L. (2015). *Evidence Briefing: Increasing the Uptake of Science in Schools.* Economic & Social Research council. Available at: https://esrc.ukri.org/files/news-events-and-publications/evidence-briefings/increasing-the-uptake-of-science-in-schools/

27 For an example see - https://theconversation.com/why-has-the-number-of-teenagers-taking-design-and-technology-gcse-dropped-46361

For such a profession to be on a child's radar, they need high-quality careers guidance. However, this is often lacking.[28] Teachers and careers practitioners face challenges in highlighting a career in engineering, including a lack of first-hand experience in the sector. This is likely to be exacerbated because of the broad-ranging scope of occupations which engineering offers, and the various routes available.

The Government's Careers Strategy placed emphasis on contact with employers and workplaces,[29] and this is also a key pillar in the Gatsby benchmarks of good careers guidance.[30] However, in the engineering field, this can be challenging due to health and safety concerns and other logistics issues. This renders engineering businesses less conducive to workplace experiences than other industries, though further research is required to understand the availability of work experience in this area, amid the overall decline in work experience in schools, which has been exacerbated by the pandemic.

### *Efforts to inspire STEM aspirations*

Alongside formal education, the Royal Academy of Engineering has identified over 600 different (and sometimes competing) organisations supporting engineering education and raising science capital through 'informal science learning' (ISL).[31] As in many other sectors, these initiatives are considered to suffer from limited co-ordination between programmes, resulting in duplications and gaps.

There are many examples of effective and robust practice (consider for example Inspire Engineering and the work of the Women's Engineering Society)[32] [33] – but considered more generally, initiatives can inadvertently perpetuate harmful notions about STEM that exclude underrepresented groups through their selection of participants and manner of delivery, [34] and as with many school outreach activities they would often benefit from more clearly defined pupil outcomes and more robust approaches to evaluation.

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28 For example, Holman, J. (2013) *Good Career Guidance*. The Gatsby Charitable Foundation. Available at: https://www.gatsby.org.uk/education/focus-areas/good-career-guidance

29 Department for Education. (2017). Careers Strategy: Making the Most of Everyone's Skills and Talents. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664319/Careers_strategy.pdf

30 Holman, J. (2013) *Good Career Guidance*. The Gatsby Charitable Foundation. Available at: https://www.gatsby.org.uk/education/focus-areas/good-career-guidance

31 Morgan, Rhys, et al. (2016). The UK STEM Education Landscape. Royal Academy of Engineering. Available at: https://www.raeng.org.uk/publications/reports/uk-stem-education-landscape

32 For more information, see - https://tfl.gov.uk/info-for/schools-and-young-people/inspire-engineering

33 For more information, see - https://www.wes.org.uk/content/education-and-outreach

34 DeWitt and Archer. (2017). Participation in Informal Science Learning Experiences: The Rich Get Richer?. International Journal of Science Education (7) 4: 356–73. Available at: https://www.tandfonline.com/doi/abs/10.1080/21548455.2017.1360531?journalCode=rsed20

*Subject options at A-level*

In post-16 education, the pipeline narrows further as differences in science capital continues to affect subject choice. For example, even those who have Triple Science GCSEs may attend schools which cannot offer physics at A-level. This is partly due to a shortage of qualified teachers and low demand to the point that schools cannot afford to offer physics as an option.[35]

Fewer students have also been able to take D&T due partly to: specialist teacher shortage; the cost of materials; health and safety concerns; and other resource implications.[36] However, most fee-paying and academically selective schools and colleges have maintained the choice of Physics, Further Maths A-levels and D&T.[37] As a result, the barriers to progression to a career in engineering disproportionately affect those from lower SEB.

*The attainment gap at Level 3*

The attainment gap between young people from lower SEB and their peers from higher SEB opens before children even start at school and is an issue throughout education. The underperformance of pupils from low SEB backgrounds may hinder their entry into available courses. For example, the Sutton Trust has previously reported that nearly half as many students from low SEB took A-level subjects that provided access to highly selective universities compared to their peers.[38] They were also less likely to take one or more A-level exams in facilitating subjects and gain top grades in these subjects.

*Technical pathways*

Vocational courses offer an alternative pathway into engineering. However, these courses generally attract students from lower SEB,[39] and the split between students taking ‘vocational’ and ‘academic’ routes has resulted in a two-tier system that closely aligns with socio-economic divisions.

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35 Source: Institute of Physics. (2015). School Sixth Forms with No Entries for A-Level Physics: A Data Report Available at: https://www.iop.org/sites/default/files/2019-04/school-sixth-forms-with-no-entries-for-a-level-physics.pdf
36 Source: The Design and Technology Association (2019) A Level and AS Level Results. Available at: https://www.data.org.uk/news/2019-a-level-and-as-level-results/
37 Vidal Rodeiro, C.L. (2019). Popularity of A Level subjects among university students. Cambridge Assessment. Available at: https://www.cambridgeassessment.org.uk/our-research/data-bytes/popularity-of-a-level-subjects-among-university-students/
38 Sammons, P, et al. (2015). Subject to Background: What Promotes Better Achievement by Bright but Disadvantaged Students? The Sutton Trust. Available at: https://www.suttontrust.com/our-research/subject-to-background-disadvantaged-pupils-enrichment-homework/
39 Kelly, S. Reforming BTECs: Applied General Qualifications as a Route to Higher Education. Higher Education Policy Institute. Available at: https://www.hepi.ac.uk/wp-content/uploads/2017/02/Hepi_Reforming-BTECs-Report-94-09_02_17-Web.pdf

Moreover, vocational courses at Level 3 have traditionally been less likely to facilitate entry to higher education, possibly thus limiting career progression and professional recognition.[40] The Sainsbury Review instigated plans for T levels,[41] which aim to bridge the gap by providing technical qualifications – some of which would be relevant to those pursuing an engineering career. These plans can act as either a pathway directly into the workplace or into higher education. However, there is evidence of some scepticism about students' prospects.[42] It is possible that T Levels become seen as a proxy for inferiority (as has been a criticism of BTECs), to therefore represent a new 'low-status' pathway predominantly used by lower-attaining students and those from lower SEB.

Consequently, while it is premature to reach any definitive conclusions, the indications suggest that T-levels in their present form look unlikely to help the engineering industry address the concerns discussed above relating to social mobility, as they may serve to perpetuate barriers, resulting disproportionately in those from lower SEB progressing more slowly in an engineering career. There are also concerns about the extent to which higher education providers will accept T-levels in their admissions processes, with less than half of universities confirming in January 2022 that they will accept T-levels for entry this year, and many Russell Group institutions noting that they will not give parity of consideration to the new qualification.[43]

### *Higher education*

As an area of study in higher education, engineering not only confers high average salary outcomes on its graduates but these outcomes may also be less subject to variation according to socio-economic factors compared with other disciplines leading to professional careers.

For example, the Engineering Professors Council recently presented LEO data analysis to show that median earnings for engineering graduates are the third highest behind Medicine & Dentistry and Economics. Furthermore, data relating to graduates' earnings, backgrounds and entry qualifications indicates that the gap between the incomes of engineering graduates from different SEBs is significantly smaller than for other graduates. The average salary of engineering graduates, ten years after qualifying, is £42,700; this is £11,700 more than the average annual salary of other graduates.[44]

Perhaps even more significantly, the recently published Institute for Fiscal Studies report (prepared in partnership with the Sutton Trust and the Department for Education) analyses data on SEB, education pathways, and adult labour market outcomes, thereby offering the clearest picture available on the ways in which higher education contributes to social mobility. (The study

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40 Source: Engineering UK. (2018). *Social Mobility in Engineering* . Available at: https://www.engineeringuk.com/research/briefings/social-mobility-in-engineering/

41 Sainsbury, David, et al. (2016). Report of the Independent Panel on Technical Education.

42 Dromey, J. (2019). *T Levels: The 5 Big Issues yet to Be Addressed*. Times Educational. Available at: https://www.tes.com/magazine/archived/new-magazine-experience

43 For an example see - https://schoolsweek.co.uk/universities-shun-t-levels-as-ucas-deadline-approaches/

44 Source: Engineering Professors Council. (2021). Engineering Opportunity – Maximising the opportunities for social mobility from studying Engineering. Available at: http://epc.ac.uk/wp-content/uploads/2021/05/Engineering-opportunity_final.pdf

also importantly highlights the limitations of the current approaches to league tables).[45] In considering individual subject areas among the mid 2000s cohort, engineering ranks sixth for social mobility, based on the analysis of access among those from lower SEB, and their success rates, as illustrated in Figure 2 below, from the summary report published by the Sutton Trust.

**Figure 2: Social mobility rate as defined in the IFS study, with the Sutton Trust and DfE[46]**

| | Subject | Mobility rate (Equality: 4.4%) | Access rate | Success rate | Students per cohort |
|---|---|---|---|---|---|
| 1 | Pharmacology | 4.2% | 11.5% | 36.6% | c. 2,200 |
| 2 | Computing | 2.9% | 10.8% | 26.9% | c. 8.500 |
| 3 | Law | 2.2% | 9.9% | 21.9% | c. 9,000 |
| 4 | Economics | 2.0% | 4.7% | 41.9% | c. 6,300 |
| 5 | Business | 1.9% | 8.6% | 22.5% | c. 24,700 |
| 6 | Engineering | 1.9% | 5.6% | 34.0% | c. 9,900 |
| 7 | Maths | 1.8% | 4.3% | 42.5% | c. 6,400 |
| 8 | Medicine | 1.7% | 2.7% | 63.2% | c. 3,700 |
| 9 | Subjects allied to medicine | 1.6% | 5.9% | 27.5% | c. 7,300 |
| 10 | Architecture | 1.4% | 4.7% | 29.6% | c. 3,000 |

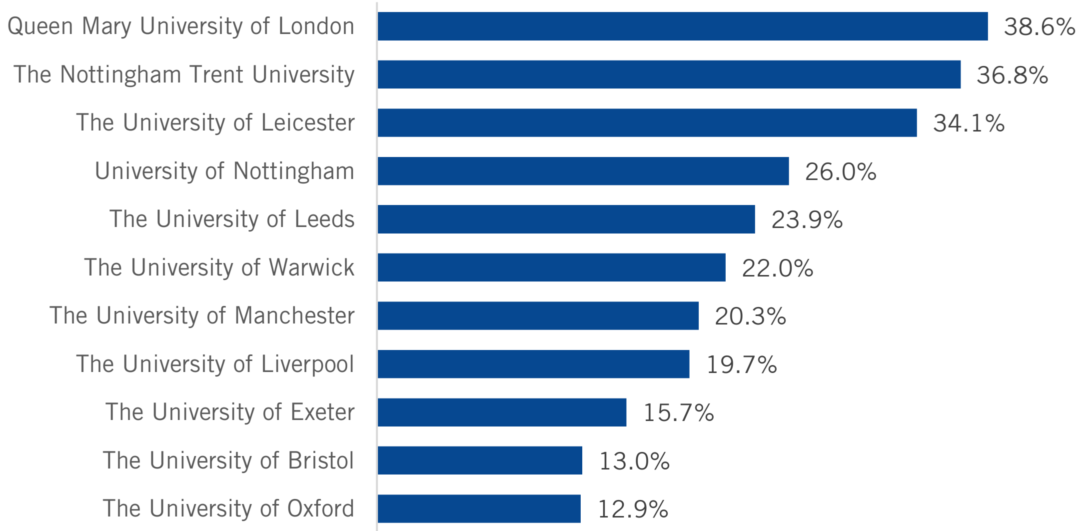
However, despite these positive effects on social mobility following graduation, and during very early career stages, engineering courses at the most competitive universities are still below targets when it comes to achieving more equal admissions. For example, the subject ranks 13th overall out of the 31 categorised subjects available at university, when considering the percentage of students admitted from lower SEB, and there is great variance by institution, as illustrated in the data sample in Figure 3 below.

The proportion of Home students admitted 2017/18 in engineering subjects from lower SEB ranges from below 20% at Oxford, Bristol, Exeter and Liverpool, to over a third at Leicester, Nottingham Trent and Queen Mary University of London.

45 Sutton Trust. (2021). Universities and Social Mobility: Summary Report. Available at: https://www.suttontrust.com/our-research/universities-and-social-mobility/

46 *Ibid.* Green indicates subjects above the median score, red indicates those below.

**Figure 3: Percentage of students studying engineering identified as lower SEB, 2020 graduating cohort by institution**[47]




While Engineering subjects often provide rewarding career paths for students, there also remains distinct geographical variability in admissions. For example, in a recent study 35.5% of full-time Engineering students are from POLAR4 quintile five (being resident in an area where participation in higher education is highest) and just 9.6% are from quintile one (being resident in an area where participation in higher education is lowest). Benchmarking against other subjects shows that Engineering courses admit a higher proportion of students from quintiles four and five than the average for all subjects, and a smaller proportion of students from quintiles one, two and three.[48]

Furthermore, once at university students from lower SEB can face continued barriers. For example, across all higher education institutions, 8.9% of Engineering students from quintile one do not progress to the second year of their studies, compared with 4.3% from quintile five.[49]

### *Apprenticeships*

From May 2015 to the end of the 2020/21 academic year, there have been 2,532,700 apprenticeship starts.[50] However, government funding has proved insufficient for the target rise in engineering apprenticeships.[51] Considering national achievement rates, on average over a third (35%) of apprentices have not completed their qualification, though relative to other areas, engineering does have lower non-completion rates at 29%.

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47 Primary analysis drawn from HESA data. JACs 2.0 *(H) codes, HOME admitted 2017/18. Disadvantaged marker is a compound marker comprising of lower SEB parental occupation rankings OR POLAR3 Low Participation Neighbourhood AND state school.

48 Bullough, T. (2019). From Admission through progression to Graduation: UK UG Engineering Students' demographics and qualifications. Presentation for the Engineering Professors' Council. And from UCAS applicant data (2018)

49 Ibid

50 From Gov.UK (2021). See link for more information - https://explore-education-statistics.service.gov.uk/find-statistics/apprenticeships-and-traineeships/2020-21

51 Evan, S. (2019). *The Apprenticeship Levy Is Set to Run out. Changes Are Needed*. Times Educational Supplement. Available at - https://www.tes.com/news/apprenticeship-levy-set-run-out-changes-are-needed

Apprenticeships are not necessarily accessible, since widening participation at this level is not seen as a deliberate government priority compared to widening access to higher education.[52] The barriers to entry reflect those in other workplaces, such as entry criteria, low pay, and confusion around the benefits system.[53]

It is evident that reforms have not delivered radical change in social mobility.[54] There is further Sutton Trust research which highlights that among those commencing degree level apprenticeships in 2018/19, those choosing engineering were less diverse by social background than other sectors, based on analysis using the Indices of Multiple Deprivation (IMD).[55] For example, 29% of those participating in engineering degree apprenticeships were from the lowest two quintiles based on IMD, compared with 32% in accounting and finance, and 36% in law and legal services.[56]

For those that do successfully complete apprenticeships, the employment outcomes, both in terms of progression into relevant employment and in terms of earnings, have been positive. However, it is unclear whether this is leading to social mobility. Exploring the evidence compiled in the 2020 report from the Social Mobility Commission on apprenticeships,[57] those in the fields of construction, engineering, ICT, and business & law are all associated with longer planned duration, above-average wages and post-completion earnings. In considering SEB, pupils from lower SEB are disproportionally gathered in low-paying subject areas, particularly at advanced and higher levels. Only 5.6% of starts at advanced and higher level in engineering were by learners from lower SEB.

Importantly, given that apprenticeships continue to offer a useful pathway into the profession, and bearing in mind the current skills shortages, progressive reforms in this area could prove beneficial toward social mobility.

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52 Learning & Work Institute. (2019). Three Million Apprenticeships: Building Ladders of Opportunity. Available at - https://www.voced.edu.au/content/ngv%3A75623

53 Anderson, K, et al. (2010). Opening the Door to Apprenticeships - Reaching Young People Who Are Disadvantaged and Disengaged from Apprenticeships. The Young Foundation. Available at - https://youngfoundation.org/wp-content/uploads/2012/10/Opening-the-door-to-apprenticeships-February-2010.pdf

54 Fuller, A, et al. (2017). Better Apprenticeships: Access, Quality and Labour Market Outcomes in the English Apprenticeship System. The Sutton Trust. Available at: https://www.suttontrust.com/our-research/better-apprenticeships-quality-access-social-mobility/

55 Cullinane and Doherty. (2020) *Degree Apprenticeships: levelling up?*. The Sutton Trust. Available at: https://www.suttontrust.com/our-research/levelling-up/

56 *Ibid*

57 Social Mobility Commission. (2020). Apprenticeships and Social Mobility – fulfilling potential. Available at: *https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/894303/Apprenticeships_and_social_mobility_report.pdf*

## Career progression and pay by socio-economic background

There has been a modest range of research relating to progression and pay in the profession, including analysis of the Labour Force Survey data, conducted by Engineering UK. In this section we explore the key findings, and present our primary research with two organisations.

Looking across elite professions as a whole, extensive work on the 'class ceiling' finds that the children of those from lower SEBs working in many sectors experience a significant pay gap throughout their career.[58] Those from lower SEBs who are in the professions are shown to earn £6,800 less compared with colleagues from higher socio-economic backgrounds (with this gap upheld, at £2,224, when controlling for various factors including education, occupational area and location).

In considering those who are short and long-range socially mobile from lower and intermediate SEBs (with the controls outlined above in place), the gap is more pronounced in some professions. For example, among finance managers it is £8,108; for doctors it is £6,996 and among IT professionals it is £3,973. Among engineering professionals, there is a smaller, but nonetheless significant pay gap of £2,483. These findings are all statistically significant.

When it comes to progression, statistics suggest a mixed picture in engineering. On the one hand, the profession is more equal compared with many others in this respect. For example, in engineering, 39% of those in their thirties from lower SEB are in managerial or professional positions, compared with 33% across the wider labour market.[59]

However, we observe a steep social gradient in the latter stages of career progression within engineering. In short, those from higher SEB are more likely to progress into senior professional roles. There is clear stratification in the Labour Force Survey data analysed by Engineering UK, with far less diversity by SEB in senior roles in engineering. This is outlined in the illustration below, for example, the percentage of people aged 30-39 in engineering occupations from higher SEB who are working in managerial and professional roles is 71%, compared with 63% among all other occupations.[60] These findings provide helpful context as we explore the primary data that has been collected.

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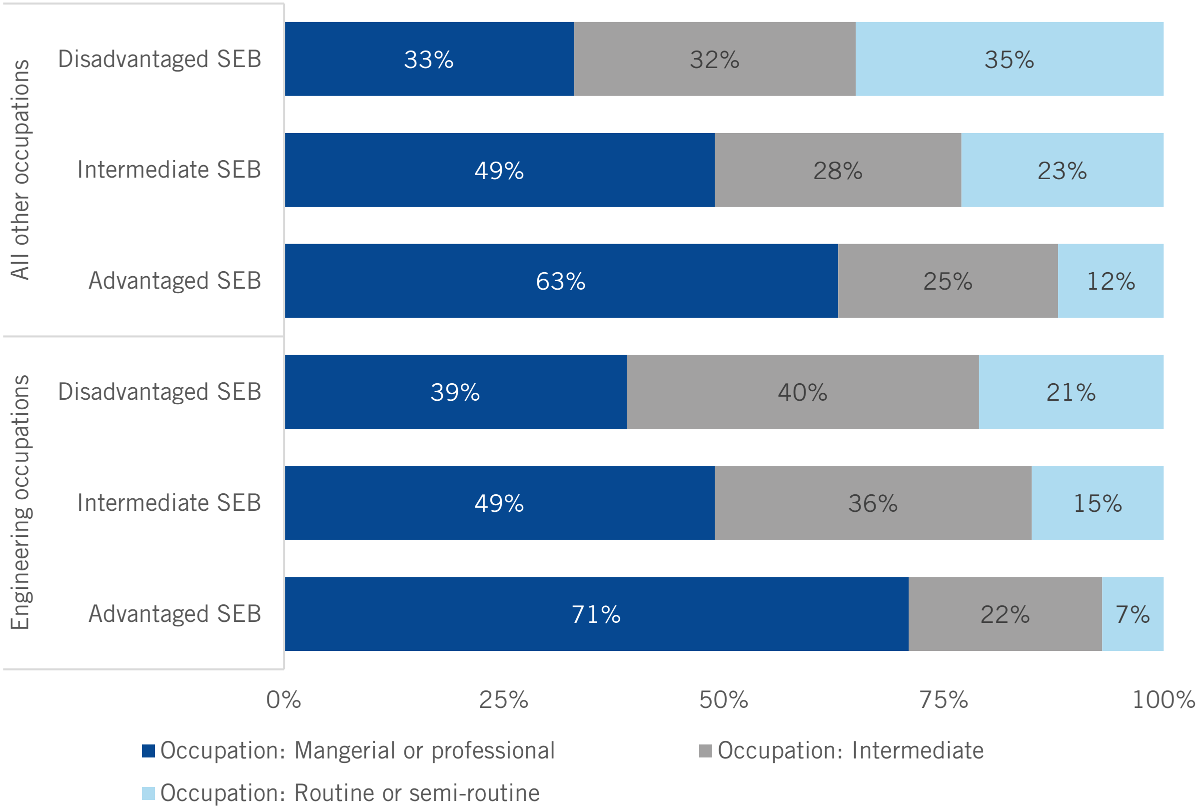
58 Friedman, Laurison and Macmillan. (2017). Social Mobility, the Class Pay Gap and Intergenerational Worklessness: New Insights from The Labour Force Survey. Social Mobility Commission. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/596945/The_class_pay_gap_and_intergenerational_worklessness.pdf
59 *Ibid*
60 Labour Force Survey 2017, Quarter 3, Office for National Statistics. For more information see - https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/uklabourmarket/november2017, and In Engineering UK (2018). Engineering UK briefing - Social Mobility in Engineering. Available at: https://www.engineeringuk.com/media/1762/social-mobility-in-engineering.pdf

**Figure 4: percentage of people aged 30 to 39 in each occupational class, by social background and engineering occupational marker. Labour Force Survey (2017).**[61]




*Presentation of new data*

Overall, when viewed against a wider backdrop of very significant social mobility challenges in the UK, the evidence presented here suggests that engineering is a sector in which people from lower SEB may experience *fewer* barriers than in other professional careers. However, engineering is a large and diverse sector, and it is possible that there are class-based differentials and social stratification internal to the profession which have been missed in large-scale, sector-wide, surveys.

Engineering's reputation for being relatively socially diverse may also mean that barriers to access and progression are not sufficiently recognised or understood. Further research would address these issues by providing more granular information on patterns of entry and career progression based on both qualitative and quantitative research.

As part of this mission, a wide range of engineering firms were contacted to participate in a data collection exercise for the current study, to improve our understanding of the patterning of the

61 Engineering UK briefing - Social Mobility in Engineering. Available at: https://www.engineeringuk.com/media/1762/social-mobility-in-engineering.pdf

workforce by SEB, and progression rates. However, gaining participation from firms has been challenging. This may have been compounded by Covid-19, and associated practical difficulties of collecting data, but resistance to taking part in this study across the sector is also highly likely to reflect a lack of existing awareness of SEB as a diversity issue within the sector.

Here, we present the headline findings from two firms we were able to work with, with the expectation that this will open wider debates within the sector. One of the key recommendations from this work is that more comprehensive data needs to be collected in relation to SEB, exploring not only outcomes but also including qualitative evidence of people's experiences progressing in the sector. Our hope is that this study will be the foundation for a consortium of engineering firms coming together to consider this important topic in collaboration, as has previously been implemented by accountancy and financial services.

Quantitative data was collected from across two employers (a total of 823 employee responses), with questions relating to:

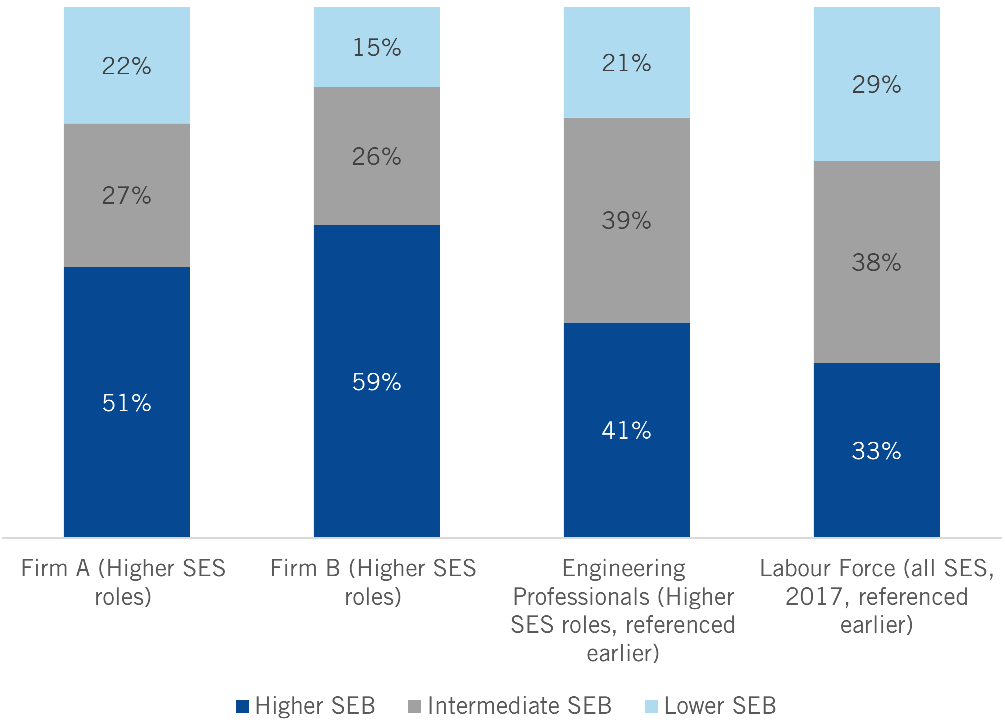
- SEB against the three recommended indicators in the Bridge Group and Social Mobility guidance (see earlier section) and as outlined in the Sutton Trust guide for employers;
- gender;
- ethnicity; and
- seniority mapped to the NS-SEC categories

We also consulted key sector bodies (6) and interviewed a small sample of the workforce (16), providing important supplementary information, to understand some of the factors affecting progression, which have helped inform our recommendations.

Clearly these are very modest sample sizes, for reasons highlighted above, and we should therefore not extrapolate too much from our analysis. However, despite this small sample, the commentary that follows will hopefully give organisations and the sector a useful flavour of the approaches that can be taken, to inspire others to collect and share their data, enabling increasingly robust findings to be considered.

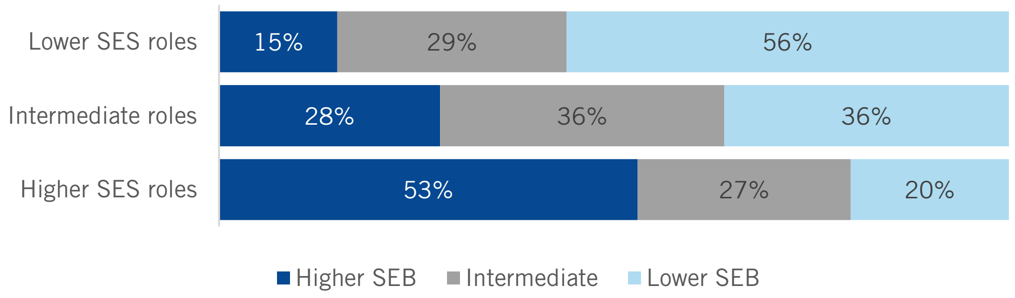
In this first illustration, we look at the SEB of those working in managerial and professional roles (higher SES) at each of the organisations. While both firms are less diverse compared with the national benchmarks, we find that Firm A, which has a geographically diverse footprint, reflects more closely the wider SEB diversity of engineering professionals (but unrepresentative of the wider workforce). In Firm B (specialising in more high-end engineering products and with a less diverse geographical footprint), there is a greater difference between the workforce based on SEB and the benchmarks.

**Figure 5: SEB in higher SES roles in two participating firms and national benchmarks**



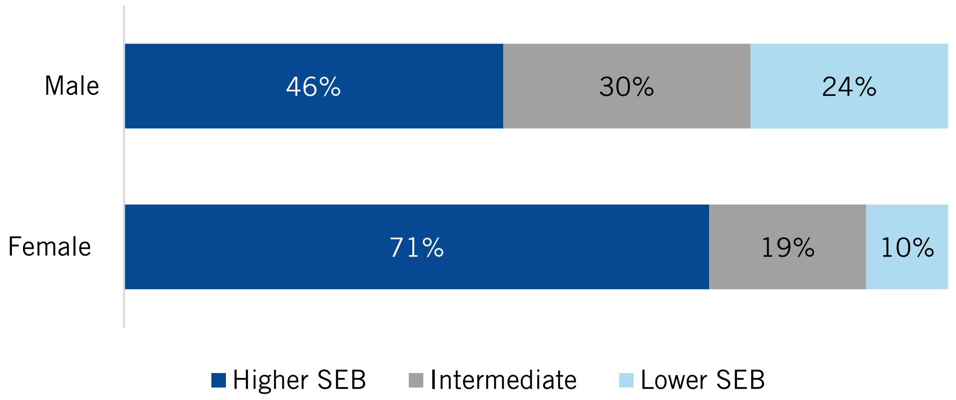

In the second piece of analysis, we consider the whole workforce sample across the two organisations. The chart illustrates that those in higher SES roles (managerial and professional) are more likely to be from higher SEB (almost twice as likely compared with those in mid-level roles - 53% vs 28%) whereas 15% of those in lower SES roles are from this background. This is suggestive of challenges relating to progression, whereby socio-economic diversity decreases as seniority increases.

**Figure 6: proportion of workplace sample by SEB and occupational class**




In this third piece of analysis, we look at the relationship between SEB and gender across the workplace. When we consider those in higher SES (managerial and professional roles) across the two firms, we find that 76% are occupied by men, and that the SEB background differences are accentuated. Women are significantly under-represented overall compared with men, but where they do hold professional occupations in the sector, they are much more likely (71% vs 46%) to be from higher SEB compared with men.

**Figure 7: proportion of workplace sample (in higher SES roles – managerial and professional) by SEB**




This descriptive data begins to suggest that progression by SEB is unequal, even if pay gaps highlighted across the sector are less prevalent. It also begins to point towards important relationships between SEB and other diversity characteristics. We build on this latter point in the section that follows, then consider the range of findings here in the context of the pandemic, and finish by sharing concluding remarks to support and build on the recommendations in the opening of this study.

*Socio-economic background in relation to gender and ethnicity*

While the focus of this review is on SEB, inequalities relating to gender and ethnicity should also be considered. With respect to the former, according to analysis of the Labour Force Survey, just 12% of those working in engineering occupations in 2016 were women, compared with 47% of the overall UK workforce. This proportion was even lower when considering just those working in engineering occupations within the engineering sector, at 9%.[62]

With respect to ethnicity, 8.1% of engineering workers are from ethnic minority groups, compared to 12.7% in non-engineering sectors, and 12.2% of the broader population.[63]

Among UK domiciles who had undertaken a first degree in engineering full time and found employment six months after graduating, 73% of employed White graduates went into the engineering sector in 2014/15, compared with 58% of ethnically diverse graduates. This proportion was particularly low among graduates who identified as Black (50%). These findings are consistent with those of the Royal Academy of Engineering (RAENG), which found that even after controlling for such factors as degree attainment, employability outcomes for BME graduates studying engineering are weaker than for White graduates.[64]

Research in workplace inequalities is also increasingly investigating the impact of intersections between different social identity characteristics. There is limited data on this subject in engineering but evidence from other occupations suggests that where identities intersect, this could contribute to complex patterns of advantage and disadvantage, which are contextually specific. Again, whether these trends are replicated in engineering requires further investigation, including exploration of organisational and sector level data looking at the relationship between intersecting identity characteristics including SEB, with access, pay and progression.

In considering progression in the available data, controlling for gender and ethnicity, those from higher SEB are still 40% more likely to achieve an intermediate, managerial or professional position in engineering, compared with those from lower SEB.[65] Socio-economic background has a clear effect on people's prospects in engineering. And these differences in pay and progression can also be exacerbated by other characteristics, including gender or ethnicity, as highlighted in the recent Engineering UK report.

While women across all social classes and ethnic groups are less likely than men to achieve a position in the higher occupational levels of any sector, the situation is particularly dire in engineering. Accounting for the effects of ethnicity and socio-economic background, men in their thirties in engineering careers are more than eight times more likely compared with women

62 Engineering UK (2018). Engineering UK briefing - Gender Disparity in Engineering. Available at - https://www.engineeringuk.com/media/1691/gender-disparity-in-engineering.pdf
63 Source: Engineering UK. (2018). Synopsis and Recommendations. Available at: https://www.engineeringuk.com/media/1576/7444_enguk18_synopsis_standalone_aw.pdf
64 Royal Academy of Engineering. (2017). Key Facts for Diversity and Inclusion in Engineering. Available at: https://www.raeng.org.uk/publications/other/dilg-key-facts-for-di-in-engineering
65 Engineering UK (2018). Engineering UK briefing - Social Mobility in Engineering. Available at: https://www.engineeringuk.com/media/1762/social-mobility-in-engineering.pdf

to be in an intermediate, managerial, or professional occupation; the same figure comparing men and women in other sectors is less than two.[66]

Furthermore, socio-economic background has a stronger effect on progression for women compared with the effect on men - and especially among those from an ethnic background other than White. The class progression gap among those in their thirties in engineering is smallest for White men (a 28% difference between those from higher SEBs in intermediate, managerial or professional backgrounds compared with those from lower SEBs) and largest for women of ethnic backgrounds other than White (where the same figure is 70%).[67]

In the penultimate section that follows, we consider this in further detail by exploring the wider evidence around key challenges and opportunities for engineering in this area. We then share our final reflections in the conclusion.

66 Ibid
67 Ibid

## Challenges and opportunities in relation to progression

In this section we expand on the complex picture of progression within the sector, combining research conducted for this study with evidence from our wider work in other sectors. This highlights that there are several factors that contribute to unequal progression to senior roles by SEB in engineering.

In some sectors, there is a generalised assumption that junior professionals starting in technical roles experience a relatively straightforward and linear route into more senior managerial and professional roles, and that promotion and progression of this type is likely to be based on neutral measures of performance. In practice, this relationship is significantly more complex, as a range of subjective factors influence how performance is measured. For example, in our property sector research published in late 2019 and in our report on SEB in technology roles in 2020, we found that those in their mid and later career were often assessed on more subjective factors, compared with the more objective and technical skills that were assessed in the early stages of their career.[68]

This is also true in other professional roles such as accountancy, where in junior and mid-career, progression is more obviously available based on *what* people know, whereas promotion to the most senior roles, including partner, relies more heavily on *who* they know. In other words, at this point, networks with colleague and clients become vital, and these networks are likely to be more readily available to people from higher SEB.

Similarly, for some engineering jobs, an important factor contributing to lower upward mobility in mid-career is likely to be the changing nature of the range of skills, knowledge and attributes that are typically required for progression. It can take, for example, around four years or more to obtain qualified status, and around another fifteen years to develop expertise in a specific area. At this early to mid-career stage, progression can take place on a relatively technocratic, and thus more meritocratic, basis.

However, as engineers seek to progress into higher management and professional roles, 'softer' skills are likely to become more important in securing these roles, especially in larger organisations – for example, networks, exhibiting confidence and gravitas, and signals of status. These are all attributes which we know, from our own research and other academic studies, are typically more available to those in the workplace from higher SEB.

We have already noted that the engineering sector is socially stratified by SEB, and this can be partly explained by exploring entry routes. Overall, engineering is the profession where the diversifying of entry routes has been most progressive, for example through apprenticeships and now via T-levels. However, as discussed, it is still unclear whether these entry routes offer parity of 'potential for progression' compared with graduate entry routes, for example – and there is a risk that these qualifications can perpetuate inequalities, since they can separate people in the talent pipeline largely along socio-economic lines. This also affects opportunities for training and

68 For more information see - https://www.thebridgegroup.org.uk/research

development mid-career, and influences ways in which talent is identified by organisations as people progress, perhaps in relatively less neutral ways.

As noted above, there is also often a perception among engineering firms that SEB diversity is not a problem in the sector, echoing again the Bridge Group research in the property sector, where these perceptions can persist despite clear evidence to the contrary. This can stall action, and the collection of data, which could reveal where challenges lie, might feel less urgent, limiting in turn the likelihood that interventions are developed to support more equal progression.

Ultimately, while engineering is more socially inclusive in quantitative terms compared with most other professional sectors, there are still challenges relating to socio-economic diversity and inclusion throughout the pipeline, and these challenges are most acute in progression to senior roles. Further data would address these issues by providing more granular information on patterns of entry and career progression based on both qualitative and quantitative research. This may also have the positive effect of offering further learning to other sectors about how they can achieve greater diversity by SEB, including in relation to progression.

## Conclusions

The Sutton Trust and the Bridge Group have contributed significantly to evidence that access and career progression in many professional occupations is unequal based on SEB; and that this in turn contributes importantly to low rates of social mobility in the UK.

Engineering in the UK matters. Those working in the sector shape the world we live in, and how we interact with it. Engineers inform many of the ways in which our society is changing. Most of today's services and products have a strong element of engineering, with people's lives affected deeply by innovation, design, and manufacture.

The Inter-departmental Business Register reveals that the sector represents a large proportion of the UK workforce: 27% of the 2.67 million registered enterprises in the UK are in the engineering sector, and 18% of the UK working population work in engineering. At least 15% of the working population in each and every region are in jobs that relate to engineering.[69]

While there are positive signs that access to the profession by SEB is more positive relative to many others, and there are learnings from engineering for other sectors, there remain barriers at entry level within the industry, and additional challenges relating to progression to the most senior roles.

The composition of the UK workforce is changing, with continued demand for high and low skilled occupations but a notable decrease in demand for middle skilled workers, creating an hourglass shaped economy. There is a considerable shortage of appropriately skilled workers in the engineering sector. The top drivers of the skills gap reported by employers include strong competition for skilled candidates, a shortage of applicants with appropriate qualifications, and a lack of awareness among young people of the educational routes into engineering occupations.

At present, the impact of Covid-19 on access to the engineering sector is not clear, and it is also unlikely to be entirely consistent. For example, it is possible that job losses and recession could contribute to fewer graduate opportunities, and apprenticeships which are an important route into the sector could be undermined. Rates of access to higher education could also be affected, and over the longer-term, the negative impact on educational opportunities because of the pandemic could have a more significant effect on young people from lower SEB, in turn affecting labour market outcomes, including in engineering. On the other hand, it is possible that jobs are created, as engineering graduates are increasingly required, for example, in medical engineering and related science and technology.

Some evidence is available on the impact of the pandemic on engineering. For example, a survey of 11 to 19 year olds conducted by Engineering UK in 2020 found that for many young people the pandemic had raised concerns about the future and their opportunities, and affected how they

69 Engineering Council. (2020). Mapping the UK's Engineering Workforce. Available at: https://www.engc.org.uk/media/3466/mapping-the-uks-engineering-workforce.pdf

approached their careers, as job security and availability had become more important than ever.[70] One finding was that young people were more interested in a career in STEM, yet interest in engineering careers was more limited compared to science and technology. This is despite the fact that young people were aware that engineers have played an important role in efforts to combat the pandemic. However, as with the impacts of the pandemic more widely, the long term effect of the pandemic on the engineering sector will not be clear for some time.

There was a noticeable lack of submissions from engineering firms to the latest Social Mobility Index, which was published in autumn 2021.[71] This study builds the foundation for creating a renewed effort among engineering firms to focus on this topic – for reasons of equality and because of the business case for action. There is also, within the sector, a strong focus on gender equality, without much understanding about how this relates to SEB. We find important intersections between SEB and other diversity characteristics, most notably gender and ethnicity – and our evidence indicates that a greater focus on SEB would also progress these other areas.

We have brought together here the latest evidence and augmented it with additional primary research with two engineering firms, before making practical recommendations for how the sector can progress its work in this area. This includes the more robust collection of data, consortium working, greater inclusion and progression routes to senior roles, understanding better the relationship between SEB and gender, and celebrating more loudly what is already effective, within and beyond the sector. Based on these findings, further work is needed to support individuals in their career progression once in the profession.

This work draws and builds on the Sutton Trust programme of research and programming in this area, alongside the work of the Bridge Group, and provides another important step in the right direction, offering a foundation on which to focus in more detail on progression in the sector.

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70 Engineering UK. (2020). Young people and Covid-19: How the pandemic has affected careers experiences and aspirations. Available at: https://www.engc.org.uk/media/3466/mapping-the-uks-engineering-workforce.pdf
71 This is run by the Social Mobility Foundation. For more information see - https://www.socialmobility.org.uk/wp-content/uploads/2021/11/Social-Mobility-Employer-Index-2021.pdf

The Sutton Trust
9th Floor
Millbank Tower
21-24 Millbank
London, SW1P 4QP

T: 020 7802 1660
F: 020 7802 1661
W: www.suttontrust.com

Twitter: @suttontrust