

Written Evidence Submitted by the National Engineering Policy Centre  
(NEPC)  
(DIV0088)

**Summary**

Engineers shape the world around us – enhancing almost every aspect of our everyday lives. It is imperative that they reflect the society they serve and that engineering careers are open to all. Yet engineering has a serious lack of diversity and a vast inclusion deficit. Just 16% of engineers are women and 10% are from minority ethnic backgrounds. The challenge is enormous.

To achieve the goal of a world-leading and truly inclusive engineering workforce in the UK we need to increase both the numbers and the diversity of those choosing engineering careers. We do not have enough young people studying physics, maths, engineering, and computer sciences and there are chronic shortages of specialist teachers in those subjects. There are not enough young women and girls and those from minority ethnic communities entering the profession.

The failure to diversify the engineering profession has significant implications for the nation's future skills needs. It denies those with the potential to become engineers the opportunity to do so, it reduces both the size and quality of the talent pool to work in the engineering sector and it increases the risk that manufactured products and services are not designed to serve a diverse population.

**About the National Engineering Policy Centre**

We are a unified voice for 42 professional engineering organisations, representing 450,000 engineers, a partnership led by the Royal Academy of Engineering. We give policymakers a single route to advice from across the engineering profession. We inform and respond to policy issues of national importance, for the benefit of society.

This response has been jointly worked on and approved by the following NEPC members:

- BCS, The Chartered Institute for IT
- Chartered Institute of Plumbing and Heating Engineering
- Engineering UK
- The Engineering Council
- The Institute of Acoustics
- The Institute of Measurement and Control
- The Institute of Physics
- The Institution of Agricultural Engineers
- The Institution of Chemical Engineers
- The Institution of Civil Engineers
- The Institution of Engineering and Technology
- The Institution of Gas Engineers and Managers
- The Nuclear Institute
- The Royal Academy of Engineering
- The Society of Operations Engineers

## **1. The nature or extent to which women, ethnic minorities, people with disabilities and those from disadvantaged socioeconomic backgrounds are underrepresented in STEM in academia and industry**

Engineering has a significant skills shortfall, and a serious diversity deficit – women and minority ethnic groups remain vastly and unacceptably under-represented across the broad spectrum of engineering and technician roles.

The data below, and the focus of this submission from the NEPC, is on the engineering profession as a whole. Several NEPC members will submit supplementary evidence to the inquiry separately on the participation of women and minority ethnic groups in their sectors of the engineering profession.

EngineeringUK will also submit evidence separately to this inquiry with data on women, socio-economic representation, and ethnicity in STEM with data on schooling and the engineering workforce. Please read this submission in conjunction with theirs. In addition, the Hamilton Commission report, *Accelerating Change: Improving Representation of Black People in UK motorsport*<sup>1</sup>, produced in partnership with the Royal Academy of Engineering, contains extensive data on the representation of participation and attainment in STEM subjects at GCSE, A-level, apprenticeships and further education, and higher education for young Black people.

### **Gender**

In terms of gender diversity, we have a fundamental challenge to attract more girls into engineering careers.

At A level, only 38.9% of the cohort are young women for maths, 23.2% for physics and 14.7% for computing<sup>2</sup>. Women make up only 16% of the engineering undergraduate cohort<sup>3</sup> and an even lower proportion of engineering apprenticeships (young women comprised 11% of total engineering related apprenticeship starts<sup>4</sup>), despite the fact they outperform boys in both maths and physics at GCSE and A level. Of particular concern is the fact that the proportion of women choosing to study engineering at university has hardly changed in decades. Changing girls perceptions around who engineers are and what they do as they make career choices in school is one of the key challenges for the engineering profession.

Progression into engineering occupations for men and women engineering graduates is similar (52% vs 49%).<sup>5</sup> Unemployment has consistently been lower amongst women than men engineering graduates (4% compared with just under 7%, respectively).

As of mid-2021, women comprise only 16% of those working in engineering occupations, across all industries<sup>6</sup>. Although this figure has increased from 12% in 2018, the

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<sup>1</sup> <https://www.hamiltoncommission.org/the-report>

<sup>2</sup> JCQ. 'GCE A Level & GCE AS Level Results Summer 2021', 2021.

<sup>3</sup> Engineering UK 2018: The state of engineering, [www.engineeringuk.com/media/156187/state-of-engineering-report-2018.pdf](http://www.engineeringuk.com/media/156187/state-of-engineering-report-2018.pdf)

<sup>4</sup> Engineering UK 2020: Educational pathways into engineering, 2020.

<https://engineeringuk.com/media/232298/engineering-uk-report-2020.pdf>

<sup>5</sup> Unpublished Royal of Academy of Engineering research using 2015/16 Destinations of Leavers from Higher Education (DLHE) survey data.

<sup>6</sup> Figures based on analysis of the Labour Force Survey Q3 2020 – Q2 2021. By 'engineering occupations', we mean those within the 'occupational engineering footprint' – that is, the occupations from the Standard Occupational Classification (SOC) that meet criteria agreed by EngineeringUK, the Royal Academy of Engineering, and the Engineering Council to constitute engineering. Occupations within the footprint have further been categorised into 'core' and 'related' engineering. For more information, please visit:

representation of women still falls far short, with women making up 47.1% of the overall UK workforce. Talent pipeline challenges notwithstanding, this significant under-representation represents an untapped potential workforce.

There are also challenges with retention, for example, 57% of women engineers drop off the register of professional engineers under the age of 45, compared to just 17% of men engineers.<sup>7</sup> For those women that do continue, engineering is a great career that consistently shows higher-than average earnings and higher-than average levels of job satisfaction, although public awareness of the benefits of a career in engineering is not high.

The gender pay gap for engineers is smaller than the gender pay gap for the UK as a whole. Data analysis based on pay data for just under 42,000 engineers indicates that the pay gap for engineers in the sample is around two thirds the national average<sup>8</sup>. Although the gap is less than feared, closing it will take concerted effort within the engineering profession.

In a survey of 7,000 UK engineers, over 80% of women who responded said that they would recommend it as a great career to friends and family<sup>9</sup>. The research showed that gender makes a significant difference to how engineers perceive the culture of their profession. In the Academy's survey of 7,000 engineers, men (82%) were significantly more likely than women (43%) to say their gender is irrelevant to how they are perceived at work. Women engineers (80%) feel less able to be open about their lives outside work than men (85%), and also less likely (72%) to speak up on inappropriate behaviour than men (84%).

### **Ethnicity**

Only 9.9% of engineers are from a minority ethnic background, across all industries, compared with 12.2% of people from a minority ethnic background in the UK working population<sup>10</sup>. This is despite 27% of engineering degree qualifiers being from minority ethnic backgrounds in 2018/19<sup>11</sup>. The picture is concerning for apprentices from minority ethnic backgrounds only making up 9.4% and 10.5% of apprenticeship starts in 2017/18 and 2018/19 respectively.<sup>12</sup>

While the employment outcomes of women relative to men in engineering are encouraging, of greater concern is the stark difference in employment outcomes between engineering graduates of white and minority ethnic origin. Ethnicity has a larger impact on the early employment outcomes for engineering graduates than the average graduate (across all subjects) and of particular concern is the unequal employment outcomes of Black engineering graduates.

Six months after graduating, Black engineering graduates are less likely to progress into engineering roles than their white engineering graduate counterparts, 35% compared with 57%, respectively, and the minority ethnic cohort as a whole at 39%.<sup>13</sup> Black engineering graduates are also more likely to be unemployed than their white counterparts and have the

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[https://www.engineeringuk.com/media/1572/engineering\\_uk\\_2018\\_annex.pdf](https://www.engineeringuk.com/media/1572/engineering_uk_2018_annex.pdf). See EngineeringUK response.

<sup>7</sup> Women's Engineering Society, RETURN Project Final Report Career Break Support for Professional Engineering Institution (PEI) Members, 2016

<sup>8</sup> <https://www.raeng.org.uk/publications/reports/closing-the-engineering-gender-pay-gap>

<sup>9</sup> Royal Academy of Engineering, Creating cultures where all engineers thrive, 2017, [www.raeng.org.uk/publications/reports/creating-cultures-where-all-engineers-thrive](http://www.raeng.org.uk/publications/reports/creating-cultures-where-all-engineers-thrive)

<sup>10</sup> EngineeringUK APPG response for Diversity & Inclusion in STEM submission (January 2021) <https://www.britishecienceassociation.org/appg>

<sup>11</sup> <https://www.engineeringuk.com/media/232298/engineering-uk-report-2020.pdf>

<sup>12</sup> DfE. 'Further Education and skills January 2020' data, 2020.

<sup>13</sup> Unpublished Royal of Academy of Engineering research using 2015/16 Destinations of Leavers from Higher Education (DLHE) survey data.

lowest proportion in full time work, compared with other minority ethnic groups, at 45%<sup>14</sup>. For those that do gain employment, Black engineering graduates in full-time employment after graduating, earn on average £643 less than white engineering graduates (for minority ethnic engineering graduates the gap is much smaller at £97).<sup>15</sup>

For those that do gain employment, research, based on a survey of over 7,000 engineers, found that engineers from minority ethnic backgrounds were 25% more likely than their white colleagues to report that assumptions are made about them based on their ethnicity or nationality, 10% less likely to feel 'quite' or 'very' included than their white colleagues, and that they are more than 10% less likely to speak up about inappropriate behaviour in the workplace when compared to white engineering colleagues<sup>16</sup>.

### **Disability**

Disabled people were also underrepresented in the engineering workforce in 2020, with 11.1% of those in engineering occupations being disabled, compared with 14.8% of those in non-engineering occupations<sup>17</sup>, despite representing at a minimum 19% of the working population<sup>18</sup>.

Research has shown that disabled engineers experience the culture of the engineering profession as less inclusive than their non-disabled colleagues. Disabled engineers are more than twice as likely to have experienced bullying or harassment than their non-disabled colleagues (27% vs 13%). Disabled engineers are 13% less clear about what they need to do to progress their career than their non-disabled colleagues and in the survey 21% reported planning to leave the profession or were undecided about doing so for reasons other than retirement, within the next 12 months, compared to those without a disability (13%)<sup>19</sup>.

### **Other groups in engineering**

The inclusion of both visible and invisible minorities is vital to achieve the aim of a truly inclusive engineering workforce in the UK. This inquiry has not asked for information on the representation and inclusion of LGBTQ+ engineers, this is a missed opportunity.

In 2017, the Royal Academy analysed the inclusion of lesbian, gay and bisexual (LGB) engineers<sup>20</sup> and engineers from different religious backgrounds<sup>21</sup>.

While LGB engineers described the culture of engineering in similar ways to heterosexual engineers, overall, they experience it as less inclusive. But there are also differences in the ways and extent to which LGB engineers experience the culture as inclusive. Gay engineers feel least able to be open about their sexual orientation and lesbian engineers feel least included in the profession, are most likely to have experienced bullying and harassment, and feel least able to speak up if someone is behaving inappropriately to them. All LGB engineers are looking for a more diverse and inclusive culture to make it a better environment to work in. Priorities for action to drive up inclusion for LGB engineers include:

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<sup>14</sup> Unpublished Royal of Academy of Engineering research using 2015/16 Destinations of Leavers from Higher Education (DLHE) survey data.

<sup>15</sup> <https://www.engineeringuk.com/media/156198/key-facts-figures-2019-final-20190627.pdf>

<sup>16</sup> Royal Academy of Engineering, Creating cultures where all engineers thrive, 2017, <https://www.raeng.org.uk/publications/reports/creating-cultures-where-all-engineers-thrive>

<sup>17</sup> EngineeringUK response to APPG on Diversity in STEM inquiry 2020

<sup>18</sup> <https://www.scope.org.uk/media/disability-facts-figures/>

<sup>19</sup> <https://www.raeng.org.uk/publications/other/inclusive-culture-analysis-disability>

<sup>20</sup> <https://www.raeng.org.uk/publications/other/inclusive-cultures-analysis-sexual-orientation>. Note there was not enough data to report on transgender engineers.

<sup>21</sup> <https://www.raeng.org.uk/publications/other/inclusive-cultures-analysis-religion>

- Creating an environment where LGB engineers feel confident and safe to be open about their sexual orientation and life outside work.
- Creating zero tolerance for bullying and harassment in engineering, particularly for lesbian and bisexual engineers, and addressing offensive banter.
- Improving the strength of leadership in setting standards for teams on creating an inclusive environment and building more good leadership role models for inclusion.

## 2. The reasons why these groups are underrepresented

The reasons why women, disabled people, those from minority ethnic, and lower socio-economic backgrounds are underrepresented in engineering are complex and vary both between and within different groups. There is no simple explanation.

Factors influencing future careers in engineering start early. As an example, the Hamilton Commission<sup>22</sup> examined a wide variety of research giving insights into the factors affecting Black students' attainment and progression in STEM subjects, which lead to careers in engineering, and their general educational experiences in school. These include:

- Streaming or 'setting' of young Black students into lower ability groups for mathematics and sciences based on low teacher expectations, limiting their ability to achieve top grades at GCSE, which in turn reduces opportunities to take mathematics and physics at A level.
- Behaviour management practices in schools disproportionately affecting young Black students, including the disproportionately high incidence of temporary and permanent exclusions of young Black Caribbean and Mixed White and Black Caribbean students.
- A lack of Black teachers and leaders in schools limiting the number of positive role models.
- Limited activity in schools to address issues of inequalities of outcomes and attainment gaps across different ethnic groups.

Creating a diverse and inclusive profession requires continued action throughout all stages of education to promote, encourage and enable those from underrepresented groups to see and access careers in engineering. EngineeringUK's response focuses on education pathways into engineering and attitudes of young people and should be read in conjunction with this response.

Even when people from underrepresented groups are attracted into engineering careers this is not the end of the story, as there is the challenge of retention, greatly boosted by fostering an inclusive workplace where all feel comfortable and valued. The availability of flexible and true part-time careers in engineering are often limited, restricting opportunities for those with a need for flexible working to stay in the profession. The cost to industry of losing engineers when they take a career break is significant and there is very often little or no support in place for engineers who have taken a career break who then wish to return to engineering<sup>23</sup>.

A key indicator is 'diversity at the top' sending signals throughout the workforce and influencing the perceptions of future talent. Performance on leadership diversity in the UK is mixed. The 33% target set by the Hampton-Alexander review for women on FTSE 350 Boards by 2020 was met but the review found that significant progress remains on the representation of women at the highest executive roles, such as CEOs. . The government backed Parker Review, led by Sir John Parker GBE FREng, set a target for all FTSE 100 Boards to have at least one director from a minority ethnic background by 2021 and each

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<sup>22</sup> <https://www.hamiltoncommission.org/>

<sup>23</sup> The Experience of Female Engineers in Early Career, Institution of Mechanical Engineers, 2017

FTSE 250 Board to do the same by 2024. However, a review of progress in 2020<sup>24</sup> found that 37% of FTSE 100 boards and 69% of FTSE 250 boards still had all-white boards.

We know that women and minority ethnic engineers are underrepresented at senior levels in engineering. In May 2021 the POWERful Women initiative, based at the Energy Institute, published its annual statistics of the representation of women in the boardrooms of the UK's top 50 energy companies. Progress continues to be extremely slow, notably only 24% of board seats are occupied by women, and 28% of companies have no women on their boards at all<sup>25</sup> Research shows that diverse leadership teams are more innovative and make better decisions. As the UK economy continues to recover from the coronavirus increasing the representation of women and minority ethnic groups on boards and senior leadership teams will help companies build back better.

The reasons for the underrepresentation of women, disabled people, those from minority ethnic, and lower socio-economic backgrounds in the engineering profession are complex and therefore require a cohesive and coordinated approach across education, government and industry. See section 5 for our recommendations.

### **3. The implications of these groups being underrepresented in STEM roles in academia and industry**

Engineers play a hugely important role in shaping the world we live in, designing and delivering products, services and infrastructure that we all rely on. Accelerating progress on diversity and inclusion (D&I) will bring benefits to both the profession and the public, from greater creativity and productivity, to increased awareness of risk and products better designed to serve the needs of people from all parts of society.

There is much evidence to show that diverse groups are more innovative, more effective, and ultimately, more productive in the economy. Diversifying the engineering profession can help close the skills gap, better reflect the needs of society and lead to stronger outputs. Engineers who feel more included are more likely to understand business priorities, be confident to speak out about improvements, mistakes or safety concerns and picture themselves undertaking a career in engineering<sup>26</sup>. But achieving improvements in D&I moving forward will require government and other organisations to put in place proactive and just policies.

The engineering workforce is over-reliant on an older male demographic that is ethnically white and not living with a disability. This is unrepresentative of the national workforce.

Failure to increase workforce diversity impacts in the following ways:

- Economic impact – A 2019 UK government paper estimates that taking action to reduce the gender gaps in labour market participation, STEM qualifications and wages could increase the size of the UK economy by about 2% or £55bn by 2030<sup>27</sup>
- Shortages in engineering employee workforce – There is an acknowledged shortfall in engineering skills in the UK. Accessing a wider talent pool, with equal representation of women, minority ethnic, disabled, and other workers, can help reduce this shortfall.
- Productive and innovative workplaces – Diversity does not automatically produce inclusion, but more diverse and inclusive workplaces which cultivate a strong sense

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<sup>24</sup> [https://assets.ey.com/content/dam/ey-sites/ey-com/en\\_uk/news/2020/02/ey-parker-review-2020-report-final.pdf](https://assets.ey.com/content/dam/ey-sites/ey-com/en_uk/news/2020/02/ey-parker-review-2020-report-final.pdf)

<sup>25</sup> <https://powerfulwomen.org.uk/board-statistics-by-company-2021/>

<sup>26</sup> Royal Academy of Engineering (2017), Creating cultures where all engineering thrive

<sup>27</sup> [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/821889/GEO\\_GEEE\\_Strategy\\_Gender\\_Equality\\_Roadmap\\_Rev\\_1\\_\\_1\\_.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/821889/GEO_GEEE_Strategy_Gender_Equality_Roadmap_Rev_1__1_.pdf)

of belonging can result in 56% rise in job performance, 50% decrease in turnover risks and 75% reduction in sick days<sup>28</sup>.

- Engagement with diverse customer base (UK and global) – More diverse teams have been shown to be more likely to radically innovate and anticipate shifts in consumer needs, helping their companies outperform their rivals<sup>29</sup>. In the post-Brexit era as the UK seeks to build strong international trading partnerships there is potential for the customer base of UK engineering companies to become increasingly globalised and diverse. Improved workforce diversity can result in better understanding of the customer, enabling companies to reach and succeed in new markets more easily<sup>30</sup> and enable engineers to be more sympathetic to, and understanding of, clients' needs. This also applies to membership, where lack of diversity in Professional Engineering Institutions membership mean that the institutions and profession miss out on different experiences and viewpoints which then affect the delivery of services and support for members.
- Financial performance – several studies suggest that gender and ethnic diversity at board room level lead to positive and significant financial gains for companies. Reasons cited for this include reduction in groupthink and other performance limiting biases, increased employee satisfaction (see above: Productive and innovative workplaces), improved success in recruitment and the ability to nurture and promote innovation.<sup>31</sup>
- Innovation – Diversity enables nonlinear novel thinking and the adaptability that innovation requires<sup>32</sup>. As an example, BCG research suggests that companies with above-average diversity “produced a greater proportion of revenue from innovation (45% of total) than from companies with below average diversity (26%). This 19% innovation-related advantage translated into overall better financial performance.”<sup>33</sup> This is relevant not only for engineering employers, but also within higher education and tech start-ups. Out of 21,000 university professors just 19 (0.7%) are Black<sup>34</sup> and just 0.9% of founders in the EU are Black<sup>35</sup>. This represents a major structural hurdle regarding university and start-up led innovation as our ‘innovation engines’ are hindered by a lack of diversity at the inception stage. STEM plays a significant role in UK innovation and brings significant economic benefit to the UK. Supporting D&I in innovation<sup>36</sup> is vital to support the Levelling up and Build Back Better agendas.
- Public message and community engagement – We see significant differences in boys’ and girls’ perceptions about engineering<sup>37</sup> and also perceptions among young Black people.<sup>38</sup> Increased representation and role-modelling is known to have a

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<sup>28</sup> <https://hbr.org/2019/12/the-value-of-belonging-at-work>

<sup>29</sup> <https://www.mckinsey.com/~media/mckinsey/featured%20insights/diversity%20and%20inclusion/diversity%20wins%20how%20inclusion%20matters/diversity-wins-how-inclusion-matters-vf.pdf>

<sup>30</sup> <https://lumoa.me/blog/the-importance-of-diversity-in-customer-experience>

<sup>31</sup> [https://www.wisecampaign.org.uk/wp-content/uploads/2021/07/WISE-Business-Case-for-Diversity-Report\\_v2.pdf](https://www.wisecampaign.org.uk/wp-content/uploads/2021/07/WISE-Business-Case-for-Diversity-Report_v2.pdf) citing: <https://www.gcu.ac.uk/theuniversity/universitynews/2020-gender-diversity-boosts-financial-performance/>; <https://www.morganstanley.com/access/gender-diversity>; [https://impaxam.com/wp-content/uploads/2020/10/20201023\\_the\\_financial\\_impact\\_of\\_diversity.pdf?pw=1301](https://impaxam.com/wp-content/uploads/2020/10/20201023_the_financial_impact_of_diversity.pdf?pw=1301)

<sup>32</sup> <https://www.forbes.com/sites/forbesinsights/2020/01/15/diversity-confirmed-to-boost-innovation-and-financial-results/>

<sup>33</sup> <https://www.forbes.com/sites/forbesinsights/2020/01/15/diversity-confirmed-to-boost-innovation-and-financial-results/>

<sup>34</sup> <https://www.hesa.ac.uk/data-and-analysis/staff/working-in-he/characteristics>

<sup>35</sup> <https://sifted.eu/articles/diverse-founder-data-uk/>

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[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/902986/InnovateUK\\_Supporting\\_Diversity\\_and\\_Inclusion\\_in\\_innovation\\_WEBVERSION.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/902986/InnovateUK_Supporting_Diversity_and_Inclusion_in_innovation_WEBVERSION.pdf)

<sup>37</sup> <https://www.engineeringuk.com/research/engineering-insights/knowledge-perceptions-and-understanding-of-engineering/>

significant impact on a person's belief in their ability to be successful in a careers or occupation, including for STEM careers.<sup>39</sup> Therefore, increasing diversity both within academic staff and in industry will increase the number of role models (both public and within small communities and families) leading to increased aspiration from young people from under-represented backgrounds.

Finally, to tackle the world's greatest challenges we will need technological transformation, but without behavioural and societal change we will not get there. In the UK the Climate Change Committee estimates 62% of the emission reductions needed to get to net zero will involve some form of behavioural or societal change, often in combination with unfamiliar new technology. The UK needs engineers with different experiences, backgrounds, aptitudes, and strengths to both reflect and understand society and its behaviours, in order to develop impactful solutions to tackle global challenges.

#### **4. What has been done to address underrepresentation of particular groups in STEM roles**

Many organisations and sectors across engineering are taking action to advance D&I. A summary below:

- The Royal Academy of Engineering, the leadership body for the engineering profession has extensive programmes, activities, and resources to address the underrepresentation of minority groups in engineering including:
  - A campaign launched in 2020 with an aspiration that at least half of all candidates elected each year for Fellowship will come from under-represented groups or specialise in technologies addressing major societal change. The goal was achieved in year one<sup>40</sup>, demonstrating to upcoming generations that engineers from any background can reach the pinnacle of the profession.
  - An award-winning Graduate Engineering Engagement Programme (GEEP) which aims to increase the transition of engineering graduates from diverse backgrounds into engineering employment.
  - A range of D&I guidance and toolkits co-produced with engineering employers which are freely available to the profession including: inclusive recruitment, creating and maintaining inclusive cultures, measuring progress, reducing the gender gap, and an interactive Team workshop series to foster inclusive team working<sup>41</sup>.
  - Creating the Progression Framework<sup>42</sup> (with the Science Council) enabling professional engineering institutions (PEIs) to measure D&I progress against 10+ business indicators and develop a coherent strategy for change. A profession-wide benchmarking exercise was conducted in 2021 that highlighted successes such as an improved gender balance on PEI boards.
  - The Academy's *This is Engineering*<sup>43</sup> campaign is aimed at changing societal perceptions around who engineers are and what they do. The social media campaign has been viewed over 55 million times by a gender balanced

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<sup>38</sup> <https://www.hamiltoncommission.org/the-report>

<sup>39</sup> <https://www.frontiersin.org/articles/10.3389/fpsyg.2020.02204/full>

<sup>40</sup> <https://www.raeng.org.uk/news/news-releases/2021/september/academy-celebrates-first-new-fellows-elected-under>

<sup>41</sup> <https://www.raeng.org.uk/diversity-in-engineering/resources/inclusive-recruitment>,  
<https://www.raeng.org.uk/diversity-in-engineering/resources/a-practical-toolkit>,  
<https://www.raeng.org.uk/diversity-in-engineering/employers/measuring-progress>,  
<https://www.raeng.org.uk/diversity-in-engineering/employers/culture/team-workshops>

<sup>42</sup> [https://www.raeng.org.uk/publications/reports/diversity-and-inclusion-progression-framework-\(1\)](https://www.raeng.org.uk/publications/reports/diversity-and-inclusion-progression-framework-(1))

<sup>43</sup> <https://www.thisisengineering.org.uk/>



audience. The content has increased consideration of engineering among teenagers overall by 85%, by 118% among young people from minority ethnic groups, and 129% among girls.

- Providing intensive STEM education-support programmes to schools in the poorest regions of the country: Barrow-in-Furness, Lowestoft, Stoke on Trent, South London, West Midlands, Welsh Valleys. Bursary schemes fund students from under-represented groups to participate in technical or higher education courses and the Academy's undergraduate *Engineering Leaders Scholarships* programme has 40% participation of women, over double the proportion of the engineering undergraduate cohort.
- A new Diversity Impact Programme<sup>44</sup>, to fund university engineering departments to improve D&I in higher education and build a community of practice. It aims to transform the outcomes for under-represented students who face barriers into engineering careers.
- Partnering with honorary Fellow Sir Lewis Hamilton, on his commission to improve progression of Black people in motorsport.
- Working to change the diversity of entrepreneurs through its Enterprise Hub and will soon launch a D&I Toolkit for start-ups, scale-ups, and SMEs to embed inclusive cultures.
- Launching Access Mentoring and pre-application support to under-represented groups and universities to improve the support for and representation of minority groups in its research programmes.
- Many NEPC members are working to promote diversity and inclusion for engineers and technicians in their engineering discipline.<sup>45</sup>
- In 2020 the offshore wind industry produced a best practice guide to support businesses measure and address ethnic diversity and gender balance across their workforce.
- In 2020 Maritime UK, the industry body for the maritime sector launched a new Diversity in Maritime programme in response to the UK government's Maritime 2050 strategy.
- In 2020 the Railway Industry Association (RIA) and Women in Rail (WR) launched a Charter to champion equality, diversity and inclusion in the UK railway industry. It has been backed by over 100 organisations.
- POWERfulWomen<sup>46</sup> is an initiative, based at the Energy Institute, that works for greater representation of women at the top of the UK energy industry. Born out of a collaboration between senior industry and government (BEIS) figures wanting to bring about step change at the top of UK energy sector POWERful Women:
  - Compiles and publishes annual data on women in UK energy boardrooms, bringing transparency and accountability.
  - Publishes of case studies exemplifying 'what works' by the Energy Leaders Coalition.
  - Provides mentoring between mid-career and senior leaders as well as broader networking opportunities.
- Women in Nuclear UK (WiN-UK<sup>47</sup>) – formed in 2014, their mission is to address the industry's gender balance, improve the representation of women in leadership, engage with the industry, government and public on nuclear issues. Win-UK have developed an Industry Charter which allows companies to sign up and commit their own individual company pledge to show their commitment to diversity across the nuclear sector. Over 60 companies have done so.

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<sup>44</sup> <https://www.raeng.org.uk/diversity-in-engineering/diversity-and-inclusion-grant/grants-and-funding>

<sup>45</sup> <https://www.iom3.org/uploads/assets/63cab1ac-6bc9-40d9-938720b51390c9ec/b63b7c2a-748c-49db-82176cf0d00a3ae1/Diversity-and-Inclusion-in-IOM3.pdf>, <https://www.iop.org/strategy/limit-less>

<sup>46</sup> <https://powerfulwomen.org.uk/>

<sup>47</sup> <https://www.winuk.org.uk/>

- Innovate UK's Women in Innovation programme<sup>48</sup> was launched to address the under-representation of women engaging with Innovate UK, to get more women with excellent ideas innovating in UK businesses and boost the economy. The programme empowers pioneering female entrepreneurs to develop innovations.
- There are also key network and membership-based organisations working to advance D&I in engineering for different communities including the Association for Black and Minority Ethnic Engineers (AFBE-UK), Women's Engineering Society (WES), and InterEngineering, the network to connect, inform and empower LGBTQ+ engineers<sup>49</sup>.

## **5. What could and should be done by the UK Government, UK Research and Innovation, other funding bodies, industry and academia to address the issues identified.**

Despite extensive efforts over the last 30 years, the figures around diversity in the engineering profession have barely shifted. The pace of change is too slow.

### **The UK government and parliaments of devolved nations should prioritise the improvement of teaching standards in STEM subjects across the UK**

The continued failure to recruit and retain sufficient STEM subject specialist teachers will act as a break on efforts to level up opportunity and will hinder future ambitions to make the UK a global science superpower. The pupil engagement and academic attainment necessary to fuel the creation of future problem solvers and innovators in engineering will not occur unless UK government and the parliaments of devolved nations prioritise the increase in subject specialist teachers in physics, computing, mathematics and design and technology. We also encourage building the evidence base of new forms of provision such as maths schools and colleges, and where approaches demonstrate significant impact wider roll out across regions should take place where appropriate.

### **The UK government should prioritise diversity and social mobility in post-16 training and skills development**

The COVID-19 pandemic has had inequitable effects on certain communities. The disruption to education and training has especially affected apprentices<sup>50</sup> and school pupils from disadvantaged backgrounds,<sup>51</sup> with implications for levels of deprivation across the UK as well as D&I within engineering sectors.

Apprenticeships and graduates in engineering, manufacturing and construction will be essential to strengthening the post-covid economy. Yet surveys last year indicated that 60% of employers have stopped recruiting apprentices altogether and 75% have reduced their apprentice starts up to four fifths of starts normally expected<sup>52</sup>. There is a critical social mobility aspect to any decline in apprenticeships. Lower-level apprenticeships are disproportionately taken by those from disadvantaged backgrounds, whilst engineering degree level apprenticeships are disproportionately populated by students from more affluent backgrounds. It is the lower-level apprenticeships that have seen the greatest decline, both prior to and during the current crisis.

As the Government develops its levelling up strategy, underrepresentation of specific groups in high-value employment, such as engineering and technology roles, should be a priority.

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<sup>48</sup><https://ktn-uk.org/programme/women-in-innovation/>

<sup>49</sup> <https://www.afbe.org.uk/>, <https://www.wes.org.uk/>, <https://interengineeringlgbt.com/>

<sup>50</sup> The Sutton Trust (May 2020), COVID-19 and Social Mobility Impact Brief #3: Apprenticeships

<sup>51</sup> The Sutton Trust (April 2020), COVID-19 and Social Mobility Impact Brief #1: School Shutdown.

<sup>52</sup> Covid-19 Impact on Provision for Apprentices and Learners Initial Results from AELP Member Provider Survey (as of 25 March 2020), Association of employment and learning providers.

## **The UK government should extend mandatory pay gap reporting to ethnicity and disability**

Pay gap reporting is an important tool to shine a light on inequalities around pay and progression within a profession, to help companies identify and understand potential causes, and to hold employers accountable. Understanding imbalances in all areas of the business, including career progression, leavers, pay and performance, will help identify potential causes of any pay gaps and effective actions to take. Pay gap reporting should be extended to ethnicity and disability to increase transparency and support the development of more equitable workplaces.

The engineering population is 85.5% male and 90.1% white, and the minority ethnic UK population is predicted to rise from 14% in 2011 to 30% by 2050<sup>53</sup>. This changing demographic picture clearly shows that greater focus on ethnic diversity in engineering is a strategic business priority for addressing skills shortage and increasing UK engineering innovation and creativity in a global marketplace. Several large engineering companies are leading the way by voluntarily publishing their ethnicity pay gap, including Mace, Mott McDonald and Shell. In support of effective implementation of ethnicity pay monitoring, we support an approach that mirrors, as much as possible, the approach to gender pay gap monitoring<sup>54</sup>.

## **Employers should take action to address and close pay gaps**

The gender pay gap for engineers is largely due to under representation of women in more senior and higher paid roles. While one well-recognised issue that is contributing to the gender pay gap in engineering is the lack of women going into the profession, there are effective actions companies can take now that go beyond addressing this initial recruitment challenge to close the gender pay gap that include implementing transparent pay structures and grades, reviewing promotion criteria and introducing flexible working options for senior and higher-paid roles. Taking effective action to close the gender pay gap for engineers is critical to the success of strategies to attract and retain more women in the profession.

Although less than 1% of the total number of UK engineering enterprises are within the scope of the gender pay gap reporting requirement (and therefore would be covered by an extension of the reporting requirements to ethnicity and disability), the larger firms that are required to report account for around 40% of the total employment of engineers<sup>55</sup>. Recommendations set out in the Academy's *Closing the engineering gender pay gap* report<sup>56</sup> should be implemented by organisations of all sizes seeking to attract, retain and develop the talents that women bring to engineering.

## **Industry should collect, analyse and use data to drive change**

Diversity and inclusion measurement is crucial to effect change. Professional bodies and engineering employers must take a long-term, data-driven and evidence-based approach to addressing D&I in order to make meaningful progress. Employers should analyse their data to understand their workforce when it comes to recruitment, performance, retention, development, pay and progression. The data should help engineering organisations to take evidence-based and data-driven approach to increase D&I, and to monitor and report on progress. Measurement frameworks, such as the Academy's which has been validated by the Employers Network of Equality and Inclusion (ENEI) and tested with both large corporate and SME organisations<sup>57</sup>, cover all stages of the employee lifecycle and provide a framework to drive cultural and behavioural change.

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<sup>53</sup> reference

<sup>54</sup> <https://www.raeng.org.uk/publications/other/ethnicity-pay-gap-reporting-response>

<sup>55</sup> [www.engineeringuk.com/research/data/2019-excel-resource/](http://www.engineeringuk.com/research/data/2019-excel-resource/)

<sup>56</sup> <https://www.raeng.org.uk/publications/reports/closing-the-engineering-gender-pay-gap>

## **Industry should take action to improve inclusion in engineering**

We know that improving diversity within engineering is vital, but it is not sufficient. We also need to create and sustain inclusive cultures: cultures in which engineers from all backgrounds feel that they are welcome, valued, able to contribute to the full and to perform at their best. The best solutions come from diverse teams working in inclusive cultures, leading to outcomes that can better meet the needs of society.

Research into culture and inclusion in engineering has found that inclusion benefits the performance of individual engineers with 80% reporting increased motivation, 68% increased performance and 52% increased commitment to their organisations. Inclusion also benefits organisational performance in that the more included engineers feel, the more likely they are to understand business priorities, be confident about speaking up on improvements, mistakes or safety concerns, and see a future for themselves in engineering.<sup>58</sup>

Supporting the inclusion of engineers from different backgrounds will help minimise skills gaps, retain diverse talent, and support development of innovation and creativity across UK engineering in support of UK plc and the prosperity of individual engineers. Inclusion benefits all engineers, but not all groups experience inclusion to the same extent.

There are many free to access toolkits and resources drawing on best practice to support building and maintaining inclusive cultures that companies can access including resources produced by the Academy<sup>59</sup>.

## **Government and industry should use procurement and supply chain levers to advance D&I**

More than 99% of engineering companies are small and medium sized enterprises (SMEs). The larger companies in the engineering profession often have hundreds of smaller companies in their supply chain. Procurement can provide a catalyst to change, making tangible action a priority for any company wishing to be on the supply chain. Employers should look to incorporate equality requirements into their procurement processes to add value to the overall outcomes, encouraging action and helping to advance D&I through their procurement levers and supply chain. There are organisations in engineering who have been nationally recognised for their inclusive procurement and supply chain practices. For example, HS2 embed equality, diversity and inclusion standards and targets into all their contract awards<sup>60</sup> and EDF Energy have developed a Supplier's Guide to Diversity and Inclusion, to embed D&I principles throughout their supply chain<sup>61</sup>.

## **Government and industry should take action to encourage more young Black students into engineering careers**

Recommendations from the Hamilton Commission report, *Accelerating Change: Improving Representation of Black People in UK Motorsport*<sup>62</sup>. The 2021 report published by Sir Lewis Hamilton MBE FREng and the Academy highlights barriers including lack of Black role model teachers, high exclusion rates, teacher preconceptions and F1 hiring practices that favour students from a select group of high-ranking universities. The report's 10 recommendations aim to have a long-lasting impact on motorsport and encourage more young Black students into engineering careers. The recommendations include the

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<sup>57</sup> <https://www.raeng.org.uk/publications/reports/diversity-and-inclusion-in-engineering-measurement>

<sup>58</sup> <https://www.raeng.org.uk/publications/reports/creating-cultures-where-all-engineers-thrive>

<sup>59</sup> <https://www.raeng.org.uk/diversity-in-engineering/resources/a-practical-toolkit> and <https://www.raeng.org.uk/diversity-in-engineering/employers/culture/team-workshops>

<sup>60</sup> <https://medium.com/@tobymildon/inclusive-procurement-at-hs2-953821ed5c36>

<sup>61</sup> [https://www.edfenergy.com/sites/default/files/suppliers\\_guide\\_to\\_diversity\\_inclusion\\_2020\\_v5.pdf](https://www.edfenergy.com/sites/default/files/suppliers_guide_to_diversity_inclusion_2020_v5.pdf)

<sup>62</sup> <https://www.hamiltoncommission.org/the-report>

Department for Education and other bodies holding data to enable easier public access to student and staff data by diversity characteristics, the development of best practice guidance for STEM inspiration and outreach activities to enable inclusive engagement with Black students in schools, and with those who influence them, and the piloting of new approaches to increase the number of Black teachers in STEM subjects that lead to careers in engineering, namely mathematics, physics, design and technology, and computing. For the full set of findings and recommendations please see the report.

Our recommendations should be read in conjunction with recommendations by EngineeringUK which focus on tackling misperceptions about engineering as well as on raising aspirations and improving knowledge of careers in the sector.

***(January 2022)***