APPG on Diversity and Inclusion in STEM

Inquiry into Equity in the STEM Workforce

Final report

JULY 2021

Secretariat:

BRITISH SCIENCE ASSOCIATION

About the APPG

The All-Party Parliamentary Group (APPG) on Diversity and Inclusion in Science, Technology, Engineering and Maths (STEM) was established in 2018 and aims to promote the inclusion and progression of marginalised people in STEM, and to encourage government, parliamentarians, academics, businesses and other stakeholders to work towards a STEM sector that is representative of the UK population. We also want to consider and influence changes in policy that will lead to this outcome.

The British Science Association acts as Secretariat to the Group. The Group is made up of Members of Parliament and the House of Lords and is a focus for collaboration with businesses and other organisations in the STEM sector.

The Officers of the APPG are:

Chair:	Chi Onwurah MP (Labour)
Officers:	Baroness Brown (Crossbench) Baroness Garden (Liberal Democrat) Baroness Grey-Thompson (Crossbench) Lord Lucas (Conservative) Stephen Metcalfe MP (Conservative) Carol Monaghan MP (Scottish National Party) Alex Norris MP (Labour, Co-op)

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Equity in the STEM workforce

Table of contents

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The views expressed in this report are those of the All-Party Parliamentary Group on Diversity and Inclusion in STEM. The report does not necessarily represent the views of any of the sponsors, witnesses, contributors and reviewers, unless stated.

This report was compiled by the British Science Association who provide the Secretariat to the APPG. The information in this brief, including reference to policies and Government status on issues, is correct at the time of writing (July 2021).

The Secretariat would like to thank Abigail Hilditch, Agasty Baylon Yogaratnam, Anissa Alifandi, Amy MacLaren, Breon Finch, Clio Heslop, Jon Fitzmaurice, and Peter Trevitt for their contribution in undertaking the inquiry and producing this report.

Foreword

We must come together, as a STEM sector, to combat inequity

Chi Onwurah MP
Chair, APPG on Diversity and Inclusion in STEM

The APPG on Diversity and Inclusion in STEM published its first inquiry into Equity in STEM Education in the summer of 2020 amidst a global pandemic. When we formed the APPG in 2018 we could never have expected that by the publication of our second report, the world would still be contending with the impacts of COVID-19. The UK has changed beyond measure over the last three years and the necessity of a truly equitable and representative UK workforce has only become more urgent.

Throughout the last 18 months STEM workers have played vital roles in heroically steering the nation through challenging and heart-breaking times. From Chief Scientific Advisors to doctors and nurses, to epidemiologists and economists, those who utilise STEM skills have underpinned the nation's recovery, while – in many cases – putting themselves directly at risk from the virus.

The pandemic has cemented the importance of this workforce and their skills in UK and global society, but it has also preyed on existing inequities and begun a trend to reverse the progress made over recent years. Without fully addressing the issues of representation and equity in STEM, we fail this sector and its workers who are so vital to society and critical to our economy.

Many of the challenges detailed in this report are historic as well as systemic. As a Black, working-class, northern woman working as an engineer in the 1980s and 1990s I know too well the barriers that minoritised groups in STEM face. Being different in any profession or job is tiring, you face people's stereotypes rather than being judged on your actual experiences and ability. Nearly 40 years later, it is saddening to know that many minoritised communities are still denied a sense of belonging in the STEM workforce.

We know the UK has a STEM skills gap, and we know how recruiting and nurturing a diversity of talent will not only help to address these skills shortages but create equitable economic opportunity with a more innovative and productive sector. But the need for diversity and inclusion in STEM goes further than any skills gap or economic imperative; it is our obligation to create an equitable society, free of systemic discrimination for future generations.

In launching this inquiry, we aimed to move beyond the concept of 'equality of opportunity' to acknowledge that the buck doesn't stop at education or recruitment. However, it has also shown to be timely. As much as the pandemic has harshly discriminated against minoritised STEM workers and devastated the health subsector, it also represents a golden opportunity for Government to work closely with a fundamental economic sector in its recovery and create a stronger, more skilled, sustainable, inclusive, dynamic and globally competitive workforce.

We must praise ongoing efforts by the STEM sector to combat these inequities. I am filled with optimism knowing that over 150 institutions, businesses, networks and individuals have contributed to the formation of this report alongside Parliamentarians across all parties. The inquiry has built on key pieces of existing research and heard from the lived experience of people from diverse backgrounds working in the sector.

The UK is a world leader in scientific and technological innovation, and we must continue our important work for current and future employees of the STEM workforce to ensure an enduring economic recovery. The recommendations in this report provide an opportunity to unite those working for equity in STEM, and a clear steer for where and how we must take action. Together we have a chance, within the next decade, to meaningfully tackle the systemic underrepresentation of minoritised groups and foster an inclusive sector across the UK where everyone can belong.

Executive summary

This report seeks to outline the evidence on where equity and inequity exists in the science, technology, engineering, and maths (STEM) workforce. While there have been many reports and inquiries into equity and equality in the wider workforce, or around specific characteristics such as ethnicity, gender and disability in the STEM workforce, there have previously not been the resources available for an intersectional, sector-wide study.

The All-Party Parliamentary Group on Diversity and Inclusion in STEM launched its inquiry in November 2020 with the ambition to detail the experiences of minoritised STEM workers and shine a light on positive sector-led initiatives and practices. In doing so, the APPG has sought to create the opportunity in this report to work with Government, parliamentarians, sector leaders and community stakeholders to recognise the findings and address the historic and systemic disadvantages faced by minoritised groups in this sector.

This report is based on written evidence from over 85 organisations and individuals, four evidence roundtables with over 40 attendees and additional desk research comprising over 150 relevant sources. The inquiry found inequity in the STEM workforce is widespread for those from minoritised groups and this inequity intersects across ethnicity, gender, disability, sexual identity, geography and socio-economic status.

The evidence received shows how barriers appear for every minoritised group along the career pathway – from issues in recruitment and retention, to access to mentors, professional development and leadership roles.

Key findings:

- The STEM workforce is less diverse than the wider workforce but consistent data collection and sharing is lacking.
- There is a need for the Government to take a multi-pronged approach to drive equity in the STEM workforce.
- Intersectional barriers continue from STEM education into the workforce.
- There is awareness of structural inequity in some large STEM organisations, but no consensus on solutions.
- There is already considerable inequity in STEM but COVID-19 is making it worse.

The result is an overall lack of representation in the STEM sector of minoritised groups such as Black people, women, disabled people and those from the LGBTQ+ community. Worryingly, evidence has shown that the STEM sector is losing valuable skills, experiences and perspectives, and cannot reach its full potential without greater equity in the workplace.

Inequity in the workforce has also been found to be historic and systemic. Despite organisations and sectors focusing on the underrepresentation of certain minoritised groups in recent years, progress has been limited. Against this backdrop of inequity, the inquiry has uncovered that the Government restrictions brought in to tackle the COVID-19 pandemic have disproportionately disadvantaged minoritised workers. This has made a bad situation even worse, and requires urgent attention.

As a vital economic sector accounting for 18% of the UK's total workforce, the STEM sector is critical to the UK's economic recovery from the pandemic. Evidence detailed in this report shows how diversity and inclusion can improve growth, creating sustainable economic prosperity and opportunities for future generations.

This report makes three recommendations. In some aspects, it requires a cross-Government approach that is fully engaged with the STEM sector. In other aspects, it requires different portfolio holders to lead on specific policy workstreams. Above all, it asks that all STEM stakeholders use the opportunity of the COVID recovery to lead a 'STEM Diversity Decade of Action' to tackle the systemic underrepresentation of minoritised groups at all levels in the sector.

Recommendations

Image source: UK Black Tech

1 The UK Government and STEM organisations, across the private, public and voluntary sectors should commit to leading a 'STEM Diversity Decade of Action' to tackle the historic and systemic underrepresentation of minoritised groups at all levels in the sector.

- The **Prime Minister** and **UK Government** should set a bold vision for a diverse and equitable STEM sector at the heart of their ambitions for the UK to become a 'global science superpower'.
  - We recommend the newly proposed National Science and Technology Council, chaired by the Prime Minister, should put 'pace and backing' into ensuring all the UK's diverse communities believe that working in the STEM workforce is 'for them'. We request that a member of the Council be tasked with the responsibility to lead on equality, diversity and inclusion (EDI) to ensure that diversity and inclusion are built into the foundations of the UK's future science and technology strategy.
  - We call on the **Cabinet Office** and the new **Office for Science and Technology Strategy** to lead a review across all Government departments and agencies to ensure that activity relating to the current and future STEM workforce – including STEM education, Sector Visions, R&D investment, COVID-19 recovery, professional qualification standard and levelling up – is working in tandem for long-term impact.
  - We call on the **Department for Business, Energy and Industrial Strategy** to form a Diversity and Inclusion Advisory Board to support the formation of the Research & Development People and Culture strategy, consult with minoritised groups and STEM leavers and ensure accountability.
- STEM leaders from organisations from across the private, public and voluntary sectors should work together to form and co-fund an Employers' Coalition for STEM Diversity to address the structural inequity in the STEM workforce and drive long-term change. The coalition should:
  - Focus on whole sector involvement, building on the examples and best practice of existing networks such as EDIS, which supports science and health research.
  - Be governed by representatives of all UK nations and regions.
  - Have an emphasis on sharing learning and resources with organisations of fewer than 250 employees, as well as larger corporations.
  - Address the current lack of effective evidence in the STEM workforce by leading independent and longitudinal evaluations of EDI interventions, taking a whole career pathway view from recruitment and workplace culture, to succession planning and retention.
  - Look to improve access and uptake of training and professional development at all levels across the whole sector and, where necessary, identify and collaborate with local and national education providers to refine pathways.
  - Ensure inclusion and diversity work is built into organisational strategy and is fairly remunerated and credited.
  - Build on the work currently being undertaken by the Royal Society and the University of Warwick to agree a methodology for defining the STEM workforce.
  - Work to regularly update the various related Government spokespeople on initiatives and progress, working co-operatively to address areas that will support diversity and inclusion in the STEM sector.

2 The UK Government must deliver a statutory workforce data strategy and drive forward changes in policy and legislation to support employers to improve equity for minoritised communities in many sectors of the UK workforce, including STEM.

- We call on the **Government Equalities Office** to:
  - Lead a whole Government approach to deliver a Workforce Information Bill (by the end of this Parliament in 2024) to increase mandatory pay gap reporting across multiple protected characteristics and to smaller organisations.
  - Expand the scope of Protected Characteristics in the Equality Act (2010) to include socio-economic disadvantage, paternity and shared parental leave and update the language used in the Act concerning gender reassignment.
  - Initiate work to review award criteria for sectoral funding to ensure diversity and inclusion best practice is integrated in its approach.
  - Initiate work with the UK Infrastructure Bank to incorporate diversity and inclusion best practice into its lending decisions.
  - Review consultations, recommendations, and proposed legislation that will complement the Equality Act (2010), including legal recognition for non-binary people, a ban on gender conversion therapy and extending redundancy protections to people returning from maternity, adoption or shared parental leave, with a view to bringing forward legislation in this Parliament.
  - Introduce a standardised model for Government departments and agencies to use the Public Sector Equality Duty (PSED) to build equality, diversity and inclusion standards into all procurement contracts, including mandatory Equality Impact Analysis.
- We request the **Office for National Statistics** and the **UK Statistics Authority's Inclusive Data Taskforce** increase the scale and level of detail in demographic workforce data collection, including within the categories of ethnicity, disability, sexual orientation and identity, and socio-economic status, to allow for improved mapping of the workforce.

3 The UK Government and STEM organisations must quickly look to address and reverse worsening inequity within the STEM workforce as a result of the pandemic.

- We call on **HM Treasury** to:
  - Produce a longitudinal study of the impact of COVID-19 on the STEM sector and wider workforce. Target support and resources to areas of the country where the STEM sector has been most disrupted by the pandemic.
  - Work with the department for Business, Energy and Industrial Strategy (BEIS) and the Minister for Universities to review where valuable research programmes have either been cancelled or significantly delayed with a view to working with funding bodies like UK Research and Innovation (UKRI) to ensure projects are restarted or reinstated.
- We call on the **Government Equalities Office and STEM organisations** to:
  - Focus on identifying and combatting the increased barriers and novel challenges faced by marginalised groups, such as workers from racially minoritised groups, disabled workers, the LGBTQ+ community and carers.
- We call on the **Department for Business, Energy and Industrial Strategy** to:
  - Work in partnership with the STEM sector, Department for Digital, Culture, Media and Sport, and wider workforce to overcome barriers within the workforce created by the pandemic, such as the roll-out of affordable, high-speed broadband, and mobile technology.
  - Consider opportunities to improve market access, support and guidance for STEM businesses of all sizes – especially outside the 'Golden Triangle' of London, Cambridge and Oxford – to grow and improve regional inequity.
  - Work in partnership with the STEM sector and Department for Education to invest in funding and incentives to support the upskilling and reskilling of the workforce.

Introduction

In July 2020, the APPG for Diversity and Inclusion in STEM agreed to conduct an inquiry into Equity in the STEM workforce, following the APPG's earlier inquiry into Equity in STEM education that reported in June 2020. Although the UK education system and UK workforce are intrinsically linked, the UK STEM workforce has a reputation for not being representative of the UK population with regards to race, gender, sexual identity, disability and socio-economic status. The APPG's Members wanted to better understand the barriers faced by different individuals, groups and communities entering and working in the UK STEM workforce.

The inquiry started in November 2020 and included an online launch event, a call for evidence, four expert roundtable discussions and desk research. The inquiry was undertaken against the backdrop of the COVID-19 pandemic and all events, meetings and interviews took place online as no events or meetings could take place in the Houses of Parliament due to UK Government regulations.

This inquiry focused on whether there are effective practices being used by the Government and organisations employing STEM workers, to create a diverse and inclusive environment. We are grateful to our Secretariat, the British Science Association, and everyone who contributed to this inquiry.

Definition of STEM

STEM is the acronym for science, technology, engineering and mathematics.

In education generally, STEM means the study of these four subjects. In secondary schools, other subjects also sit under these terms, including biology, chemistry, physics, statistics, computer science and design and technology.

For the purposes of this inquiry, however, we are using a broader definition of STEM. In this inquiry, STEM means those sectors of employment and industry that use the specialised skills associated with science, technology, engineering, and maths, rather than just subject knowledge itself. Construction, defence, finance, planning, product design and manufacturing are all examples of STEM jobs that do not link directly to a specific school subject.

Definitions and descriptions of the STEM workforce

The APPG notes that there are limitations with different definitions and descriptions of the STEM workforce. At the start of the inquiry in 2020, the Secretariat took the decision to use the Gatsby Charitable Foundation's 'Understanding the UK STEM technician workforce' (2014, updated in 2020)[1] to understand the different roles, disciplines, qualifications and sectors that are often included within the STEM workforce. This model uses Standard Occupations Classifications (SOCs) to describe the workforce and it should be noted when reading data points that this varies from the Higher Education Statistics Authority (HESA) subject coding system for the academic sector.

At the time of publication there is no sector consensus on STEM workforce definitions, but it is noted that the Royal Society is currently working with the Institute of Employment Research at the University of Warwick to develop a methodology for defining the STEM workforce based on the ONS SOC codes.

Why equity?

Equity and equality are two approaches used to try to create fairness. This inquiry defines "equity" as a needs-based approach to ensure people with different needs can be equally as successful, and "equality" as treating everyone the same.

The inquiry chose to use "equity" as many studies state that treating everyone equally within the workplace and education tends to lead to unequal outcomes, as it assumes all workers begin in similar circumstances, underestimating the impacts of structural inequalities.

A full Glossary of terms can be found in Appendix 1.

Background to the inquiry

The inequity faced by individuals, groups and communities across the UK is not a new problem. STEM careers experience some of the highest levels of growth of any industry (EDF, 2016), yet skills gaps remain and diversity is sorely lacking. Women make up less than a quarter of the core STEM workforce in the UK (WISE, 2019), 'Black and racially minoritised' men (the source's phrasing) are 28% less likely to work in STEM than White men (CaSE, 2014), 29% of LGBTQ+ people surveyed would not consider a career in STEM due to fear of discrimination (IET, 2018), and disabled people represent only 5% of the engineering workforce (CaSE, 2018) compared to 14% of the wider workforce (APPG, 2020). These figures offer a snapshot of the sector but using different measures and data, comparability of the issues remains difficult.

Understanding the reality of exclusion of marginalised groups within STEM industries and academia is has challenged policy-makers, businesses, civil society and campaigners for many years. The evidence suggests there is a mismatch between the STEM skills needed and those available in the UK (National Audit Office, 2018) and the shortage of STEM skills in a number of important sectors has been estimated to cost businesses £1.5bn per year (STEM Learning, 2018). Addressing this skills gap requires changes to workplace recruitment and retention to make sure that no one is excluded from a career in STEM or where STEM skills are important.

The Industrial Strategy (2017), the UK Research and Development Roadmap (2020) and Build Back Better Plan For Growth (2021) have also recognised the value of STEM to the UK economy. STEM workers represented an estimated 18% (APPG on Diversity and Inclusion in STEM, 2020b) of the UK working population in 2019 and therefore a significant share of the UK's GDP. As research, development and innovation become increasingly integral to the UK's future prosperity outside of the European Union, and against the backdrop of an economy slowed by the COVID-19 pandemic, a diverse STEM workforce is likely to give the UK an economic and social advantage. While some limited progress has been made to diversify the workforce, further improvements would help alleviate what many see as one of the UK's key economic problems (National Audit Office, 2018).

The importance of diversity and inclusion in the STEM sector extends beyond the economic imperative, to the intrinsic benefits of equity for societal fairness and success. Addressing the structural issues of inequity inherent in the STEM workforce will not only combat skills gaps but create a stronger, more innovative and trusted sector.

State of the sector (2020)

Before launching the inquiry, the APPG on Diversity and Inclusion in STEM undertook a data analysis (2020b) of the Office for National Statistics' 2019 Labour Force Survey to reveal the state of the sector before issuing a call to evidence in November 2020. It found:

- 5.9 million (18%) out of a workforce of 32.8 million worked in STEM occupations (as defined by our analysis).
- The STEM workforce, when contrasted with the rest of the UK workforce, has a lower share of female workers (27% vs. 52%) and disabled people (11% vs. 14%).
- When grouped as one category, the STEM workforce has a comparable share of Black, Asian and racially minioritised workers to the rest of the UK workforce (12%). However, when the data is looked at in more granularity, STEM has a lower share of Black workers (2% in engineering, technology, science and maths compared to 3% in the rest of the workforce) across all sectors apart from health, and a lower share of Bangladeshi and Pakistani workers in science, maths and engineering (1% compared to 2% in the rest of the workforce).

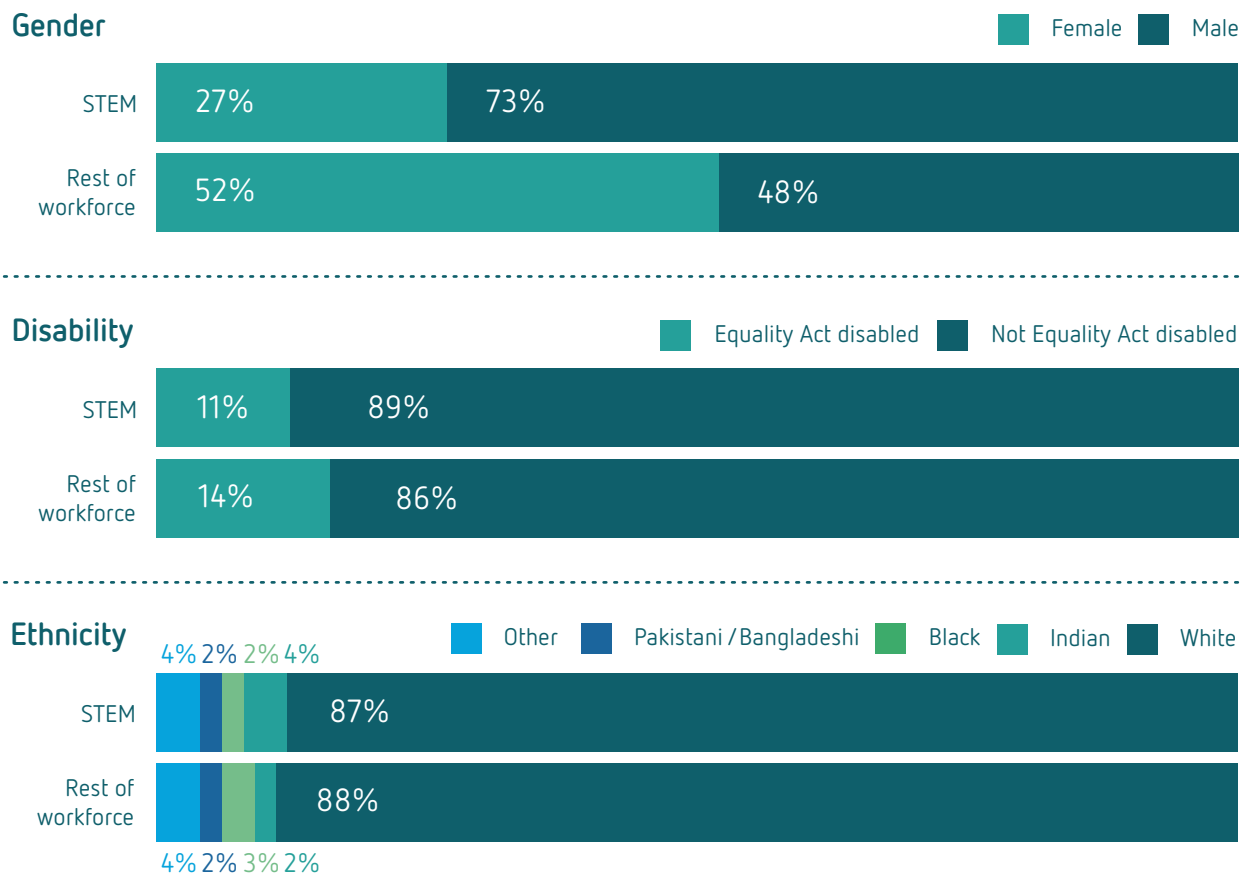

Figure 1: Composition of STEM workforce by gender, disability status and ethnicity (in line with the Equality Act 2010 definition). UK, 2019.

Source: Analysis of ONS, Labour Force Survey

The background research attempted to take an intersectional approach to data analysis where possible. It looked across multiple protected characteristics to identify those particularly marginalised in STEM, though it must be acknowledged that intersectional data is not available in many STEM sectors; consequently any intersectional findings were limited. Key insights were:

- Disabled people (who declared disability) of all ethnicities are marginalised in the STEM workforce. The gap in representation between STEM workers and others, is larger for disabled women than disabled men. The majority of disabled workers in the wider workforce are women (59%), in the STEM workforce only one third (33%) of disabled workers are women.
- 65% of the STEM workforce are White men.
- The STEM gender gap remains consistent across age groups; 29% of 16–29-year-olds in STEM are women, compared to 28% of the 30–49 group.
- Women are a minority of the workforce at all National Statistics Socio-Economic Classification (NS-SEC) levels and are least represented among lower supervisory workers and small employers.

Ongoing work in the sector

Government, Parliament and campaigning organisations have been raising the profile of a lack of representation from certain communities in the STEM workforce for many years. For example, the Women's Engineering Society has been supporting diversity and engineering for over 100 years, and the Women in Science and Engineering Campaign (WISE) has been aiming to increase the participation of women in STEM since 1984.

More recently, initiatives to increase representation in STEM for younger people, such as the Institute of Physics Limit Less campaign, have been launched. Newer groups aiming to challenge the lack of representation in STEM have also emerged, such as the Athena Forum, the Black British Professionals in STEM (BBSTEM), the Black Women in Science Network, Pride in STEM, InterEngineering and Equal Engineers, which aim to connect and empower LGBT+ engineers.

Successive governments since the early 2000s have been concerned with improving the take-up of STEM subjects in schools and its impact on the numbers of students that go on to study those subjects in higher education. In 2017, the Government launched the paper 'Industrial Strategy: Building a Britain fit for the future' where it called for the need to '…tackle particular shortages of STEM skills. These skills are important for a range of industries from manufacturing to the arts' (HM Government, 2017) and addressing the spatial inequity of skills forms a central tenet of the UK Government's 'Levelling Up' agenda. As part of the Research and Development (R&D) Roadmap announced in July 2020, the upcoming Government R&D People and Culture strategy aims to 'attract, retain and develop the talented, diverse people and teams that are essential to delivering our vision' of the UK as leader in research. This is seen as an opportunity to build equitable policy into the research sector if enacted.

Lines of inquiry

The APPG on Diversity and Inclusion in STEM focused its inquiry on the current state of equity in the UK's STEM workforce, as this is an area that has not been covered by previous reports undertaken by Government departments, Parliamentary committees, and organisations from the STEM and education sectors.

Many other reports highlight various elements of the wider workforce and STEM inequity, but few take a holistic and intersectional approach in relation to equity and diversity in STEM. The Commission on Race and Ethnic Disparities (2021) report, the McGregor Review on Race in the Workplace (2017) and the Qualitative Analysis of the 2015 Race at Work Survey (Ashe & Nazroo, 2016) all tackle the reality of racial disparities and exclusion in the UK workforce, to varying degrees of success. Recent work from the STEM sector includes the Royal Society (2021) research into ethnicity and disability in STEM academic communities, WISE (2019) gender and STEM workforce statistics and multiple reports from across the engineering and health sectors.

The inquiry aimed to unite these multiple areas to enable a more intersectional conversation about systemic barriers to equity in the STEM workforce and its impact on the STEM skills gap and other societal issues.

This report brings together evidence submitted by a wide variety of organisations as well as existing research, and provides evidence and recommendations on equity in the STEM workforce in the UK. The APPG consists of members of the House of Commons and the House of Lords who scrutinise the work of the UK Government, which is responsible for many of the policies that oversee the STEM workforce.

The inquiry aimed to address the following questions:

- What are the demographics of STEM workers? Are there gaps in the quality of evidence or reporting?
- Where is there inequity across the different protected characteristics and how are different communities impacted across different:
  - STEM disciplines or sector/subsectors?
  - Types of organisation (e.g. private, public, non-profit)?
  - Type of STEM activity (e.g. academic research, education, engagement, commercial, funding)?
  - Job levels and/or qualification?
- Where are there best practice inclusive behaviours and policies within different organisations, subsectors, sectors and countries relating to:
  - Recruitment?
  - Retention?
- Are there policies or activities undertaken by the UK Government, or its agencies, that advance or inhibit equity and inclusive cultures within the STEM workforce?
  - Where could policy change or sector action lead to addressing the equity of opportunity within the UK's STEM workforce?
  - What are the impacts of COVID-19 on equity for STEM workers (including job and income security, contract type etc) in the short and medium term? Which communities, groups, organisations or sectors are being most impacted?
  - What are the implications and opportunities of new policies and employer action in the next 5-10 years following COVID-19 and Brexit? What will the future impacts be for communities, groups, organisations or sectors?

Evidence considered

This report combines over 80 pieces of submitted evidence and discourse from four roundtables attended by over 40 participants from across the STEM and EDI sectors, alongside further desk research. The inquiry received many high-quality submissions from larger employers, research funders and professional bodies. The information provided by some of the submissions was particularly well-informed and helpful. However, there was a lack of evidence from small and medium enterprises (SMEs), defined as those with fewer than 250 employees. The APPG has attempted to gain further insight into the experiences of these bodies through additional research and acknowledges that the findings will have been influenced by the types of organisations who submitted.

Timeline

10 November 2020	Inquiry online launch event
10 November 2020 - 29 January 2021	Call for evidence open
3 February 2021	Roundtable: 'Mapping inequity across the STEM workforce and Protected Characteristics'
18 February 2021	Roundtable: 'Data, demographics, and diversity: improving the quality of evidence and reporting on representation in the STEM workforce'
24 February 2021	Roundtable: 'Inclusive recruitment and retention in the STEM workforce'
4 March 2021	Roundtable: 'How does the UK Government policy advance and inhibit equity and inclusive cultures within the STEM workforce?'
20 July 2021	Final report published

Key findings

1 The STEM workforce is less diverse than the wider workforce but consistent data collection and sharing is lacking.

The overview data analysis conducted by the inquiry in November 2020 found clear evidence of demographic inequity in the STEM workforce, which worsens with seniority. It has a lower share of female workers (27% vs. 52%) and disabled people (11% vs. 14%) than the rest of the workforce. The analysis also highlighted that, while the percentage of the STEM workforce that are from ethnic minorities is similar to the wider UK workforce (12%), amalgamating minoritised groups skews the data, so that it appears more ethnically diverse than it actually is. Greater representation of workers of Indian ethnicity in the STEM workforce masks the underrepresentation of Black workers, specifically Black women and Black-African men. The relative diversity of the health sector also contributes to this when compared to less diverse sectors, such as engineering (APPG, 2020b).

The inquiry found that there have been rapid improvements in demographic data collection relating to EDI in the STEM workforce amongst large employers, professional bodies and funders in recent years which is welcome. Most of these data collection and analysis efforts have focused on gender. It is likely that the increase in availability and usability of frameworks, awards, and charters, plus policies such as gender pay gap reporting have driven this.

However, the lack of consistency and tendency to focus on single characteristics of much of the data prevents a full demographic overview of the workforce. Few studies aim to or are able to gather intersectional data. This is partly because some characteristics are much harder to track than others, as they rely on self-declaration, hence good quality data is harder to come by. Due to the variation in sectors, disciplines and the intersectionality of issues faced by minoritised groups, it is unlikely that comprehensive mapping will ever be possible if reporting continues in this pattern. There is widespread agreement that more comprehensive data is key to understanding progress, gaps and action required in creating an inclusive and diverse STEM workforce (Science Council, 2021) to inform best practice (Academy of Medical Sciences, 2021).

The composition of different STEM workforces is also influenced by the demographics of the population local to the employer. Age and gender are relatively similar throughout the UK and between urban and rural communities, but ethnicity, socio-economic status and disability are not. Though this may change due to the normalisation of remote working as a result of COVID-19. There is a lack of clarity concerning whether organisations should aim to reflect the local or national demographic in their own workforce.

Issues relating to lack of specificity and data do not just arise when referring to demographics or characteristics. A major issue in analysing the evidence submitted to this inquiry was lack of specificity over what defines a STEM job and a STEM worker. This inquiry did not seek to create a new definition of the STEM workforce but did encounter multiple definitions of STEM throughout the evidence and research. The inquiry noted that the Royal Society and the University of Warwick are working to agree a methodology for defining the STEM workforce.

This inquiry received a large amount of data relating to the demographic make-up of the STEM workforce from STEM organisations and national datasets, and drew on numerous published reports in an attempt to further map the sector. A major challenge in compiling this report is that where the data is specific, it rarely focuses on more than one characteristic. Analysis of the sector by individual characteristic lacks intersectionality but was the most efficient method of examining the available evidence. The inquiry is aware that many STEM employees belong to more than one marginalised group and the following sections should not be read in isolation.

The evidence submitted by numerous organisations confirmed that, in general, women are proportionally under-represented in STEM. An overview of sectors was possible by gender due to the large amount of evidence and great variation was found that is often masked by top line statistics. Only 14.5% of engineers are women (Engineering UK, 2021) but amongst NHS doctors there is almost gender parity with 48% of doctors being women (British Medical Association, 2021). We received a multitude of evidence on the barriers women face throughout the sector and along the career ladder but any nuance beyond the gender binary was not reported.

Whilst ethnicity was the second most reported on characteristic in our evidence, available data is inconsistent. Underrepresentation of STEM workers from racially minoritised groups is largely true of the STEM workforce, but beyond this generalised finding the picture varies significantly. For example, figures for the life sciences sector estimate that 1% of employees are of 'Black/African/Caribbean/Black British' ethnicity, compared to 4.4% of Indian and 1.7% of Pakistani ethnicity (ONS, 2019). Several organisations who submitted workforce data on ethnicity used the categorisation 'Black, Asian and Minority Ethnic' (BAME) which limits the extent to which the workforce can be analysed, and experiences understood. Where demographic data was available, it evidenced the extent of exclusion of racially minoritised groups in STEM. Further detailing of available data can be found in the Analysis of Evidence section of this report.

Beyond gender and ethnicity, other characteristics become harder to track in the data. The quality of mapping of disabled employees depends on the sector; engineering and STEM academia stand out as offering the most insights and both illustrate a lack of disabled employees. Low levels of self-reporting further mask the experiences of disabled workers.

There is currently insufficient information to facilitate a demographic overview of the LGBTQ+ STEM workforce, creating difficulty in understanding the problems faced by this community. Whilst representation remains unclear, discrimination does not, and evidence submitted suggests a pattern of inequity for LGBTQ+ workers in STEM. It is also important to note that the acronym LGBTQ+ covers different sub-groups, whose experiences should not be considered the same (Pride in STEM, 2021).

Socio-economic status is not widely reported on by employers or national workforce statistics, and is often treated as tangential or irrelevant to EDI. Collecting socio-economic status data lacks standardisation and consistent definition, work would need to be done to support any collection. However, socio-economic disadvantage has a clear intersectional impact and where there is data, inequity is apparent. People from more privileged backgrounds are overrepresented in the life sciences workforce (Social Mobility Commission, 2021) and more likely to achieve a managerial or professional position by age 30-39 (Engineering UK, 2021).

Where there are signs that representation of some historically minoritised groups is increasing, the evidence submitted to the inquiry was limited to addressing single characteristics (usually gender or ethnicity), and often to a single context (sector, type of employer, size of employer, seniority, geographic location). The inquiry received little evidence on religion or belief, gender reassignment, marital status, international workers, pregnancy and maternity.

Inquiry findings on data collection in the STEM sector

Data type	What is needed?
Quantitative	Clearer definitions and categorisation across all protected characteristics and minoritised groups that experience inequity in STEM workplaces
	Better granularity to avoid grouping characteristics together, reduce misinterpretation, and provide a better picture of the real problems and mechanisms underlying intersectional inequity
	More consistency in approach, frequency, and harmonisation of EDI data
	Trust building to support declaration of personal data and experiences
	An intersectional approach that focuses on the impact of multiple diversity characteristics on peoples' real 'lived experience' in the STEM workplace
Qualitative	Linking quantitative data to lived experience to show 'blind spots' and identifying where approaches need to change
	Better evaluation to understand the impact and effectiveness of specific interventions
All data	Clear rationale for data collection and clear communication of usage

2 There is a need for the Government to take a multi-pronged approach to drive equity in the STEM workforce.

The inquiry found evidence that some new legislation and Government-led initiatives are having a positive effect on reducing inequity in the STEM workforce, but the Government's approach is fragmented, lacks high-level coordination and is not using many of the tools at its disposal to support minoritised groups. The inquiry identified multiple areas in which existing and future Government policy and legislation can be leveraged to champion workforce equity.

New legislation over the last 15 years has had a real impact on what employees can expect from their employers but it has dated quickly and often lacks sufficient guidance to make it effective. The Equality Act 2010 provides important protections for historically marginalised groups, listed as protected characteristics, and provides a flexible and, potentially, very powerful framework for more equitable workplaces and practices. The inquiry found it has major gaps and deficiencies that require updating. For example, it uses outdated language around gender reassignment (EDIS, 2021) and the protected characteristics do not include socio-economic disadvantage and paternity. Intersectional or combined discrimination claims are currently not possible, as section 14 of the Equality Act, which allows for a single intersectional claim, is not in force (Bourne, 2020). Socio-economic disadvantage particularly has wide-reaching political and social implications; this needs to be addressed in relation to the STEM workforce and equity, but also to the wider 'Levelling Up' agenda. There is a need to expand the scope and improve the language of the Equality Act 2010, so that future legislation which builds on it does not continue to disadvantage these groups.

Further Government support and guidance in the Employment Code of Practice on what constitutes positive action (as opposed to positive discrimination) (Enginuity, 2021), and how data can be collected and used to inform decisions, could result in employers using this framework to its full potential on the recruiting and promoting individuals with one or more of the protected characteristics (Employment Lawyers Association, 2021).

The inquiry also received evidence that a number of consultations, recommendations, and expected legislation that would complement the Equality Act 2010 have not yet been taken forward. These include legal recognition for non-binary people, reform of the Gender Recognition Act, a ban on gender conversion therapy (Pride in STEM, 2021) and certain elements of the Good Work Plan that could extend redundancy protections for those returning from maternity, adoption and shared parental leave (British Medical Association, 2021). Consultation on ethnicity pay gap reporting is also ongoing and a Government response is currently overdue (SIP Futures Group, 2021).

The Equality Act 2010 (Gender Pay Gap Information) Regulations 2017 has had a positive impact on the importance that businesses and organisations place on gender equality. However, organisations with fewer than 250 employees are not legally required to provide gender pay gap statistics and this means 99% of engineering enterprises, and 60% of engineering employees are not reported on (Royal Academy of Engineering, 2021). There is likely to be a similar picture across other sub-sectors of STEM, however, evidence from smaller STEM employers was largely absent, limiting this inquiry's ability to evaluate the whole STEM sector's track record on gender pay gap reporting.

The Government's 'Build back better' plan for a strong COVID recovery provides an opportunity to drive STEM and workforce equity through use of financial levers. In the 2020 Spending Review, the Chancellor of the Exchequer set out a national infrastructure strategy that will deliver a 'once-in-a-generation investment' worth £100 Billion and Government spending on R&D in 2021 to 2022 will be £14.9 billion (HM Government, 2021).

The UK Research and Development Roadmap 2020 provides an opportunity to achieve greater diversity by developing the new R&D People and Culture strategy which will 'attract, retain and develop the talented, diverse people and teams that are essential to delivering our vision'. Respondents to this inquiry saw this as a key policy opportunity to embed EDI within the UK's R&D and levelling up regional economy ambitions. They called for marginalised communities from across the STEM and innovation sectors to be involved in the formation of this strategy to create an inclusive and equitable research innovation culture.

The Public Sector Equality Duty (PSED) places a duty on public authorities to consider how their public procurement affects people who are protected under the Equality Act. The inquiry found some examples of where Government departments and agencies have used procurement to embed equality, diversity and inclusion standards into their contracts, such as High Speed 2 (Royal Academy of Engineering, 2021). Recent sector deals – partnerships between government and industry aiming to increase sector productivity – agreed as part of the Industrial Strategy (now Plan for Growth) have had diversity targets built into them, such as the new deals for the Nuclear and Construction sectors (Nuclear Decommissioning Authority, 2021). There is no standardised model across Government, which limits the potential positive impact for embedding EDI standards within procurement, and thereby improving EDI for employees in smaller organisations.

Due to a lack of standardisation and top-level coordination, a multi-pronged approach has the highest chance of success in driving equity in the STEM workforce and beyond.

3 Intersectional barriers continue from STEM education into the workforce.

Experiences of inequities in education and in wider society continue to play out, and in many cases worsen, at every level of the STEM career pathway. The APPG's previous inquiry into Inequity in STEM Education (2020a) found that inequity needs to be viewed through an intersectional lens and that there is clear evidence of inequity at each stage of the education journey from early years education to the workplace. The 'leaky pipeline' is often blamed for the lack of diversity within the STEM workforce, and many of the evidence submissions from the current inquiry highlighted issues within STEM workplaces that are likely to be causing staff retention issues. Peoples' career decisions are influenced by a variety of factors, and inequity cannot be treated as a problem caused by aspirations, motivations, or attitudes of individuals in minoritised communities.

Similar to the APPG's education inquiry, this inquiry also found extensive evidence that for many categories, sectors and settings, the barriers are even greater, which results in a serious loss of talent. A key task remains translating the increased activity and expressed good intentions of Government and those employers who are prioritising and adequately resourcing EDI, into wider action that is sustained, system-wide, and responsive to the real intersectional, complex barriers that minoritised STEM workers face.

The inquiry found clear evidence that inequity increases along traditional STEM career pathways in academia and large organisations. This is due to barriers to progression such as hostile working environments, and policies that disadvantage people taking career breaks or flexible working patterns. Comprehensive data on employee retention is needed to fully scope the problem in STEM organisations of all sizes.

This inquiry can only draw firm conclusions from career pathways into and within large STEM organisations. Submissions were mainly from large employers in the private and academic sectors, and membership bodies from the scientific and more highly paid professional disciplines. Little information was received, and relatively little is available, concerning SMEs in the STEM sector. For example, although less than 1% of the total number of UK engineering enterprises are within the scope of the gender pay gap reporting requirement, the larger firms that are required to report account for around 40% of the total employment of engineers (Royal Academy of Engineering, 2021).

The multiple, intersectional barriers faced by those entering the STEM sector do not disappear after hiring. Recruiting a talented and diverse workforce is pointless if the systemic inequalities of the sector continue to exclude many minoritised groups and sustain a culture in which they are unable to fulfil their potential. For example, the inquiry found that the STEM workforce has mixed opinions on whether EDI initiatives are needed. Submitted evidence on perceptions of inequity and EDI in STEM point to a culture which reinforces the positive experiences of majority groups, who often downplay or do not recognise instances of discrimination, perpetuate stereotypes, and therefore minimise the need for change. This was evidenced in submissions from Engineering UK (2021), Royal Academy of Engineering (2017), Advance HE (2021) and the Athena Swan 'ASSET' (2017) data.

Whilst ensuring there are clear routes from education to employment is important, in some cases the emphasis on future employees has meant work to reform current STEM workplaces has lagged. Evidence submitted to the inquiry demonstrated an understanding of issues within the workplace and an awareness that action needs to be taken within recruitment, retention and workplace culture. However, there remains a tendency for some Government and large STEM employers to put more focus on investing in the 'education to workplace' pathway than on internal cultures and practices. The inquiry found that regardless of where resources are directed, these issues cannot be treated in isolation, and that much better coordination and collective action is necessary for driving change.

4 There is awareness of structural inequity in some large STEM organisations, but no consensus on solutions.

The inquiry received evidence of a number of initiatives already underway by some large STEM employers which aim to support marginalised groups to participate and progress. Amongst larger STEM organisations the evidence shows an increasing awareness of barriers imposed on marginalised groups concerning recruitment, retention and workplace culture. However, many of the EDI initiatives are in early stages and are not yet evaluated to a degree where significant change could be demonstrated. It is unclear to what extent they are meeting the needs of all employees.

Inclusive recruitment was posited as a central theme in the inquiry's Call for Evidence. Creating routes into STEM for marginalised groups and diversifying recruitment strategy broadens and deepens the skills base and helps to start addressing growing skills gaps. Recruitment is an important tool in creating an equitable workforce, especially ensuring a smooth transition from education to the workplace, but can only be successful in tandem with efforts to retain talent and create an inclusive workplace culture.

From the evidence received, the inquiry found that larger public and private STEM organisations are starting to reform their recruitment and hiring practice and have been for several years. Following the Bridge Report in 2016 the Government implemented anonymised recruitment processes across public sector jobs, including the Civil Service and the NHS. This is an example of an earlier inclusive recruitment initiative, in comparison to the more recent introduction of organisational strategies that incorporate EDI. Similar evidence was not received from smaller organisations such as SMEs or their representatives and further research is needed to understand their position. The inquiry found that, due to capacity and resources, SMEs struggle to respond to calls for evidence.

Multiple examples of recruitment tactics were submitted to the inquiry including anonymised recruitment, gender neutral language, use of recruitment agencies who draw upon a good representation of recruits across socio-economic backgrounds and the protected characteristics, job boards, targeted university recruitment campaigns and more. There was also evidence of engaging with methods to recruit career break returners back to the workplace. As efforts to improve recruitment are more established, there is some evidence from larger organisations that targeted initiatives are yielding more entrants from across socio-economic backgrounds and protected characteristics.

However, despite the work being done, the workforce mapping shows that STEM remains unrepresentative of the wider workforce and population, especially within engineering. We do not know the extent to which recruitment interventions are being enacted, and there is a lack of monitoring and evaluation strategies. The work may be starting to make an impact; however, the problem is too complex to be solved by recruitment practices alone.

Changes in recruitment must be accompanied by improvements to retention practices. Key retention areas highlighted by STEM organisations included leadership, internal communication, progression, awareness and training.

Several submissions showed there is a clear will for leadership-driven change and acknowledged the importance of senior management buy-in, particularly in changing workplace culture and attitudes to those from minoritised groups. Evidence emphasised the need for leaders to implement EDI action plans at board level, with clear accountability. Examples of best practice range from senior 'champion' posts with EDI responsibilities, codes of conduct, ambitious targets, and senior level groups to oversee strategy, such as the Royal Society Diversity Committee or the Wellcome Trust Anti-racism Expert Group. However, as many of these high-level changes have only been implemented in the past two years, or are based around long-term strategic plans, it is not possible to evaluate their success to date.

The inquiry found many examples of large STEM organisations using internal networks run by and/or for minoritised groups of employees, and that this practice is expanding. These Employee Resource Groups are usually formed with the aim to support wider organisational EDI goals; share ideas, experiences, issues and challenges; raise awareness of lived experience of colleagues from marginalised groups; and improve organisational culture. There is a need to ensure that staff networks have a diverse membership, and that they do not burden, or intrude on, those experiencing structural disadvantage.

Previous work in this area, such as the McGregor-Smith review of Race in the Workplace (2017), has shown that transparency around career pathways, succession planning, and support at all levels could influence progression. Employers are becoming more aware of barriers to senior roles for minoritised groups, and are putting measures in place to support progression. As these are yet to make a significant impact in many areas, it is too early to know if the approaches are the right ones or go far enough.

The inquiry found evidence to suggest inequality of access and uptake of training and professional development at all levels. Early-career support and entry schemes are in some cases even less diverse than the workforces they will become part of. The inquiry found very few examples of formal training and CPD which targeted or incentivised minoritised groups in large STEM employers in the private and public sectors. By contrast there were many examples of approaches such as mentoring and external professional networks or alliances, such as Black and British in STEM or Pride in STEM, to bring employees together who share one or more protected characteristic.

Although mentoring and networks appear to be performing useful functions for the organisations that use them, there is a lack of good outcome-orientated evaluation of these techniques, and the case for these measures appears to be largely anecdotal. Reverse mentoring (where leadership are mentored by junior team members) appears to improve senior staff and decision-makers' awareness and understanding of the lived experience of employees from minoritised groups, but it places a high degree of risk and expectation on individuals to declare information and educate others.

Additionally, some STEM organisations are taking steps to raise awareness of EDI and equip their staff to take more inclusive approaches, including introducing EDI training for purposes beyond recruitment, such as leadership skills and improving workplace culture. However, there appears to be relatively little structured evaluation of the outcomes of training at an organisational level and it is unclear whether the recent enthusiasm for these measures will continue apace. Full analysis of these findings can be found on page 52.

5 There is already considerable inequity in the STEM sector, but COVID-19 is making it worse.

The inquiry found that many marginalised groups in the STEM workforce have suffered disproportionately from changes to working patterns and missed development opportunities caused by the pandemic. The inquiry heard many examples of negative effects on groups in the STEM workforce that already face greater barriers, including women, people of racially minoritised groups, disabled people, carers and others. Intersectionality, socio-economic disadvantage, and access to technology (digital exclusion) are also important in determining the degree and type of impact.

Short-term impacts

The immediate impact of the COVID-19 pandemic on STEM employees was on their day-to-day experiences of work. For example, their ability, support and motivation to do the role they were hired to do, and their opportunities to continue and develop.

Although not every issue is unique to STEM, the inquiry received evidence of inequity resulting from the pandemic including:

- **Short-term funding and contracts**: Early career STEM researchers (ECRs) on fixed-term funding are expected to produce research outputs within the lifetime of the grant, and many PhD students have lost a year of work they will not be able to regain (Society for Applied Microbiology, 2021). Some funders are already taking action by offering short extensions to grants (Russell Group, British Heart Foundation, 2021) but this has not been implemented across the board (CREDS, 2021). As a result, people are facing uncertainty over their future employment, and the UK could lose out on important research outputs.

- **Reduced opportunity for progression**: Closure of communal working areas meant that researchers and people in some STEM industries lost access to their laboratories, fieldwork facilities and training programmes. These facilities were particularly important for early career researchers (ECRs), apprentices, or those returning to work after a career break, and who needed to generate outputs and skills to aid their future career progression (Bellingan, 2020, Royal Society of Chemistry, 2020). The inquiry found widespread concerns that those with young children or caring responsibilities, people from working-class backgrounds, and people from Black and racially minoritised backgrounds have been most affected by setbacks of this kind.

- **Redundancy**: Economic losses, temporary changes to activities, and closures have led to widespread redundancies. This is likely to have affected people who already experience some form of disadvantage. For example, if they are on short or fixed-term contracts, are at early or late stages of their careers, or are disabled and are already more at risk of redundancy than their non-disabled counterparts (Lightfoot, 2020). This can create an ongoing threat of redundancy and leave people unable to plan for their future, the uncertainty of which can cause severe anxiety.

- **Loss of income**: There was widespread concern that people with caring responsibilities, young children, and/or part-time working patterns, were more likely to be furloughed under the Coronavirus Job Retention Scheme, and therefore see their income reduce by as much as 20% while under significant pressure to provide for their families and communities.

- **Altered working patterns**: The pandemic forced many STEM employers and employees to experience more home working and other forms of flexible working. In general, we found that the greater benefits — such as increased time with families, more time for outdoor and leisure activities,

and lower commuting costs coupled with home office space — have fallen to those who are in senior roles, or from characteristics which represent the majority in the workforce (White, male, non-disabled, affluent, no caring responsibilities). Meanwhile, the negative impacts such as isolation, increase in unpaid responsibilities, and unsuitable spaces for work are more likely to have affected junior employees and minoritised groups. This can affect motivation, productivity, and whether or not people feel valued.

- **Health inequality and access to treatment**: Lack of capacity in the NHS as a result of surging COVID-19 cases led to long waiting lists and delays for treatment of other health conditions. Health inequalities between people of different ages, ethnicities, geographical locations, and socio-economic groups are likely to have been widened due to the COVID-19 pandemic (Marmot, 2020). For example, the disproportionately high rates of infection among Black, Asian and other racially minoritised communities (Public Health England, 2020).

- **Personal lives and privacy**: Changes to home working patterns and medical shielding policies meant that people were more likely to have had to declare disabilities or long-term health conditions to colleagues, which may have affected their mental health and productivity (STEMM Change, 2021). Similarly, people with caring responsibilities, people who practise religion customs, or people from the LGBTQ+ community were more likely to have had to reveal (or work harder to hide or 'cover') parts of their identity, which can take a considerable mental toll.

Combined, these short-term impacts are likely to have a significant impact on whether people, particularly people from minoritised groups, see a long-term future in STEM. This is a particular issue for early career researchers: evidence received by this inquiry shows that a large proportion of STEM researchers (as many as 25% according to the British Neuroscience Association 2020 and 40% according to AMRC 2020) are considering leaving the field altogether.

Long-term impacts

At a societal level, the pandemic has demonstrated the value of high-quality science and many roles in science, technology and engineering in particular. This has potentially strengthened science capital and raised the aspirations of many young people to follow careers in STEM (37% of young people said the pandemic had made them more likely to consider a scientific career, according to the British Science Association 2020). To meet the needs of the existing and future STEM workforce, evidence indicates a need for priorities to shift post-COVID-19, so that skills-building, networking, career development and lifelong learning are brought to the fore. Infrastructure such as access to ultra-high-speed broadband including in rural areas, and accessible workspaces are also crucial to supporting a diverse and inclusive sector.

Increased Government investment and incentivisation of industry partnerships could lead to an increase in STEM jobs, particularly in digital roles. As noted above, home working is only an option for some groups of STEM workers, whether due to the nature of their role or their personal circumstances; in general, those who are underrepresented in the STEM workforce are less likely to be in those groups who can work from home successfully. However, there could be an opportunity for workplaces to adopt more flexible working patterns and adapt their recruitment and working practices to operate in a way which is more inclusive to women, disabled people, single parents, and people located outside areas with high STEM investment and industry.

Although this inquiry has uncovered many emerging inequalities, the lasting impact of COVID-19 is still unfolding. It is still unclear which groups are being most affected, and how quickly the STEM sector will recover. However, it is important that the STEM sector and the Government work together to plan and invest in the upskilling and reskilling that the STEM workforce – and those currently absent from the labour workforce – will need to adapt to a post-COVID working environment.

Analysis of evidence

Equality, diversity and inclusion in the STEM sector

Recent progress — gender and ethnicity in the workplace

Limited data collection for STEM jobs and difficulty in making comparisons over time can make it hard to discern the overall trends in the workplace, however, the inquiry was able to gain a picture of the progress on gender and ethnicity representation in recent years up to COVID-19. The academic workplace has seen a strong focus on gender equity in recent years, however, improvement prior to COVID-19 was variable and any progress is generally limited in scale, summarised by the Equilibrium Network as 'slow and piecemeal'. For example:

- The proportion of female science professionals has risen by three percentage points from 2009-2019, but the upward trend has not been consistent over this period (WISE Campaign, 2019).
- The proportion of women professors increased in the six years between the two most recent surveys by the Royal Astronomical Society, however, at more junior levels it has been changing very slowly and the proportion of women lecturers in solid-Earth geophysics declined by 15% in the same period.

Other measures show a similar picture, for example, figures from Engineering and Physical Sciences Research Council (EPSRC) for proportion of funding applications from women (EPSRC, 2020) have remained statistically unchanged since 2015/16 at 14%. For workplaces in business and industry there appears to be some progress on gender, however, the rate of progress is also slow and variable. The WISE Campaign (2019) reports improvements in engineering where the proportion of women employed has increased from approximately 5% to 10% over the ten years from 2009, however, the proportion of female ICT professionals has remained static at 16% (BCS, 2020) and the Equilibrium Network reports that in the construction industry 'initiatives that have been run so far have had little impact, and there has been little evidence of change over the last twenty years'.

Amongst academic and other workplaces, there has been some progress in overall representation of racially minoritised groups in some sectors pre-COVID-19. For example, the percentage of UK national academic staff working in science, technology, engineering, mathematics and medicine (STEMM), from Black and racially minoritised backgrounds increased from 8% in 2009/10 to 10% in 2015/16, compared to 14% of the UK population (CaSE, 2018). The Open University (2021) reported that the proportion of staff from Black, Asian and racially minoritised backgrounds in STEM roles has grown steadily since 2014/5 from 11.4% to 13.7%. Network Rail (2019) reports increases in the percentage of people from a Black, Asian and racially minoritised backgrounds from 6.5% to 8.5% of its total workforce over the five years from 2014.

Perceptions of equality, diversity and inclusion (EDI) in the workplace

Studies show that there are considerable variations in perceptions of inequity, particularly between those in majority groups and those in underrepresented groups.

Perceptions of majority groups

- White male engineers feel that the culture of engineering is more inclusive than White female engineers who in turn feel that it is more inclusive than engineers from Black, Asian and racially minoritised backgrounds (Royal Academy of Engineering, 2017).
- The 2017 Athena Survey of Science, Engineering, and Technology (ASSET) found that males see fewer gender barriers for women than men do (ASSET, 2017).

Perceptions of underrepresented groups

- BCS, The Chartered Institute for IT (2021) reports that 38% of Black, Asian and racially minoritised people in the UK have or believe they have experienced discrimination in the workplace because of their ethnicity – 29% also feel they aren't taken seriously at work (Hired, 2019).
- Oxford Brookes University (2021) reports that there is a perception among women spinout company founders of gender bias in the highly male-dominated investor community.
- A London Business School Survey (2014) found that 70% of women in business feel anxious about taking a career break.

SCOPE's Disability Perception Gap survey (2018) found that in 2000, 37% of disabled people and 34% of non-disabled people felt that there was a lot of prejudice around disability. By 2017 the gap between disabled and non-disabled people's perceptions of prejudice has more than trebled, with 32% of disabled people and 22% of non-disabled people feeling there is a lot of prejudice against disabled people. This could indicate a belief by majority groups that EDI is improving faster than it actually is. There are indications that some employers are specifically accounting for perceptions in their EDI strategies, for example, Wellcome (2021a) includes targets for perceptions of EDI in its strategic plans such as 'by 2026 we want at least 80% of Black, Asian and racially minoritised groups and disabled staff to feel that Wellcome is an inclusive organisation'.

Small and medium-sized enterprises (SMEs)

Submissions to the inquiry were mainly from large employers in the private and academic sectors, and from membership bodies from the scientific and more highly paid professional disciplines. Little information was received from small and medium-sized enterprises (SMEs) in the STEM sector. The inquiry found that due to capacity and resources SMEs struggle to respond to calls for evidence.

Data on engineering shows that some 60% of engineers are employed in UK engineering enterprises that have fewer than 250 employees, and are below the threshold for gender pay gap reporting requirements (Royal Academy of Engineering, 2021). A 2018 report commissioned by the Royal Academy of Engineering found that only around half of engineering employers with less than 50 staff (48%) saw increasing D&I as important/very important to their business compared with 85% of larger employers (Royal Academy of Engineering, 2018). However, this evidence cannot be extrapolated to the wider STEM workforce.

There is some evidence that in the wider workforce, smaller employers are engaging with official diversity programmes. Of the 700+ organisations who have signed the charter since BITC Race at Work Charter, 155 are employers with under 250 employees. Stonewall conservatively estimates that of the 850 organisations who are part of their Diversity Champions programme, 70 are SMEs. This represents a small proportion of the 6 million SMEs in the UK in 2020 (Ward, 2021).

The submission by the CFA UK Inclusion and Diversity Network (2021) stated that larger firms have programmes and access routes in place to encourage diversity in recruitment, but smaller firms rely more on their traditional backgrounds and do not necessarily have the resources or diversity education to provide more inclusive workplaces.

The inquiry notes that procurement practices of larger organisations that purchase from SMEs could be an important stimulus for change in SMEs, but heard little evidence of activity in this area, suggesting this warrants greater attention.

Analysis of the current status of protected characteristics

This inquiry acknowledges analysis of the sector by individual protected characteristics does not provide an intersectional insight into the multiple barriers many individuals face, however, it was the most efficient method of examining the available evidence when considering the Equality Act 2010. The inquiry is aware that many STEM employees belong to more than one marginalised group and the following sections should not be read in isolation. More detail about the availability of intersectional data can be found on page 44.

The below section is categorised by the Equality Act 2010 protected characteristic titles, to align with the official wording of the Act. However, the inquiry has chosen to use 'gender' and 'ethnicity' throughout the majority of this report, as opposed to 'sex' and 'race', to align with the updated and appropriate language used in 2021.

Age (Equality Act 2010)

There is a clear overall pattern of decreasing diversity with seniority and age in many STEM roles. For example, data from the UK space workforce (Space Skills Alliance, 2020) shows strong links between age/seniority and levels of inequity, while surveys by Rise – a group for Women in Broadcast (2021) – found that women's representation in roles in its sector drops off after age 55.

A recent study by Liftstream (2020) examined 132 UK Life Sciences companies, including 70 private companies and 62 public companies. It found that women represent just 14.7% of companies' boards and just 9.8% of CEOs, while 7.3% of board directors are from Black, Asian and racially minoritised groups and 7 in 10 boards have no representation from people from a Black, Asian or racially minoritised background.

HESA data (Advance HE, 2020), analysed by Universities UK (2021), shows that inequality increases along the traditional academic research pathways i.e., from undergraduate student, through to professorship. A review of the STEM workforce in Scotland by The Royal Society of Edinburgh (2018) found that in academic roles, the proportion of women declined through every career level and stage, with the rate of decline accelerating from undergraduate level.

Covance, a global contract research organisation and drug development services company, reports that 'a disproportionate number of executive positions (in healthcare) are held by male employees' (2020).

Disability (Equality Act 2010)

According to Government figures, over 7.7 million people of working age in the UK are disabled or have a health condition which requires reasonable adjustment. Historically, there has been a significant gap between the proportion of disabled people employed compared with non-disabled people (Department for Work and Pensions, 2020) which in 2019 stands at 28.6% for the UK as a whole (ONS, 2019b). Disability Rights UK (2020) states that 'despite progress in society, disabled people are underrepresented in the workplace'.

Disability covers a range of very different conditions and challenges, giving rise to different levels of underrepresentation. Data from Advance HE (2020) shows how the proportion can vary between a range of conditions, in this case for UK academic staff as shown in Figure 1 below:

Disabled Academic staff (total)

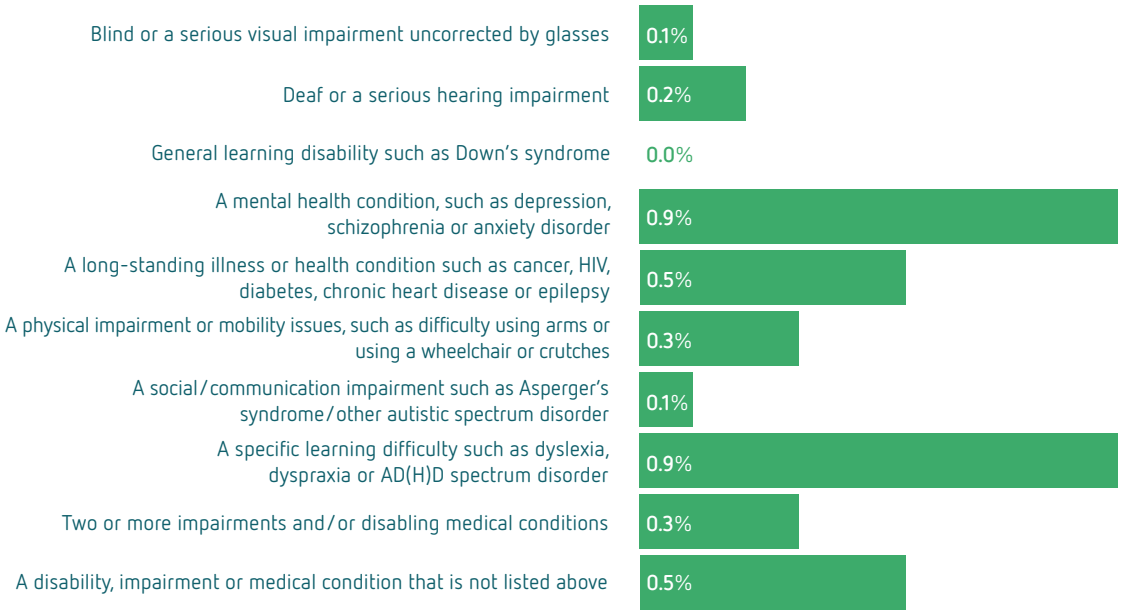

Figure 1: Proportion of different disabilities amongst the 3.8% of STEMM academic staff in the UK who disclose a disability.

Source: Advance HE 2020

Government data shows disabled people are significantly more likely to experience unfair treatment at work than non-disabled people (Department for Work and Pensions, 2014). For many, securing workplace adjustments they are legally entitled to, and the need to work safely and effectively, can be challenging. For example, a survey (British Medical Association, 2020) of disabled doctors and medical students found only 55% of the respondents that needed adjustments said they managed to secure what they need.

The inquiry sought to gauge disability outcomes in the engineering sector, noting that issues of non-declaration can affect employee data. Engineering UK reports that a higher proportion of those working in engineering occupations in the public sector were disabled than those in the private sector, with 10.7% of engineers in the private sector with a declared disability, compared to 16.0% of those in the public sector (Engineering UK, 2021). The figures also vary considerably across different engineering disciplines as shown in Figure 2.

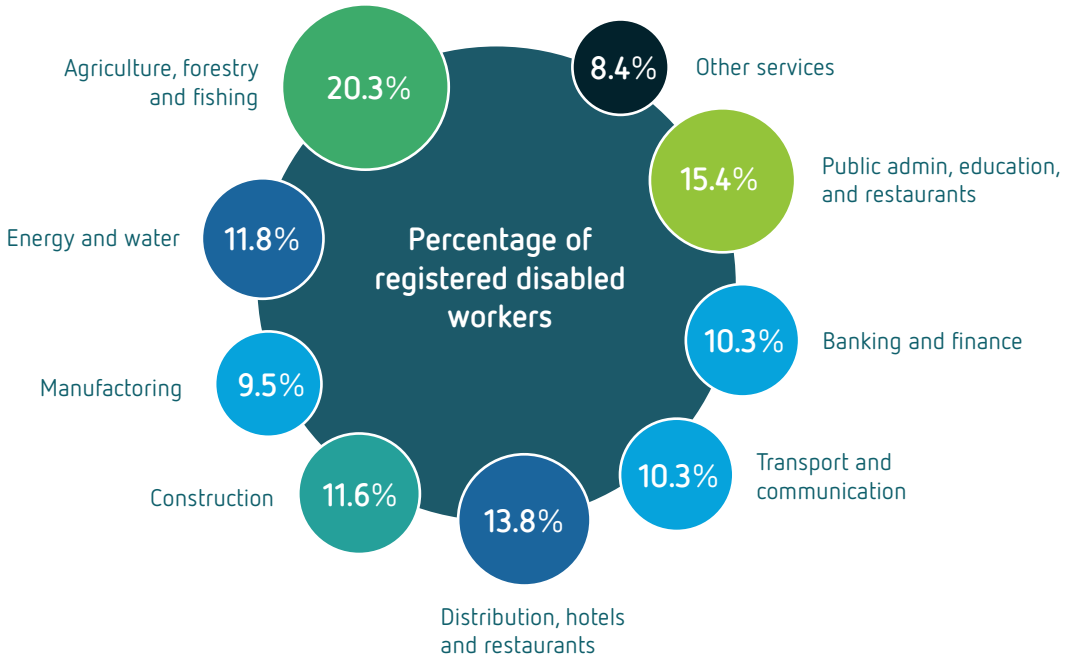

Figure 2: Percentage of registered disabled workers across engineering disciplines in the UK

Source: ONS, Labour Survey Jul – Sept 2020, Presented by Engineering UK 2021

Underrepresentation also occurs in other sectors. Disabled people are underrepresented in Royal Astronomical Society membership (2021) and Wellcome (2021a) reports 5% of staff are disabled, compared with a baseline of 19% in the UK workforce.

The inquiry found that strategies to tackle barriers facing disabled workers often appear weak, the data is incomplete and support is often inadequate. The Equilibrium Network (2021) reported to the inquiry that the construction sector is 'particularly poor at supporting disabled employees' and the Nuclear Decommissioning Authority (2021) states there is no sector wide consensus or targets for disability, which continue to be underrepresented in engineering/STEM organisations, at all levels of seniority.

Sex (Equality Act 2010)

This inquiry received a larger amount of evidence on gender inequity across the STEM sector, compared to other protected characteristics. Gender in the workforce was one of the characteristics reported on across the majority of the private sector workforce data submitted to the inquiry. However, whether organisations reported beyond the gender binary and on gender identity varied greatly.

The inquiry's original data analysis found that 27% of the STEM workforce in 2019 were women, compared to 52% of the wider workforce. Similarly WISE found that in 2019, 24% of the core STEM workforce (not including health or skilled trades) were women (APPG, 2020b).

The gender make-up of the STEM workforce varies considerably by sector and type of organisation:

Technology

Women represent:

- 17% (249,000) of IT specialists in 2019 (BCS, The Chartered Institute of IT, 2020)
- 5% of leadership position holders (BCS, The Chartered Institute of IT, 2021)

Engineering

Depending on the source:

- 14.5% of those working in engineering in 2020 were women (Engineering UK, 2021)
- Women were underrepresented in senior positions (12.9%), and skilled trade occupations (2.6%) in 2020 (Engineering UK, 2021)
- Retention of female engineers is poor, with 57% of female engineers leaving the professional register before the age of 45 (compared to 17% of male engineers) (Royal Academy of Engineering, 2021)

Medicine

- 48% of NHS doctors are women and 57% of medical students are women (British Medical Association, 2021)

STEMM academia

Advance HE (2021) found that:

- Females comprise the majority of staff working in Higher Education Institutions (HEI) but are underrepresented in academic staff, science, technology, engineering, maths, medicine (STEMM) subject areas and senior management roles. Males accounted for 71.4% of senior managers in STEMM subjects in 2018/2019.
- 42.6% of STEMM academic staff were female in the academic year 2018/2019 and males were more likely to hold teaching and research contracts (45.9% were male, compared with 35.0% who were female).
- Subject areas with higher proportions of male staff included electrical, electronic & computer engineering (84.1%) and mechanical, aero and production engineering (83.0%).
- Subject areas with higher proportions of female staff included nursing and allied health professions (74.4% female staff) and psychology and behavioural sciences (62.2% female staff).

Public vs private sector

- In 2020, 13.2% of those working in the private engineering sector were women compared to 29.2% in the public sector. However, the public sector comprised just 8.1% of those working in engineering (Engineering UK, 2021).

Women are also poorly represented in the fields of: computer science, energy, materials science, mathematics and physics & astronomy (all fields that contribute to Artificial Intelligence and quantum technologies, which are a focus of the UK Government).

Variation is also seen in training and apprenticeships. For example, the proportion of female apprenticeship starters varies from just 9% in engineering and manufacturing technologies up to 75% for health, public services and care (Institute for Apprenticeships and Technical Education, 2021).

Pregnancy and maternity (Equality Act 2010)

Research by PwC (2016) found the economic benefit of addressing the professional women career break penalty is calculated as providing an additional £1.7bn to the country's economic output.

Detailed data relating to parenthood, pregnancy and maternity/paternity history and marital status is often not available in employers' external data sets, however, these groups represent a large proportion of the STEM workforce (Institute of Physics, 2021). For example, a survey (Space Skills Alliance, 2021) of the space sector found that parents make up over a third of most organisations, with the highest being defence (37%), industry (32%), government (30%), non-profit (29%) and academia (25%).

The inquiry found evidence that some employers have progressive policies to support those with caring responsibilities. For example, Sir Robert McAlpine (2021) has a range of 'Family First' policies, and Novartis UK offer both men and women 26 weeks of paid parental leave as part of their Global Parental Leave Policy. The Royal Society of Edinburgh (2021) reported that some universities arrange meetings and seminars to take place when staff with external caring responsibilities are normally at work.

Note that pregnancy and maternity are protected characteristics under the Equality Act (2010), but paternity is not. A survey of the astronomy and geophysics community in 2016 found that only 4% of men had taken career breaks, mostly relating to parental leave, compared with 35% of women (Royal Astronomical Society, 2017).

Race (Equality Act 2010)

The broad data shows that diversity of racially minoritised groups in many STEM occupations is lower or much lower than that of White British workers.

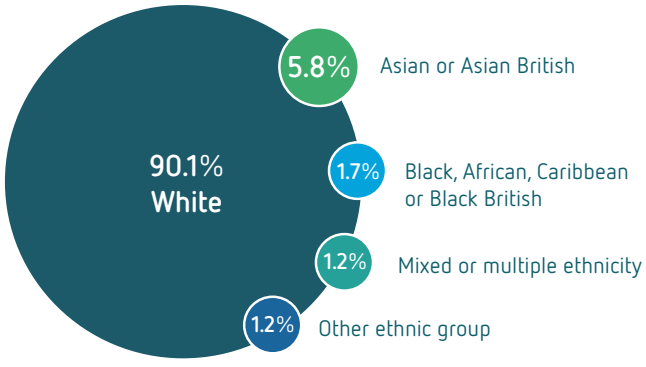

Figure 3a: Percentage of those in engineering occupations by ethnicity

Source: ONS, Labour Force Survey Jul – Sept 2020, Presented by Engineering UK 2021

Looked at by sub-sector, there is considerable variation underlying the overall data as illustrated by data from engineering.

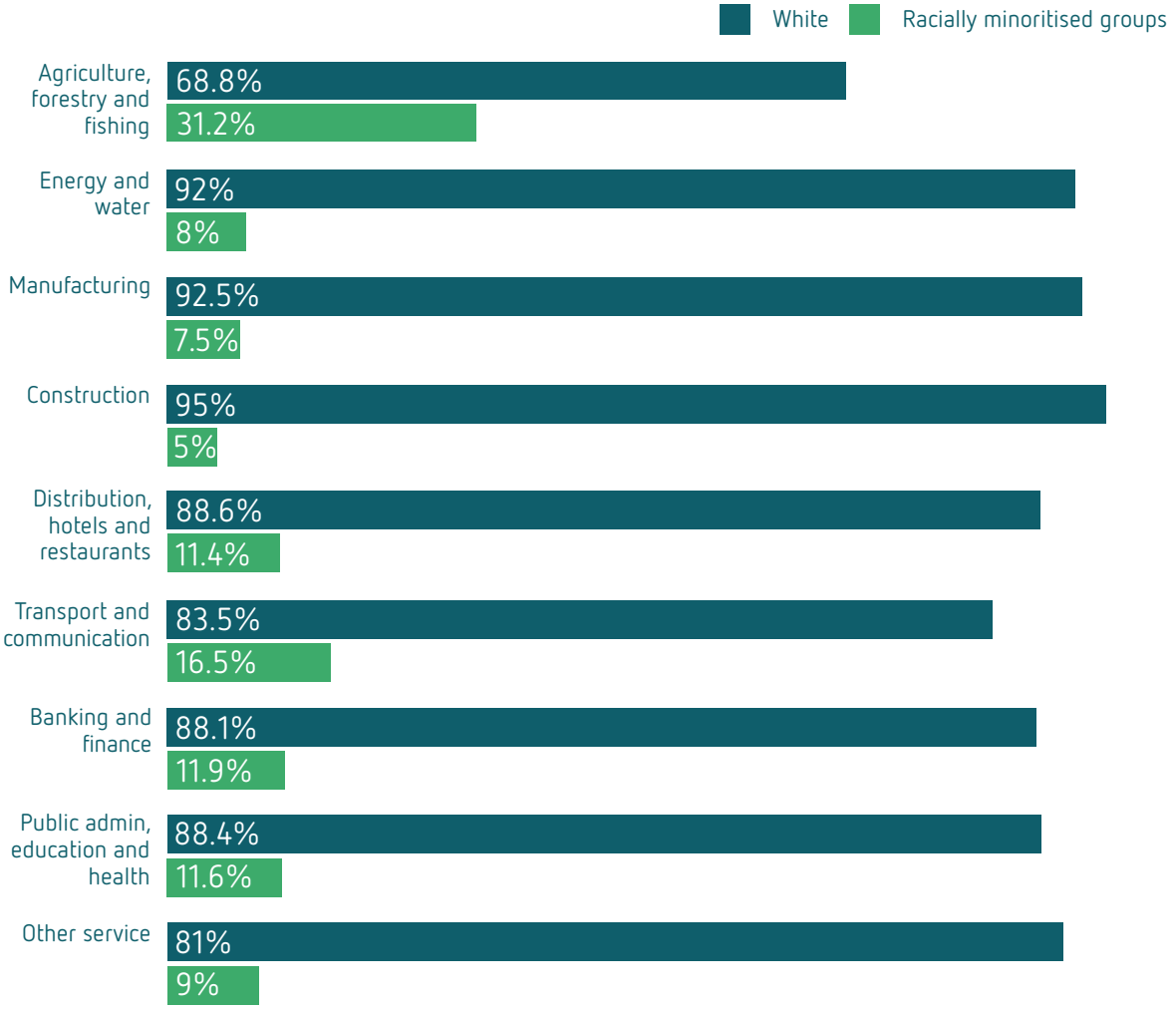

Figure 3b: Percentages of White and racially minoritised groups by sub-sector

Source: ONS, Labour Force Survey Jul – Sept 2020, Presented by Engineering UK 2021

In the life sciences sector data shows approximately 1% of employees are of 'Black/African/Caribbean/Black British' ethnicity, compared to 4.4% of Indian and 1.7% of Pakistani ethnicity (ONS, 2019).

In the chemical sciences, the Higher Education Statistics Agency (HESA) 2019/20 data analysed by the Royal Society of Chemistry (RSC, 2021) shows an underrepresentation of racially minoritised-identifying individuals which is particularly pronounced for Black chemists. There is a significant point of attrition of Black individuals from undergraduate (4.8%) to PhD (1.4%) level, which drops even further through every career level and stage, to 0.9% non-professorial staff and 0% chemistry professors who are Black. Furthermore, there has not been a significant increase in Black representation across the chemical sciences in the last 10 years, except for a small increase in undergraduate students (from 4% in 2010/11 to 5% in 2019/20). It is evident that this underrepresentation of Black, and other racially minoritised groups in the chemical sciences extends beyond academia. A recent high-level roundtable focusing on the chemical sciences industry, innovation and entrepreneurship identified that increasing Black and racially minoritised groups representation in these sectors should be a priority.

Data collection at more granular levels is often patchy. A recent report (Institute for Fiscal Studies, 2020) on ethnicity in economics summarised this as follows: 'Further quantitative approaches to understanding barriers to progress are limited by a lack of data: in many cases, these data are not being collected, and where collected they are not analysed or made available for analysis'.

Despite the gaps in data, it is clear that there are important differences between sub-sectors as noted above, and between occupations, regions of the UK, seniority/age levels and for other intersectional reasons. However, there are some exceptions to the high-level picture of underrepresentation, for example those of Indian ethnicity make up 13% science, engineering, or tech professionals, more than double the share of the whole working population (McKinsey, 2020).

Variability in the extent of underrepresentation is also apparent within funding for STEM. For example, across all UKRI councils in 2018-19 the UKRI fellowship award success rate for racially minoritised groups was 21%, however, within that category Asian applicants had a 25% success rate, compared to 0% for Black applicants (of 20 Black applicants, none were awarded fellowships) (UKRI, 2020).

Caution over the data is also important for other reasons. University departments and research establishments are global recruiters, so often appear to have an ethnically diverse workforce, however, this can mask barriers experienced by those from Black and racially minoritised backgrounds in the UK.

Regional differences can also be highly significant. For example, amongst IT specialists, inclusion of staff from Black, Asian and racially minoritised groups varies significantly by region, from 4% in the South West of England to 33% in London. In this sector the evidence also shows that they have had to achieve more to secure employment, with 85% having an HE level qualification compared to 66% for those from a White background (Tech Returners, 2021).

The inquiry found patterns of inequity at the entry point to STEM careers. In the tech industry, two thirds of Black students and half of Asian students have no tuition fee assistance, and racially minoritised workers are over a third more likely than White workers to be working temporarily, or on zero-hour contracts (Tech Returners, 2021). Engineering students from Black, Asian and other racially minoritised groups are more likely to be in non-engineering jobs or unemployed six months after graduation (Royal Academy of Engineering, 2018)

Within career pathways multiple barriers remain:

- The Nuclear Decommissioning Authority (2021) reports that Black, Asian and racially minoritised workers continue to be underrepresented in engineering/STEM organisations at all levels. Prospect's 2018 Workplace Behaviours Survey showed that nearly two thirds of the Black, Asian and racially minoritised workers in the nuclear sector had experienced bullying, harassment and/or discrimination (Prospect, 2021).
- BCS, the Chartered Institute for IT, reported that Black, Asian and racially minoritised IT specialists are less likely to be in 'positions of responsibility' than those of White ethnicity, with 32% and 43% respectively stating that they were a manager/foreman or team leader in 2019 (2020).
- The British Dental Association (2021) reports accounts of dentists from racially minoritised groups who feel they have been over-looked for promotion, have been rejected for job roles in favour of less qualified candidates, and have found it more difficult to buy dental practices.
- The Society for Applied Microbiology (2021) reported that Black and racially minoritised students are well represented at degree level in the biosciences, but this declines drastically through the career progression and job levels, and is especially true for women of colour.

The inquiry received information showing greater levels of awareness and of action beginning to be taken by some larger employers and professional bodies. However, in many cases this did not include details of evaluation or effectiveness.

Sexual Orientation (Equality Act 2010)

A general demographic overview of LGBTQ+ STEM professionals is difficult to obtain, and existing reports often lack intersectionality (Pride in STEM, 2021). Data evidence received through this inquiry focused more on the proportion of LGBTQ+ employees in STEM who had faced discrimination and career limitations.

The STEM Equals research and impact project by the University of Strathclyde looked at its staff, finding that LGBTQ+ academic staff and PhD students and that the experience of LGBTQ+ people in STEM is characterised by a pervasive pattern of inequities. Data collection is also a problem since for 45% of staff sexual identity information is either not known or not declared (3% of staff at the University identify as Lesbian, Gay, or Bisexual) (STEM Equals, 2021). A survey conducted for the 'Exploring the workplace for LGBTQ+ physical scientists' report by the Institute of Physics, Royal Astronomical Society and Royal Society of Chemistry (2019) found:

- Doing the best for science means retaining LGBTQ+ scientists (28% of LGBTQ+ respondents had at some point considered leaving their workplace because of the climate or discrimination towards LGBTQ+ people).
- LGBTQ+ physical scientists had experienced or observed exclusionary behaviour, with 16% of all respondents having personally experienced harassment or other exclusionary behaviour.

Gender Reassignment, Marriage and Civil Partnership, Religion or Belief (Equality Act 2010)

The inquiry did not receive sufficient evidence on gender identity, partnerships or religion to draw conclusions on their status within STEM.

Analysis of further characteristics

Socio-economic

Socio-economic disadvantage has a strong intersectional impact with many in underrepresented groups also experiencing economic disadvantage. Many STEM employers do not collect data on the socio-economic backgrounds of their staff, however, where there is data, it shows a clear picture of significant and widespread inequity.

In engineering occupations, 70.9% of those from advantaged backgrounds obtained a managerial or professional position by age 30-39, compared to 59.9% of those from intermediate backgrounds, and 48.0% of those from disadvantaged backgrounds (Engineering UK, 2021). Research commissioned by the British Pharmacological Society (2017) indicated that in 2014, some 27% of pharmacology students came from the highest socio-economic bracket. Just 9% of life sciences professionals are from a working-class background (ONS, 2019) and access to the sector requires a particular 'cultural fit' more available to young people from privileged backgrounds (Social Mobility Commission, 2021).

The barriers are evident at the start of the career ladder. Research by the Sutton Trust (2018) found that internships are an increasingly integral part of the graduate job market, yet are characterised by many features that are socially exclusive and afford advantages to those from better off backgrounds. The Social Mobility Commission (2021) found that disadvantaged young people from Black Caribbean backgrounds are more likely to take low-earning courses post-16, as are disadvantaged women from White British backgrounds.

Where you live

For many STEM employers the diversity of their employees will depend in part on the demographics of their local population, as well as on their practices and other factors such as the willingness of staff to relocate, homeworking or the number of regional offices. Some characteristics such as gender and age are relatively similar across the UK and between urban and rural areas, but there are significant regional variations for other characteristics such as ethnicity, socio-economic background and disability.

The proportion of working age disabled adults varies considerably by region (Scope, 2021): from 15% in London to 25% in the North East, East Midlands and Wales. Regional variations in ethnicity are also pronounced, see table below.

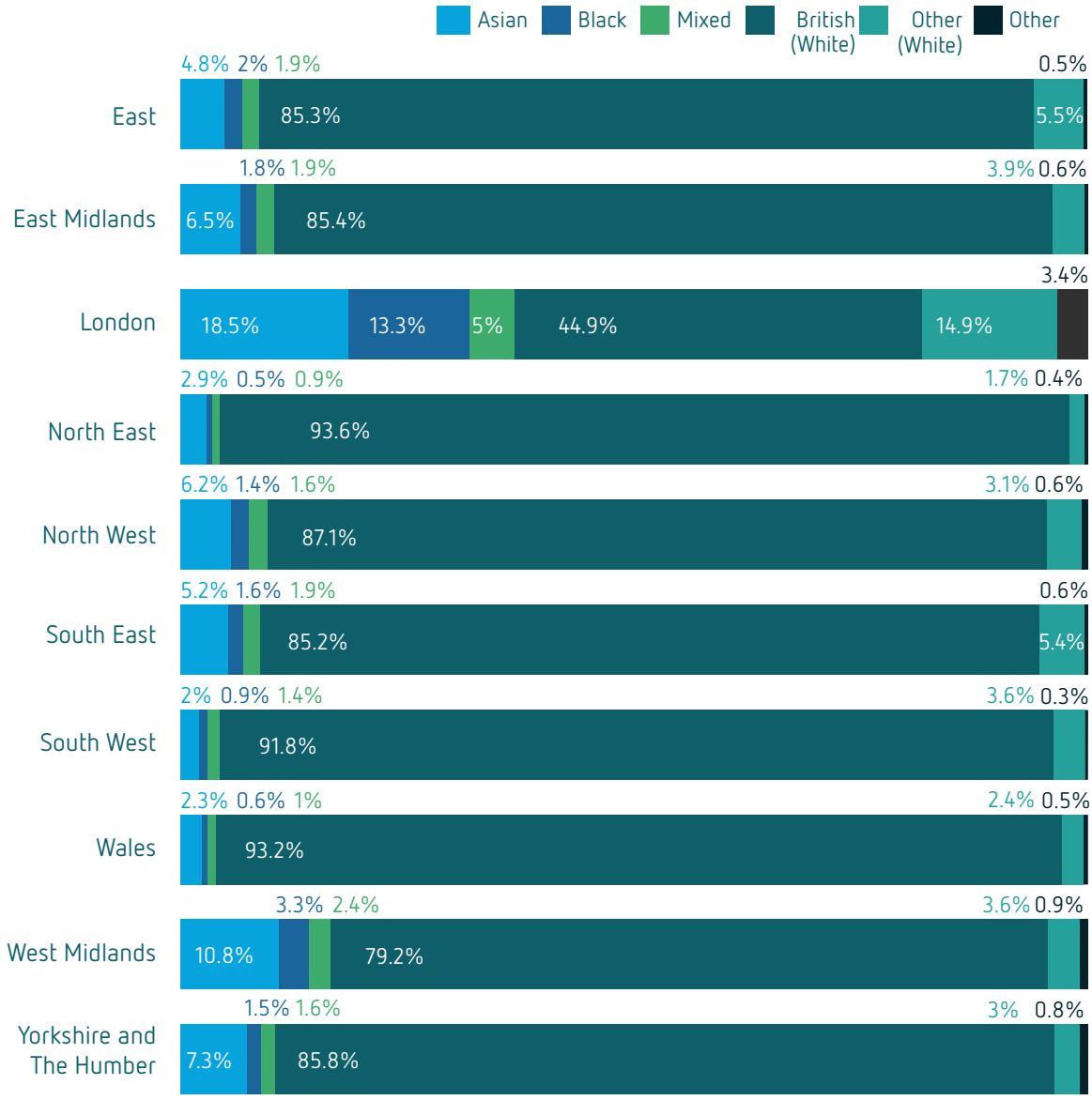

Figure 4: Areas of England and Wales by ethnicity

Source: England and Wales 2011 Census, Office for National Statistics

Many of the organisations that responded to the inquiry were large employers with multiple locations where regional variation is likely to be less of a factor in their policies and targets, and many did not reference regional variation in their submissions, however, this is likely to be more important for SMEs.

Where data was available, it indicated that regional factors need to be taken into account to establish diversity levels more accurately, particularly for smaller employers. For example, Black, Asian and ethnic minority representation amongst IT specialists varies significantly across the UK from just 4% in the South West of England to 33% in London (BCS, The Chartered Institute of IT, 2020).

Regional factors also affect the type, quality and quantity of job opportunities available. For example, a report by Emsi UK (2018) showed that 'there are big differences in STEM requirements between different parts of the country'. Investment in R&D is not evenly spread, with London and the South East benefiting more than regions such as Wales and the Midlands (Institute for Fiscal Studies, 2020). When these factors come together, for example in the so-called 'golden triangle' formed by Oxford, Cambridge, and London, STEM career opportunities of those living outside of that relatively affluent area are likely to be reduced.

Other characteristics

The inquiry found useful indications of action concerning characteristics that are not widely discussed in relation to EDI or elsewhere in this report, but which warrant closer attention. For example:

- Neurodiversity
- People feeling alone / wellbeing
- Long-term unemployed and those not in education, employment or training (NEET)
- Those undergoing the menopause
- Young people leaving the care system
- Paternity, adoption and fostering
- Those with caring responsibilities
- Regional disparities
- Care leavers.

Data

Data collection

Throughout the STEM sector it is clear that some larger employers and membership bodies have recently been improving and expanding their data collection in relation to EDI. Typically, this begins with gender, followed progressively by some other protected characteristics such as ethnicity or disability. However, larger organisations in the public or private sectors appear to be at a different point in this transition, and to be tackling it somewhat differently. It is notable that some, such as the Nuclear Decommissioning Authority or the Weir Group are currently working to improve their data gathering infrastructure to enable improved monitoring.

For Higher Education Institutions (HEIs) it is mandatory to report annually on staff age, disability status, ethnicity, and gender to Higher Education Statistics Agency (HESA). It has also recently become mandatory for HEIs to report staff religion and belief, however, sexual orientation and gender identity status remains non-mandatory.

Data collection by professional bodies and learned societies in the STEM sector in relation to EDI is also improving and the Science Council which represents 34 professional bodies and learned societies, is encouraging professional bodies to seek a much broader range of data across their activities (Science Council, 2021).

The inquiry found it more difficult to gauge EDI data collection by SMEs for whom there may be reduced economies of scale in relation to both the systems and the expertise needed. The Equilibrium Network (2021) reported that ONS data has little or no data for individual construction sector roles and very few engineering, construction, and architecture companies collect data on their workforce by gender. Smaller staff numbers also increases the risk of unintentional deductive declaration of information about individuals.

Despite recent improvements in the data collection by many larger employers, in some cases the level is still very limited. For example, OFGEM's (2021) demographic information is incomplete in a number of categories including ethnicity, disability status, sexual orientation and other protected characteristics. Network Rail acknowledges (Network Rail, 2019) that gaps remain in its data and knowledge about the diversity of its people.

Lack of consistency is also a problem, making cross-sector comparison and analysis difficult. A review of the women in science in Scotland by The Royal Society of Edinburgh found that there is little consistency across industry on the collection and publication of gender-disaggregated data on participation, progression and retention (Royal Society of Edinburgh, 2018).

Other constraints arise due to GDPR and the Data Protection Act 2018, with the Employment Lawyers Association (2021) commenting, 'Practically, an employer can only ask employees to provide the data on a voluntary basis and should always provide a "prefer not to say" option, meaning it is virtually impossible to obtain reliable data for the whole workforce. This will be a significant barrier to meaningful ethnicity pay gap reporting.'

Insufficient data can have important implications for employers' ability to address EDI issues using the positive action framework, a pre-existing mechanism in s.159 of the Equality Act 2010. Without sound data, any proposed steps to take positive action may present significant risks to employers (Employment Lawyers Association, 2021).

Categorisation

Much of the data relevant to EDI in the STEM workforce is collected using different definitions and categorisations, and these may be used inconsistently over time. This hampers harmonisation of data, comparisons between groups and sectors, and tracking of changes.

EDI data is often considered in relation to the protected characteristics as defined by the 2010 Equality Act, however, these categories do not include all minority groups that suffer inequity in the STEM workplace, and are in themselves somewhat out of date or misleading. For example, pregnancy and maternity is a protected characteristic but not paternity, and certain forms of disability and definitions of sexual orientation and language around trans status require updating. Notably, socio-economic disadvantage is not covered by the Equality Act. It is beginning to be considered as an EDI issue in the workplace by some of the professional bodies, but there are significant challenges in defining this and how to collect meaningful data.

The inquiry heard a number of concerns about the term 'BAME' and the problems this over-broad classification can cause by masking and conflating factors such as youth unemployment, economic inactivity, and labour force exit and entry (Employment Lawyers Association, 2021). Despite this serious limitation, many employers do not differentiate adequately between ethnicity groups. It is not helpful that there is no statutory or commonly agreed classification of racial and ethnic groups. Though the Government has produced a list of 18 suggested ethnic group classifications (Cabinet Office, 2021) that were used in the England and Wales 2011 Census, there is a view that an intermediate approach involving five or six categories may be more successful (Employment Lawyers Association, 2021).

Masking the barriers people face by aggregating data also occurs in other areas, for example disability, where the barriers faced by individuals can be entirely different. Data also varies greatly between the STEM disciplines. For example, data from the Health and Safety Executive (2021) shows that average representation of women in the STEM workforce is 41%, but it actually ranges widely from 12% to 58% between different disciplines. In all categories, a greater granularity of data helps to avoid misinterpretation and provides a better picture of the real problems and mechanisms underlying inequity.

Difficulties also arise due to the use of different definitions of the STEM workforce. Unfortunately, the standard Occupation Classification ('SOC') codes cannot be used straightforwardly to define the STEM workforce.

In 2017, the Royal Society commissioned the Institute for Employment Research at Warwick University (IER) to propose a detailed methodology for using SOC code classifications to define STEM occupations. The IER produced a draft report that set out a four-category approach to defining STEM occupations using the 4-digit SOC codes. Following the publication of SOC 2020 by the ONS, the Society has asked the IER to update their 2017 report to reflect SOC 2020 using 6-digit SOC codes for greater granularity. Using the IER methodology may allow organisations to track diversity in STEM in a consistent way (Royal Society, 2021). The WISE Campaign (2018) uses a 'core STEM definition' that includes science, engineering, and information and communications technology but excludes health occupations and skilled trades. The Gatsby Charitable Foundation's (2014) definition of the STEM workforce is also seen as a useful framework.

The inquiry heard calls for improved definition and categorisation in two further areas:

- The UKRI's evidence review (2020) of bullying and harassment in the research and innovation sector found that evidence gathering and understanding trends can be hampered by the lack of agreed definitions of bullying and harassment.
- The Centre for Research into Energy Demand Solutions (CREDS) evaluation of the EDI performance of its ECR Flexible Fund Call recommended that more diverse criteria by which to define Early Career Researcher (ECR) would be helpful (2021).

Demographic data on the whole population is needed for comparison and this also has limitations. For example, Stonewall has called for the ONS Labour Force survey to collect data on sexual orientation and trans status (Stonewall, 2021).

Intersectionality and 'lived experience'

An intersectional view of inequity and diversity can show a different and more meaningful picture than one that looks at single characteristics, with potentially significant implications for policy and action. Qualitative data and accounts of 'lived experience' can also shed light on the real barriers people face.

Intersectional and qualitative data can reveal the full extent of inequity that may otherwise be overlooked. For example, EngineeringUK (2021) reported that a higher proportion of women from racially minoritised groups work in engineering occupations (23.6% female) than White engineering employees (just 13.5% female) and data shows that women are underrepresented in the IT sector accounting for just 0.7% of workers (BCS, The Chartered Institute for IT, 2020).

Intersectional data can also point more clearly to where barriers may lie. For example, analysis of gender and ethnicity by Universities UK (2021) shows that the gap in representation of Black, Asian and racially minoritised female academics compared to White males is 31.3% at postgraduatr level, but widens further to 63.7% at professorial level at which stage just 2.3% of professors are women from a Black, Asian or racially minoritised background.

Despite the advantages of intersectional analysis, the inquiry found that data of this kind is collected and used relatively rarely. A review of women in science in Scotland by The Royal Society of Edinburgh found a paucity of intersectional data that reflects the experiences of people with a combination of protected characteristics, both in information collected and published by industry, and in labour market statistics gathered by the UK and Scottish Governments (2018). Examples of the collection of 'lived experience' qualitative data in STEM include:

- Rollock, N. (2019). Staying Power: The career experiences and strategies of UK Black female professors.
- British Veterinary Association. (2019). Report on discrimination in the veterinary profession.
- Institute of Physics, Royal Astronomical Society and Royal Society of Chemistry. (2019). Exploring the workplace for LGBT+ physical scientists.
- Accounts of inequity across multiple characteristics impacting numerous aspects of a person's career (in HE). Athena Survey of Science, Engineering and Technology (ASSET) for 2016.

Evaluation

The inquiry received information from employers about many EDI schemes, often recently set up, but in relatively few cases were these accompanied by the results of evaluation of outcomes or was data presented to show impact. The reasons for this are unclear and, in some cases, it may be too early for evaluation to show results. However, it is possible that insufficient evaluation is taking place. Examples of good evaluation practice include:

- The Centre for Research into Energy Demand Solutions (CREDS) conducted evaluation of the EDI performance of its ECR Flexible Fund Call (2020).
- Ford Motor Company reports successfully achieving an average retention rate of 90% for all employees taking maternity and adoption leave after two years of returning following the implementation of a series of diversity and inclusion initiatives to promote female engineers in the automotive industry (Employment Lawyers Association, 2021).
- The Open University (2021) was able to show that a specific measure to address inequity associated with a STEM course raised Associate Lecturer appointments of those identified as Black, Asian or from a racially minoritised background to 11%, compared to 5.3% of the overall Associate Lecturer population in STEM.

Data declaration issues

Under the Data Protection Act UK businesses can only collect and store a minimum amount of personal data, and cannot mandate that their employees share sensitive personal information about themselves (RELX Elsevier, 2021). Non-anonymised demographic data is also considered personal data and is subject to strict processing conditions.

Issues of trust and privacy can be of concern for staff and many submissions highlighted low rates of declaration of personal data across STEM. For example, some may not wish to reveal information about their health or sexual orientation for personal reasons, because they may fear problems such as bullying or harassment which are well documented in the workplace, or difficulties with career progression (Pride in STEM, 2021). These issues can be more acute where staff numbers are low or where characteristics are otherwise not apparent to colleagues (for example, a neurological condition). The British Medical Association in their 2019 survey found that due to a lack of disability inclusive culture, only 36% of respondents would feel comfortable sharing their disability.

These can be important issues for organisations. The Society for Applied Microbiology (2021) stated, 'it becomes extremely difficult to use the data effectively when there are gaps e.g., when survey respondents skip particular diversity questions or select "prefer not to say"'.

Interpretation of non-declaration rates becomes more difficult where the baseline of those with the characteristic are not known and where rates differ, such as between occupations or career stages. The inquiry noted BAE Systems' experience that comparatively few disabled people declare their conditions when they apply for apprenticeships, but that this percentage rises substantially once they are employed and develop their individual learning plans (Employment Lawyers Association, 2021). Non-declaration is a particular challenge in relation to sexual identity. Universities UK (2021) reports that staff data on transgender and sexual orientation is limited, with 72% and 55% of staff respectively providing no information. The inquiry found that some employers do not acknowledge or include non-declaration rates in their data which is unhelpful.

Non-declaration is also an issue in the allocation of funding. UKRI (2019) states: 'Self-declaration remains a consistent challenge that is not overcome merely by trying to entice individuals to declare their information. What may impel someone to declare information about themselves to one organisation may elicit a negative response in another context, producing a dataset that has uneven rates'. At present there is relatively little survey data concerning staff's socio-economic disadvantage, however declaration is likely to be a considerable issue.

Government policy

Current areas for attention

The Department for Business, Energy and Industrial Strategy (BEIS) published the UK Research and Development Roadmap (the 'R&D Roadmap') in July 2020. It outlines the Government's commitment to ensuring a diverse, equal and inclusive workforce stating that it must 'remove any barriers and dismantle any inequalities in the system that limit the ambitions, inclusion and participation of people from any background'.

The R&D Roadmap states that BEIS will work towards achieving greater diversity by developing a comprehensive new R&D People and Culture Strategy. The inquiry found that this is seen as a key opportunity to embed policy and action on EDI (Employment Lawyers Association, 2021).

The inquiry heard a range of comments and advice about the development of the R&D People and Culture Strategy:

- A forward-thinking diversity data strategy, with bold ambitions for a positive and inclusive research and workplace culture, should be at the heart of this strategy (British Pharmacological Society, 2021).
- When developing the People and Culture Strategy, the Government should take into account learnings from Wellcome and the Nuffield Council on Bioethics (Royal Society of Biology, 2021).
- Opportunities to consider and address issues of EDI in the research and innovation workforce and research practice present themselves. These developments will shape investment, organisational behaviour and influence individual response (Royal Society of Chemistry, 2021).

Other key areas of policy flagged to the inquiry included the Public Sector Equality Duty, rules around flexible working, the reasonable adjustments policy and the Disability Confident scheme.

Law

The Equal Pay Act, the Equality Act, and more recently the Public Sector Equality Duty are seen as providing important protections. The inquiry heard concerns that Government may reduce these protections following Brexit.

The Equalities Act 2010 does not cover socio-economic disadvantage, paternity and other minority groups who may experience inequity and uses outdated language around 'gender reassignment' (EDIS, 2021). The positive action framework within the Act that could allow employers to take 'positive action' to recruit or promote individuals from underrepresented groups is currently not being used to its full potential due to uncertainties around data collection and where the boundaries of the framework lie, and further clarity would be extremely useful (Employment Lawyers Association, 2021). Under the Act, intersectional or combined discrimination claims are currently not possible, as section 14 of the Equality Act, which allows for a single intersectional claim, is not in force (Bourne, 2020).

The inquiry also received evidence that a number of consultations, recommendations, and expected legislation that would complement the Equality Act (2010) have not yet been taken forward. Pride in STEM (2021) evidenced that legal recognition for non-binary people, reform of the Gender Recognition Act and a ban on gender conversion therapy have not been implemented despite Government reports and pledges dating back to 2016. Certain elements of the Good Work Plan that could extend redundancy protections for those returning from maternity, adoption and shared parental leave.

The Public Sector Equality Duty (PSED) applies to public spending of some £236 billion each year and requires those carrying out public functions to consider or think about how their policies or decisions affect people who are protected under the Equality Act (Royal Academy of Engineering, 2021).

The inquiry heard a range of positive views of gender pay gap reporting requirements (prior to their temporary suspension due to COVID-19). These were felt to have had a clear impact on how businesses or organisations behave and what they consider to be important, improved the quality of evidence available and given women a legitimised framework within which to raise their concerns. However, SMEs or organisations with fewer than 250 employees are not required to report gender pay, this means 99% of engineering enterprises, and 60% of engineering employees are not reported on (Royal Academy of Engineering, 2021). There is likely to be a similar picture across other sub-sectors of STEM, however, evidence from smaller STEM employers was largely absent, limiting this inquiry's ability to evaluate the whole STEM sector's track record on gender pay gap reporting.

Ethnicity pay gap reporting is not currently a legal requirement however some organisations report growing pressure to publish ethnicity pay data (BCS, The Chartered Institute for IT, 2021). There are also calls for disability pay gap reporting, the Royal Academy of Engineering (2021) stated: 'We support the extension of pay gap reporting to ethnicity and disability to increase transparency and support the development of more equitable workplaces.'

The Data Protection Act (2018) has important implications for EDI and in particular the gathering, processing and use of data that could shed light on inequity and help address barriers to inclusion. These issues are discussed in the research funding section on page 49.

Flexible Working Regulations (2014) are seen to have had a significant impact on how organisations behave and on the ability of parents and carers to maintain and progress their careers. There are concerns that requests for flexible working (either as a disability-related reasonable adjustment or for other reasons) are not enacted in a timely fashion.

CASE STUDY 1

The power of collaboration: **Diversity networks**

Equality, Diversity and Inclusion in Science and Health (EDIS) is a coalition of organisations working to improve equality, diversity and inclusion within the science and health research sector, originally established by The Francis Crick Institute research centre, independent funder Wellcome Trust, and its commercial partners GlaxoSmithKline. EDIS has now grown to 20 member organisations and the collaboration between different types of organisations across the sector is fundamental to its ways of working.

EDIS's vision is for everyone to have equal opportunities and access to a successful career within science and health, its research and its outcomes. For 2020/21 EDIS is focusing on 'inclusive conferences & and events' and 'inclusive research & experimental design'. EDIS members are engaged to act across the science and health research system in multiple ways towards this common vision. This coordinated approach from its members leads to greater waves of change increased impact.

Since its creation EDIS has created and shared practical tools and resources for the wider community, one example of which is the Diversity and Inclusion Survey (DAISY). The DAISY Guidance, published in 2020 was a first step towards harmonising member data collection. Based on member feedback over the past year, EDIS has been able to identify seven further elements to consider when planning diversity data collection, to continue improving their guidance. EDIS has also developed guidance for publishers to create inclusive name change policies, enabled members to improve accessibility and inclusion at events, coordinated responses to the DHSC Women's health strategy consultation and provided anti-racism training for all of its members.

EDIS is an example of a successful multi-organisation collaboration to achieve common equality, diversity and inclusion goals. The group model is one that could be replicated across the STEM sector to achieve collective goals.

Governmental reports and reviews

A cross-sector literature review (Department for Business, Innovation and Skills) carried out by the UK Government in 2013 found that a diverse research workforce is more productive and creative, however, the Department for Education's recent white paper, Skills for Jobs: Lifelong Learning for Opportunity and Growth (2021) acknowledges that STEM skills gaps were and are emerging and that work needs to be done to bring disadvantaged and underrepresented groups into STEM.

The 'My Science Inquiry' (2019) by the House of Commons Science and Technology Committee usefully shed light on the impact of science funding policy on EDI and explored how current procedures and cultures marginalise and exclude individuals.

In 2019, the Government consulted on a number of measures to increase transparency and bolster flexible working in response to the Taylor review and the Good Work Plan.

In 2018/19, the Department for Business, Energy and Industrial Strategy (BEIS) and the Race Disparity Unit carried out a consultation on the proposal to introduce ethnicity pay gap reporting comparable to the current gender pay gap reporting procedures. This is seen as a positive step and could help employers take positive action under s.159 of the Equality Act 2010.

In 2015, the UK Parliament held an inquiry into the state of transgender equality. The following year Parliament recommended legal recognition for non-binary people, reform of the gender recognition act, to allow 16-year-olds to change their legal gender and to improve NHS gender identity services. None of these recommendations have been implemented.

Devolved Government

This inquiry received submissions that mainly focused on England, however, it is acknowledged that there are significant differences in some areas within the devolved nations. For example, in Wales the Well-being of Future Generations Act (2015) is based on principle of equity in outcome rather than equity of opportunity and flexible working rules are different in Northern Ireland (2014). The Scottish Government has continued to fund the equivalent of WISE (Equate Scotland) while England has not.

Research funding

The importance of EDI to research, and how funding can influence this, is widely acknowledged by funders. UK Research and Innovation (UKRI) recognises that, 'Equality, diversity and inclusion is a critical aspect of a healthy research culture' (2021). The UK Government's R&D Roadmap (2020) states that UKRI will develop and launch bold initiatives to increase the participation, retention and promotion of a diversity of talent into research and development.

However, this positive language is not matched by the actual outcomes, and the inquiry found a range of concerns about the results of funding processes and the diversity of funding recipients.

A report by Leading Routes (2019) found that over the three academic years to 2018/2019 just 1.2% of PhD funded studentships awarded by UKRI research councils were awarded to Black or Black Mixed students, and only 0.15% of those were from Black Caribbean backgrounds. Wellcome (2020a) reports that figures from EPSRC for proportion of funding applications from women have remained statistically unchanged since 2015/16 at 14% and very low applications from those declaring disability (2% compared to UK Government figures of 19%).

A 2019 appraisal by TIGER in STEMM of UKRI data found:

- Disparity in the success rates of female, disabled and racially minoritised applicants for research funding, this is evident in White principal investigators achieving a success rate of 27% compared to 17% for those from minoritised ethnicities.
- Women and ethnic minority applicants consistently receive smaller grants on average.
- Disabled researchers are awarded less than half the amount of funding compared to non-disabled researchers.

An open letter to UKRI by Addy Adelaine et al (2020) acknowledged these are complex issues but drew attention to the allocation of funding by a UKRI and NIHR funded study to explore COVID-19 and its disproportionate impact on Black, Asian and racially minoritised communities, where none of the £4.3 million budget was awarded to Black academic leads.

The problems are not confined to the research councils, for example prior to the launch of its Women in Innovation initiatives, just one in seven applications for Innovate UK support came from women (Innovation Funding Service, 2020).

The inquiry also heard significant problems with the data needed to monitor EDI in research funding. For example, the British Heart Foundation (2021) expressed concerns that it had taken until 2020 for UKRI to publish detailed ethnicity analysis of its awards, with minoritised ethnicities broken down into different ethnic groups (Asian, Black, Mixed). However, the main data source for UKRI EDI funding data does not provide a breakdown of ethnicity for applicants, award rates or award rate by value. TIGER in STEMM's appraisal (2019) of UKRI data found that is fails to provide sufficient detail or disaggregation to enable the development and implementation of evidence-based interventions needed to reform our research funding ecosystem.

Concerns exist about inadequate funding for carers involved in research. The inquiry heard that this often negatively influences research recruitment decisions for diverse candidates (Society for Applied Microbiology, 2021) and could have the effect of deterring grant holders from hiring women of childbearing age (Royal Astronomical Society, 2021).

UKRI is expected to publish a five-year plan on EDI to foster a more inclusive and diverse research and innovation environment. It is understood this is to be informed by its 2019 review (Guyan and Oloyede, 2020) which made a number of recommendations concerning broadening the focus beyond gender, and issues concerning data, evaluation, resources and other interventions.

Higher Education funding

The Research Excellence Framework (REF) influences more than £2 billion funding universities receive for research. Various equality measures are embedded in the current REF, for example it uses peer assessments and research outputs across the UK as metrics for measuring success and can make adjustments to take account of the effects of equality-related circumstances on researchers' productivity.

Recognition of the impact on research of a range of equality related factors as well as career breaks are recognised within the Guidance on Submissions for 2021 and REF 2014, but not all HEIs have reflected REF requirements within their recruitment and promotions processes (REF, 2020).

The Athena SWAN Charter was originally established in 2005 to improve the career progression of women working in STEMM within HE but in 2020 the Government has recently ended the requirement for institutions to meet the standards of the Athena SWAN charter in a bid to achieve significant reductions in bureaucracy for the research, innovation and university sectors during the COVID-19 pandemic. As of July 2021, no replacement framework is in place.

Advance HE (2019) cites strong evidence that the Charter's requirements supported cultural and behavioural change. However, there is also criticism, for example for a 'lack of attention to qualitative data and the lived experience' (Johns, 2020), and evidence indicating it has disproportionately benefitted White middle-class women and failed to address systemic racial inequities (Bhopal and Henderson, 2019). Overall, this inquiry found a consensus for reform rather than replacement.

The Race Equality Charter aims to improve the representation, progression and success of minority ethnic staff and students within higher education. Views expressed to the inquiry were similar to those received for Athena Swan.

Procurement

The Public Sector Equality Duty (PSED) places a duty on public authorities to consider how their spending affects people who are protected under the Equality Act. Private companies are also under this obligation in relation to contracts for public bodies.

Some private companies see commercial reasons for greater equity in procurement, for example international pharmaceutical firm Roche found that bringing a diverse group of people – different cultures, gender and life experience – when selecting suppliers can bring about innovation (Buist, 2017). A US study by The Hackett Group (2019) found the top three objectives of diversity in procurement were to: support corporate diversity culture; reputation management and investing in local communities.

The Chartered Institute of Procurement and Supply (CIPS), the professional body for the procurement and supply profession, state 'From the workforce to the supply chain, diversity and inclusion of people and ideas are critical drivers for further growth in any organisation' (CIPS, 2021).

Some large organisations are already actively using procurement as a lever for EDI, for example in the engineering sector High Speed 2 (HS2) embed equality, diversity and inclusion standards and targets into all their contract awards and Energy and Utility Skills has a 'Procurement Skills Accord' with 67 signatory employers participating (Energy and Utility Skills, 2020).

The inquiry heard calls for increased use of procurement as a catalyst for change through the supply chain (Dawn Bonfield, 2021) Royal Academy of Engineering (RAE, 2021) and for further research to understand the extent to which procurement is being used as a lever for change in the UK, what impact this is having on EDI, and how this could be increased.

Employers

Leadership and governance

Many of the EDI policies and interventions of STEM employers acknowledge the importance of strong leadership and support, particularly in changing workplace culture and attitudes to those from minority groups or with different needs. An Institute of Physics, Royal Astronomical Society and Royal Society of Chemistry (2019) survey of those working in the physical sciences found that if decision makers are not effectively considering LGBT+ needs, then it seems unlikely that their policies and procedures will do so either. They called on senior managers to speak openly and publicly about LGBT+ issues.

Submissions to the inquiry emphasised the need for leaders to:

- Ensure diverse membership, searching in wider talent pools or using quotas if necessary;
- Include EDI-specific representation in organisational governance and involve underrepresented
- groups in decision-making processes affecting them;
- Have EDI action plans at board and senior level, with accountability.

Many larger organisations and institutions in the public and private sectors have made changes to internal accountability and processes to strengthen EDI in recent years, including senior posts with EDI responsibilities, codes of conduct, and senior level groups. For example, since 2019 the Royal Society has set up two sub-groups to focus on supporting scientists from minoritised ethnicities and supporting disabled scientists, Wellcome has set up an Anti-racism Expert Group in 2020, and AVEVA has appointed its first Global Director for Diversity, Inclusion and Wellbeing.

In recent years, many larger employers have also been extending their plans and policies concerning EDI and professional bodies are producing longer-term plans to address EDI issues, such as the Institute of Physics' strategy 2020-2024, 'Unlocking the Future', which has EDI as a core theme and the Royal Academy of Engineering's Strategy 2020–2025 Engineering for a sustainable society and inclusive economy.

Larger employers, organisations and membership bodies in the STEM sector report working in strategic partnership in relation to EDI initiatives. For example, AVEVA partners with WISE Campaign, Society of Women Engineers and Stonewall, while Sir Robert McAlpine has partnered with flexible working campaigner Anna Whitehouse to research flexible working. New forms of partnerships are emerging, for example for the first time, professional bodies across engineering and science have joined forces to benchmark their performance on diversity and inclusion (Science Council, 2021).

The strength of leadership and partnerships among SMEs was less clear and warrants further investigation.

Culture and practice

There is a clear link between workplace culture and lack of diversity. For example, the Equilibrium Network (2021) describes construction, a sector with particularly poor representation of women, as a sector that is 'widely perceived as suffering from an adversarial, macho and misogynist culture'. An evidence review by UKRI (2020b) found that institutional culture in the research workplace such as strong hierarchies and incentive structures, significant workloads, competitive behaviours and job insecurity can be detrimental to promoting and delivering equity for staff. A report by the British Medical Association (2020b) concluded that poor behaviour, stereotypical attitudes and bullying cultures need to be tackled to create an inclusive environment for all doctors.

Bullying or harassment are a clear sign of poor workplace culture. The 2020 Wellcome research culture survey report (Wellcome 2020b) indicated that 43% of respondents had experienced bullying or harassment, while 61% had witnessed it. The UKRI evidence review referred to above reported that 'incidents of bullying and harassment are cited as the top factor negatively impacting research integrity'. In relation to the LGBTQ+ community, an IOP, RAS and RSC (2019) survey of those working in the physical sciences in the UK and Ireland found that problems such as exclusionary behaviour, discrimination and a lack of a comfortable working climate created a difficult workplace culture.

The inquiry heard from large private and public sector organisations working to change their culture to become more inclusive. For example, Public Health England (2021) is encouraging staff with disabilities to share their stories to raise awareness of challenges of living with a disability and how colleagues can support the improvement their workplace culture. RELX Elsevier (2021) reports that staff feedback suggests morale has significantly improved since initiating efforts to improve diversity and inclusion.

The inquiry found good evidence for an increase in awareness in HEIs of attitudes to women and gender equity issues, with clear indications that this is at least partly due to the result of Athena Swan and its requirements in relation to gender. While many HEIs have updated policies concerning gender equity, it is unclear how effective these have yet been in changing the culture, particularly at more senior staff levels, or whether this is likely to happen within a reasonable timeframe. It is a concern that other forms of discrimination and inequity appear to receive less attention than gender.

Pay

Equal pay is clearly a fundamental element of equity in the workplace, influencing workplace culture and perceptions, recruitment and retention, policy and strategy.

The inquiry found that mandatory gender pay gap reporting for larger employers has been widely seen as positive by employers across all STEM sectors and the principle of pay gap reporting as a lever for positive change for other minority groups in STEM is also widely accepted. The limitations of the measure are also acknowledged: the variance in average pay between all men and women within a workforce does not take into account equal pay for equal work. There are also concerns that the data does not provide a full picture of the different factors leading to inequitable pay, for example at different levels of seniority, or the barriers faced by many lower paid staff.

A more sophisticated analysis of the pay gap tries to determine whether minoritised ethnicities' earnings are lower even after controlling for other factors that can affect income; this is called the 'conditional pay gap' (McKinsey 2020). In 2019, researchers at the Bank of England adjusted earnings differences between ethnic groups using several relevant factors, including age, qualifications, occupation, and sector. The report found that when comparing people with very similar individual and job characteristics, ethnic minority workers earned 10 percent less than White workers in the period 2014 to 2019 (McKinsey, 2020).

There are calls for pay gap reporting to become mandatory for characteristics other than gender, and for the threshold of 250 employees to be lowered, in order to assist the changes of policy and culture needed to address current inequities. For example, the Equality and Human Rights Commission's Fair opportunities for all: A strategy to reduce pay gaps in Britain (2017) proposes extending pay gap reporting to cover ethnicity and disability. A consultation on ethnicity pay gap reporting is on-going and a Government response is currently overdue.

PwC reports that across all sectors in 2020, almost one quarter (23%) of businesses are now voluntarily calculating their ethnicity pay gap, compared to just 5% of companies in 2018, with some intending to publish the data. A number of larger employers and STEM leaders such as Wellcome (2020c), Mott McDonald and Shell (2021) are already reporting ethnicity pay gaps for their staff, with others such as the UK Atomic Energy Authority (2021), are planning to do so.

Issues of voluntary declaration and compliance with the Data Protection Act 2018 are a particular problem for disability pay gap reporting and further work may be needed on the reporting mechanisms in this area.

Pay gap reporting alone does not lead to change, and active interventions will be required thereafter. It is not clear how widely or effectively these changes are being adopted in the STEM workforce, and concerns remain at the slow rate of progress. For example, research by the Chartered Insurance Institute's (CII) Insuring Women's Futures group (2021) suggests that the gender pay gap will not close until at least 2050 (Rise – Women in Broadcast, 2021).

Recruitment

The inquiry heard examples of larger employers seeking to improve the equity of their recruitment practices. For example, the UK Government has agreed to implement blind-recruitment processes across public sector jobs including the Civil Service and NHS following the Bridge Report (2016) commissioned by the Cabinet Office.

The Social Mobility Foundation (2021) reports that more recently, employers have placed an emphasis on achieving greater diversity within recruitment, and on safeguarding against overlooking the best candidates for the job or those with the most potential. However, there has tended to be a more limited focus on socio-economic background.

There was also evidence that these changes are having some positive effects:

- A case study published by Engineering UK (2018) describes a successful approach to gender balanced recruitment by engine manufacturer Cummins, which found that taking a flexible approach to recruitment can make a big difference to who applies for jobs.
- Evaluation of changes in recruitment practice to professional construction programmes at Gateshead College, Derby College and Northumbria University saw positive improvements in the diversity of the students enrolling on the courses, and subsequently entering the construction industry (Strachan, et al. 2020).

Improvements can potentially be achieved at different stages of recruitment, such as the targeting of searches, advertising content, and selection processes. The Health and Safety Executive (2021) reports using local diversity demographics and information about the proportion of Black, Asian and racially minoritised students in STEM subjects at universities in order to inform decisions about where to recruit. E.ON (2021) has brought in tailored tools to help identify new talent marketplaces.

The importance of review and monitoring is underlined by an example from the US, that found that the number of applications from Black, Asian and racially minoritised individuals decreased when a disclaimer that the employer welcomed applications from individuals from a Black, Asian and/or racially minoritised background was included (Leibbrandt and List, 2018).

The inquiry heard from a number of organisations that have made changes to selection panels. Network Rail (2019) uses mixed interview panels, while the Open University (2021) aims for all staff on interview panels to have had unconscious bias and 'Recruitment, Selection and Interviewing' (RSI) training (though it must be acknowledged that the efficacy of unconscious bias training is debated). The Institute of Physics (2021) has recently started undertaking blind shortlisting and aims for inclusive interview panels that display a variety of experience, gender, and ethnicity balance and other characteristics.

CASE STUDY 2

University of Nottingham:
Changing the Language of Exclusion to Inclusive Practices in STEMM Recruitment

STEMM-Change is a consortium-based project funded by the UKRI's Engineering and Physical Sciences Research Council's (EPSRC) Inclusion Matters portfolio. Changing the Language of Exclusion in STEMM Recruitment forms part of a series of work that aims to facilitate a step-change in recruitment practices within the STEMM workforce, through robust evidence.

The research and resultant report detail key research findings and recommendations for improving communications in recruitment materials in STEMM. Led by two sociolinguists, Prof. Louise Mullany and Dr. Jacqueline Cordell, from Linguistic Profiling for Professionals in the Centre for Research in Applied Linguistics, this research has investigated the recruitment language used in a variety of STEMM organisations, including within industry, higher education institutions and research institutes. There is a particular focus on evidencing patterns of exclusionary language and unconscious bias that negatively impact upon recruitment outcomes.

The research found that language relating to equality, diversity and inclusion in recruitment materials can be divided into four main types of statement: legal compliance, affiliation, encouragement and expectation. The report also identified systemic barriers to diversity and inclusion in recruitment, which cause significant knock-on effects when attempting to recruit diverse and inclusive STEMM workforces. The following key recommendations were identified for recruiters:

- Place diversity & inclusion content throughout all parts of recruitment materials, especially in places where these are not seen currently (e.g., essential criteria, person specifications). It is crucial to avoid just putting these in the final lines of any advertisement or recruitment text.
- Avoid simply relying on 'statements of legal compliance', (obligatory wording that must be included in adverts for organisations to be compliant as equal opportunity employers) to show organisational engagement with D&I, to avoid tokenism.
- With 'statements of affiliation' (evidence of employer commitments to diversity and inclusion beyond legal expectation), improve their effectiveness by creating versions which convey explicit acknowledgement that workforce diversity leads to more productive environments, has economic advantages, and/or improves quality of service offered.
- With 'statements of encouragement', such as "We welcome applications from…", use them to target prospective applicants that would fill diversity gaps in the existing workforce.
- Include more 'statements of expectation' which clearly include an explicit commitment to D&I as an essential part of the role.
- Build on existing D&I language by including modifications to improve inclusiveness. This can be achieved by engaging directly with applicants through a change in formality, e.g., using 'we' as an inclusive pronoun to refer to the organisation and 'you' – to address the prospective employee. This process is more likely to appeal to more diverse applicant pools.
- Communicate essential criteria in the most unbiased way, whilst still specifying the key skills needed to perform the role with maximum effect. Ensure the language used is expressed without vagueness or hyperbole, without the use of stereotypical metaphors (e.g., 'put the boot in') and without the inclusion of identity labels that encode any dominant worldviews (e.g., 'master').

Flexible working

Flexible working (or 'agile working') refers to a potentially wide range of measures that alter the working regime of staff to better fit their needs and preferences without reducing productivity. These include flexible hours and shift patterns, part-time working, home and remote working, parental and other forms of leave, allowances for disability or health reasons or for caring, and can be temporary or permanent. Some of these arrangements are also known as 'family friendly' policies because they often benefit those in this group, however, many who can benefit are not parents.

Across the STEM sector, the inquiry found that a number of larger employers were adopting more flexible working practices before COVID-19. The initial impetus is often the need to attract and retain women, with flexible working measures around pregnancy and childcare being seen as helpful to this group. However, the benefits of flexible working are recognised as potentially beneficial to other groups. For example, the Equilibrium Network (2021) highlighted a number of reasons why minoritised groups of employees in the construction industry may benefit from working part-time, such as women, disabled people, and those suffering long-COVID-19 or other chronic or long-term illnesses. Some larger employers are broadening the measures to meet the needs of fathers and other groups of workers, often linked to their policies to improve recruitment and retention.

Working Families, a work-life balance charity aiming to remove the barriers faced by people with caring responsibilities, have created a campaign to encourage more employers to consider the incorporation of flexible working into roles (2021). Sir Robert McAlpine recently launched the Forever Flex Report (2020), which surveyed some 1,400 employers and interviewed leaders and decision makers at 32 organisations across the UK during COVID-19, to explore how flexible working can be made more sustainable in the long-term (2021).

Internal staff networks

Staff network groups focusing on specific minority characteristics are now in use in a number of larger STEM employers. For example, AstraZeneca has established an internal network run by graduates and apprentices called AZInspire, which is specifically designed to support early talent at a personal and professional level. This complements a range of other internal groups, including ones focused on neurodiversity, LGBTQIA+, and mental health, as well as a group supporting people of colour that will be launching soon. Members of the network typically meet regularly and may have additional roles related to the relevant characteristic. Many of these networks have been relatively recently established, and this expansion in their use by these organisations appears to be continuing.

Their purpose is described as improving culture and addressing workplace problems for the organisation as a whole, and supporting individual staff by opening up conversations, raising awareness of challenges, and sharing stories, ideas and issues. Initial feedback from staff appears to be good.

The inquiry was unable to assess the networks' effectiveness to influence the quality of decision-making within the organisations or to make lasting improvements, perhaps because many are relatively new. It was unclear how some of the schemes are being evaluated and there is a concern that if meaningful improvement does not occur within reasonable timeframes, their credibility and sustainability as a means of long-term EDI improvement may be undermined.

Returners

Arrangements for a period away from work, and for returning after it, can lead to disadvantage and inequity, particularly for women, and is contributing to loss of talent from the STEM workforce. The Women Returners Research report published in 2016 by PwC found that across all sectors: some 550,000 professional women in UK are on extended career breaks for caring reasons, 420,000 want to return to work at some point, but two-thirds (280,000) could be working below their potential when they return.

Women are also much more likely than men to be returners. In the astronomy and geophysics community, the Royal Astronomical Society's survey in 2017 showed that only 4% of men had taken career breaks, mostly relating to parental leave, compared with 35% of women.

Research in 2015 followed Open University graduates of its 'Return to SET' course and found that after five years, female STEM graduates had mostly returned to STEM jobs, but in different employment sectors and in particular into the health and education sectors. Many felt these careers offered more flexibility but still enabled them to use their scientific skills, and offered the possibility of working from home or part-time in order to combine working with family life. Moving into these fields, however, usually entailed a trade-off of taking lower paid and lower skilled jobs. Some went back into teaching roles within universities but on short term contracts with no job security (Herman, et al. 2019).

The inquiry also heard examples where action has been taken with positive results. The Ford Motor Company successfully achieved an average retention rate of 90% for all employees taking maternity and adoption leave after two years of returning following a series of diversity and inclusion initiatives (Employment Lawyers Association, 2021).

Training

A number of larger STEM employers now provide training to those involved in recruitment, such as unconscious bias training. For example, pharmaceutical company MSD (2021) provides training and strategies to mitigate unconscious bias. The Open University (2021) encourages staff on recruitment panels to complete online unconscious bias and 'Recruitment, Selection and Interviewing' (RSI) training, and aims for all panel members to have received RSI training by 2022. Similar approaches are being taken by some funders, for example, the Academy of Medical Sciences (2021) asks panel members to watch short videos on unconscious bias and making group decisions prior to panel meetings and funding recommendations. It must again be acknowledged that the benefit of unconscious bias training is debated.

There is also some evidence of EDI-orientated training being delivered for purposes other than recruitment, such as leadership skills and improving workplace culture. For example, the Nuclear Decommissioning Authority (2021) group offers training and development on the themes of Respect at Work and Inclusive Leadership.

The inquiry also found evidence of some training courses targeting particular sectors. For example, to tackle a lack of women experts in the media, the Academy of Medical Sciences has developed an award-winning media training programme for female scientists providing access to long-term support and media opportunities. Many of the 107 women engaged in the programme have completed high-profile broadcast interviews and, since its inception, widespread efforts across the sector have improved the ratio of women to men experts in the media from 4:1 to 2:1 (Academy of Medical Sciences, 2021)

Lack of diversity is a concern for apprenticeships, and engineering apprentices remain even less diverse than the wider engineering sector workforce (Enginuity, 2021). There have been recent efforts to improve accessibility for women. For example, the Institute for Apprenticeships and Technical Education has established a 'trailblazer' group of employers who design and update apprenticeships to widen access. The Institute is currently trialling the use of software to check for gender-biased terminology in its apprenticeship standards (IfATE, 2021).

CASE STUDY 3

Supporting returners and addressing skills gaps:

The Daphne Jackson Trust is the UK's leading organisation dedicated to realising the potential of returners to research careers following a career break of two years or more taken for a family, caring or health reason.

A Daphne Jackson Fellowship provides a unique combination of mentoring, retraining and research, boosting an individual's confidence and skills so that they can successfully return to a research career. The Trust has helped over 400 individuals return to research and now awards around 25 Fellowships per year. Seven out of ten former Fellows say they are now in their first-choice career thanks to their Daphne Jackson Fellowship and nine out of ten remain long-term in STEM careers.

Last year, the Trust expanded its remit to include research in the arts, humanities and social sciences. This reflects the increasingly multidisciplinary nature of research and the necessity for cross-sectoral collaboration.

The Trust is also piloting a new Technology Fellowship that offers highly skilled candidates the opportunity to retrain and reskill in specific advanced scientific and engineering techniques. As well as returning more individuals to research carers, it is hoped that this approach will also help to address specific skills shortages that may otherwise hamper future research endeavours.

Dr Maria Ribera-Vincent graduated with a BSc in Aerospace Engineering from Saint Louis University, followed by a MSc and PhD in Aerospace Engineering from the University of Maryland, specialising in Rotorcraft. After finishing her PhD, she relocated and settled in the UK, where she worked as a post-doctoral Research Fellow at the University of Southampton, in computational engineering and optimisation.

When her first child was born, Maria chose to take nine months' maternity leave and then returned to work full time. After the birth of her second child, she decided that, with her long commute to work in Southampton and with her husband now working longer hours, she needed to stay at home to look after her two young children. *"The time flew by during my career beak. I filled my time with volunteering at school but also continued my PhD research and even published a paper at the European Rotorcraft Forum. Before I knew it, my oldest child was at school and my youngest was at nursery. I was now ready to restart my career after a three-year career break. However, I knew I wanted to work flexibly and if possible, part time."*

Maria successfully applied for a Daphne Jackson Fellowship at the Surrey Space Centre, University of Surrey, where she would learn new skills in Satellite FEM validation as well as refresh and deepen her knowledge of other theories and project elements connected to aerospace and automotive structures.

"The retaining aspects of the Fellowship have certainly opened up a lot of doors for me in my career to date. The courses I completed during my Fellowship really helped improve my confidence and personal development."

After completing her Fellowship, Maria gained a position as a Teaching Fellow in the Department of Aeronautics at Imperial College London.

CASE STUDY 4

Using apprenticeships to enhance equity in the STEM workforce:

AstraZeneca has around 200 apprentices in the UK, based mostly in Cambridge and Macclesfield. The majority of these apprentices are studying at degree-level in vital skills for the future of the business, such as advanced manufacturing and data science.

The company believes that apprenticeships offer the opportunity to improve the diversity of its workforce. Because of their nature – paid employment, learning new skills on the job whilst also studying – they can attract individuals for whom the graduate route isn't a preference or those who face significant barriers to entering the sector.

Holly Carter, for example, joined AstraZeneca not long after completing her A-Levels. Holly decided that the flexibility of being able to study and earn during the apprenticeship was the right route for her. The Level 5 laboratory scientist apprenticeship she completed consisted of working four days a week in the chemical development department at AstraZeneca's manufacturing site in Macclesfield and one day a week studying towards a foundation degree in chemical sciences (FdSc). This, Holly said, "allowed me to gain the chemistry knowledge I need for the job while also learning about different areas that are important to working within the industry."

The company also provided mentorship services and offer a range of internal colleague networks through which apprentices can receive support. Holly secured a full-time job with the company following the apprenticeship, which also allows her to study towards a BSc in chemical sciences. Indeed, in the last three years (2018-2020) the average retention rate for apprentices at the company has been 94%.

Given the pace of change in the world of work, especially in the wake of COVID-19, apprenticeships will increasingly offer a vital route for employers to attract talent that otherwise may not have been able to qualify to enter the workforce.

Mentoring

The inquiry found many examples of larger STEM employers in the private and public sectors using mentoring linked to EDI goals, however, the benefits are mainly anecdotal and usually concern the gains for the mentee, rather than the mentor who may have more potential influence over EDI strategy.

There appears to be relatively little structured evaluation of the outcomes at an organisational level, perhaps because many programmes have not been operating for long enough, and this warrants further investigation. The inquiry could not form a view of the extent of the use of mentoring to support EDI objectives by SMEs, and further research is required.

Reverse mentoring

Reverse mentoring is a form of mentoring that is currently less common among STEM organisations. The University of Nottingham's STEMM Change group, which has been undertaking a specific inclusion initiative around reverse mentoring, defines reverse mentoring as when 'a person with less (perceived) power, in a more disadvantaged position, from an underrepresented, marginalised or oppressed group mentors someone in a more powerful, less disadvantaged position/group' (STEMM Change, 2021).

The technique appears to have particularly attractive benefits, for example, Mott Macdonald has introduced a reverse mentoring scheme (Mott Macdonald, 2018) that Enginuity (2021) describes as 'pioneering'. The Employment Lawyers Association (2021) describes reverse mentoring as 'helping senior staff develop an understanding of minoritised ethnicities and their experiences in the workplace'. Early lessons from the evaluation of the STEMM Change group's first two cohorts suggest that these relationships are enhancing the cultural competence and cultural humility of university leaders.

COVID-19

COVID-19 positive effects

At a societal level, the pandemic has demonstrated the value of science and many roles in science, technology and engineering in particular potentially increasing science capital and raising the aspirations of many young people to follow careers in STEM. For some sectors, the economic effects could lead to more STEM jobs in sectors such as those associated with digital working (Energy & Utility Skills, 2021).

The pandemic has forced many STEM employers and employees to experience more home working and other forms of flexible working, and this was a dominant theme in responses to the inquiry. A range of potential benefits of flexible working included more accessible recruitment and selection methods such as virtual assessment, enabling recruitment outside of normal geographic boundaries, (Energy & Utility Skills, 2021), improved working conditions (STEMM Change, 2021) and increased accessibility to meetings, training courses and events (Royal Society of Biology, 2021).

Underrepresented groups who could benefit positively include: people with family or caring responsibilities, especially single parents or those who previously spent long periods commuting or away from home (Energy & Utility Skills, 2021); individuals with disabilities for whom on-site working is difficult, or those living in regions with fewer STEM job opportunities (Society for Applied Microbiology, 2021).

It is important to note, however, that home working or flexible working is only an option for some groups of STEM workers and in general those who are underrepresented in the STEM workforce are not in those groups. Consequently, there is a danger that adopting greater flexible working practices could inadvertently widen the EDI gap.

COVID-19 negative effects

The inquiry heard many examples of negative effects on groups in the STEM workforce that already face greater barriers, including women, racially minoritised groups, disabled people, carers and others. Intersectionality, socio-economic disadvantage, and access to technology (digital exclusion) are key to the degree and type of impact:

Problems arose from greater use of homeworking as noted above, but also due to a range of other effects of lockdowns and restrictions. For example, for those with caring responsibilities the closure of schools, nurseries, respite care and care homes all placed a heavy burden on many people in this highly intersectional group.

- Energy & Utility Skills (2021) stated, 'groups that were disaffected before the pandemic will now be further away from successfully accessing jobs'.
- Research conducted by Fawcett Society, the London School of Economics and Political Science, Queen Mary's University London and the Women's Budget Group (2020) highlights the unequal gendered impact of the pandemic finding that this was compounded for Black, Asian and racially minoritised women.
- The first UK-wide lockdown in March 2020 led to many research facilities having to shut and researchers being forced to work from home. A survey of over 10,000 researchers between May and June 2020, conducted by Vitae for the Department for Business, Energy and Industrial Strategy (BEIS), found that Early Career Researchers (ECRs) were the group hardest hit by the lockdown (Vitae, 2020).

CASE STUDY 5

Sector Collaboration:

Energy & Utility Skills (EUS) is a not-for-profit, employer-led membership organisation for businesses in the UK power, gas, water, and waste management industries. It focusses on workforce and skills – working in collaboration with sector employers to ensure a sufficient, skilled, safe and sustainable workforce.

Workforce Renewal and Skills Strategy 2020-2025

To achieve the sector's sustainable workforce goals, EUS created the Energy & Utility Skills Workforce Renewal and Skills Strategy 2020–2025, which makes an inclusive approach to employing diverse talent a specific priority. This includes:

- The Sector Inclusion Commitment: 50 CEOs from leading employers and stakeholders have agreed to work collaboratively to attract, recruit and retain more diverse talent to the sector
- Commitment to becoming a 'Disability Confident' sector
- Development of sector-wide Inclusion Measurement Framework building on the Royal Academy of Engineering work in this area.

Twenty-eight employers participated in the inaugural Inclusion Measurement Framework which focused on leadership and recruitment. The results identified low application rates from women and a significant dilution of Black, Asian, and racially minoritised groups and young people in the sector's selection processes. The results also highlighted low levels of representation of Black, Asian, and racially minoritised groups at senior levels. This data drives the sector CEO inclusion priorities for 2021-22.

Energy & Utilities Jobs

To encourage greater diversity in recruitment, the Energy & Utilities Jobs platform was created: a collaboration of 23 of the partnership's key employers. It aims to attract and inspire new people, bringing new skills, ideas and ways of thinking, to engage with the sector's employers through a range of New Entrant, Apprenticeship and Graduate routes.

- Energy & Utilities Jobs has helped to extend the sector's reach to underrepresented groups, reaching over 8 million people
- As of April 2021, Energy & Utilities Jobs reported 10.171 million Opportunities to See (an industry standard measure of reach and impact)
- In 2020 women represented 57.6% of all visits to website, and there were 10,264 clicks to apply (referrals to employer web sites)
- Over 6,400 candidates joined the sector talent pool, and since March 2021, 22.3% of those registering in the talent pool are of Black, Asian, and Minority Ethnic origin and 18.5% are female

Image source: FCC Environment / Energy & Utility Skills

Characteristic	Inquiry evidence of negative impact
Gender	ONS figures show women's childcare duties have increased by two thirds (2020). An HMRC (2020) study showed that women were more likely to be furloughed than men, which is likely to have long-term impact on their career progression. Research found COVID-19 particularly impacted the livelihoods of women (Burki, 2020) and that women took the burden of childcare and have been most likely to lose, or had to leave, their jobs or shift to part-time employment (Topping, 2020). Many women were impacted by a change in the balance between caring responsibilities and work (Viglione, 2020). The Royal Society of Chemistry's COVID survey (2021) found that three quarters of respondents who were affected by challenges accessing childcare during lockdown reported a decrease in productivity as a result, with women more likely than men to report a significant decrease in productivity.
Disability	Disabled people were at increased risk of redundancy (Lightfoot, 2020). COVID-19 has replicated already existing health inequalities and, in some cases, increased them (Public Health England, 2021). Concerns that staff have experienced a loss of privacy as their medical conditions had become more widely known (STEMM Change, 2021).
Ethnicity	58% of Black, Asian and racially minoritised workers have had their employment affected since the start of the pandemic compared to 47% of White workers (Turn2us, 2020). Ethnic minority communities have been disproportionately more affected by COVID-19 from every angle compared to their White counterparts because it exposes existing inequalities within modern society (Lally, 2020). Analysis by McKinsey (2020) found that COVID-19 disproportionately affected Britain's minoritised ethnicities: a number of groups are concentrated in high-proximity occupations.
LGBTQ+	Staff and student colleagues may now find themselves working in environments where they are not able to be honest about their sexual orientation and identity (STEMM Change, 2021).
Carers	Difficulties of balancing work and care duties under more difficult and restricted conditions (STEMM Change, 2021).
Religion and belief	For those who practise religion, absence of physical gatherings and community associated with faith organisations will bring a negative impact on mental health and wellbeing (STEMM Change, 2021).
Early career researchers	See COVID-19 impact on researchers.

COVID-19 impact on researchers

Prior to COVID-19, there were initiatives seeking to reduce inequity for early career researchers (ECRs), such as the programme of capacity-building and funding support for ECRs by the Centre for Research into Energy Demand Solutions (CREDS).

The inquiry heard many examples of inequity caused by disruption to the work of researchers during the pandemic. The Chair of the Academy of Medical Sciences' report on the impact of COVID-19 on biomedical research careers (2020) described this as having 'impacted differently across different researchers, undoubtedly widening all of the cracks in our journey for greater equality, diversity and inclusivity'.

The problems can already begin to be seen from the outputs, for example the Institute of Physics reports that female academics have been publishing fewer articles than their male counterparts during the pandemic (2021). A number of surveys have shown the severity of impact in more detail:

- A recent researcher survey from the British Neuroscience Association (2020) found over a quarter of respondents are considering leaving research altogether, due to the effects of the COVID-19 pandemic.
- In a survey of its members, the Society for Applied Microbiology (2021) found that 18.6% of respondents have considered changing research career due to COVID-19. The Society summarised the impact of COVID-19 as particularly significant for early career scientists since 'most PhD students and research assistants on short contracts will have lost over a year of practical work that in all probability will never be recovered'.
- The Royal Society of Biology conducted a survey investigating the impact of COVID-19 on researchers in May 2020 finding that 74% of UK respondents had to abandon or suspend experiments or fieldwork due to the pandemic, with concern over limited future job prospects, career progression and financial worries (Bellingan, 2021). The survey also highlighted that women, people with child and dependent caring responsibilities, and those coping with COVID-19 in their families, reported significant disruption to their work and fears about progression.
- The Royal Society of Chemistry's COVID impacts survey conducted in November 2020 found that laboratory closures and restrictions had negatively impacted both research and teaching. It also highlighted concerns about skills and professional development for early career researchers and employment prospects for new graduates. 57% of respondents expected work-life balance to be an increased challenge for them in the coming months.
- Impact evaluation by Vitae (2020) shows that early-career researchers faced greater reductions in hours spent on research that could not be done from home than more senior colleagueS. Four out of ten researchers reported reduced capacity due to caring responsibilities (Universities UK, 2021).
- A recent survey of 523 charity-funded ECRs found that over 40% had considered leaving research due to funding concerns during the pandemic. Additionally, over half (280) of the respondents reported that their funding would expire by the end of 2021, and of these, two thirds (183) had been unable to secure funding to take them to the next stage in their career (Association of Medical Research Charities, 2020).

Respondents also highlighted concerns about potential harm to future careers of ECRs. Those on fixed-term funding are expected to produce research outputs within the lifetime of the grant and the number of students who do not complete their research projects is expected to rise significantly. For some, this impact has been partially mitigated by funders, for example some UKRI-funded students have been offered a funding extension of up to six months – this has been welcomed but puts others at an unfair disadvantage (Royal Astronomical Society, 2021).

Hundreds of postgraduate researchers recently signed an open letter to UKRI calling for more support and a number of institutions voiced calls for action to help researchers and particularly ECRs, for example:

- The British Heart Foundation (2021) stated: 'Without urgent support for the sector, the UK faces losing a generation of scientists, with uncertainties around career progression and job security likely to worsen, and progress on equality, diversity and inclusion and research culture across the sector undone.'
- The Institute of Physics (2021) has called for support for career development, progression and longevity in all physics roles, especially for early career members.
- A report by the Academy of Medical Sciences (2020) on the impact of COVID-19 on biomedical research careers stated: 'It is critical that we act collectively to protect our researchers against these impacts.'
- Wellcome (2021a) called for targeted interventions to ensure Black, Asian and racially minoritised (and specifically Black British) students are supported to become postgraduate research students — for example, creating dedicated PhD fellowships for students from Black, Asian and racially minoritised backgrounds.

Important further action has already been taken. The National Institute for Health Research (2020) has published a 'Restart Framework' for research activities disrupted by COVID-19. The framework sets out guiding principles, preconditions, study prioritisation, and local and national roles. The Academy of Medical Sciences (2021) is part of cross-funder efforts to develop a question set on the impact of COVID-19 to better understand the effects on awardees, contextualise the decrease in research outputs, and identify opportunities that may have arisen. A number of key funders have also taken action, for example:

- Research England and the Office for Students has recently launched an £8 million joint funding competition for project proposals to improve access and participation for Black, Asian and racially minoritised groups in postgraduate research study (OfS, 2021).
- Wellcome (2021b) has adapted its grant application process to take into account the impact of the pandemic on applicant's research when reviewing applications.
- The British Heart Foundation (2021) has extended 120 PhD studentships at 28 universities at a total cost of just over £1 million.
- The Royal Society of Edinburgh (2021) will be launching a Scottish Funding Council-funded call for academics experiencing COVID-19 related disadvantage.

COVID-19 calls for action

The inquiry received a number of calls for urgent government action, such as:

- Restart non-COVID-19 research (Association of the British Pharmaceutical Industry)
- Steps to ensure that women are not employed merely as a short-term stop gap, then left with no career support or promotion or made redundant when COVID-19 work slows (Equilibrium Network, 2020).

Proposed action to support ECRs include calls for more research into the impacts of COVID-19 on researchers and additional targeted funding. The COVID-19 Impact on Careers Workshop report (Academy of Medical Sciences, 2020) proposed a COVID-19 'crisis memory' and increased flexibility in funding policies, while the British Pharmacological Society has called for post-hoc normalisation of any CV gaps for those affected. A number of submissions stressed the need for the most urgent support to be well targeted.

There was also a call for priorities to shift post-COVID-19, suggestions included:

- Enhance 'soft skills' such as networking, career development opportunities and mentoring for underrepresented communities with pre-existing barriers to access (Academy of Medical Sciences, 2021).
- Invest in funding and incentives to support and encourage lifelong learning, enabling people to upskill and reskill in the STEM sector (Open University, 2021).
- Tackling ethnicity pay inequalities is even more important now as economic disadvantage is considered to be linked to poor COVID-19 outcomes (Employment Lawyers Association, 2021).
- Faster roll-out of ultra-high-speed broadband (Health and Safety Executive, 2021) and increased and standardised access to broadband and mobile technology (CFA UK Inclusion and Diversity Network, 2021).

Submissions to the inquiry included calls for better data collection on the effects of COVID-19 (British Heart Foundation, 2021), the need for further evidence and research on the effects of the pandemic and its after affects, and for a UK Government review of what has and hasn't been successful in inclusion and inequality during COVID-19.

Brexit and other

Responses to the enquiry were overshadowed by COVID-19 but included concerns about the negative impact of Brexit on equity in UK science and the STEM workforce. For example, the Society for Applied Microbiology (2021) was concerned that withdrawal from the Erasmus exchange programme may deter diverse and talented individuals from studying and/or working in the UK, and the Royal Astronomical Society (2021) highlighted that the new Turing scheme no longer covers tuition fees for UK students (Waters, 2021), which can be significant, and may well deter applicants from low-income backgrounds.

Glossary

Glossary

The following terms used in this report are defined as follows.

Diversity (in the workforce)	Recognising difference in employees. Acknowledging the benefits of having multiple voices in an organisation and a representative workforce (CIPD, 2021).
Inclusion (in the workforce)	Valuing differences in employees and creating a workforce where everyone belongs without having to conform. Inclusive environments allow everyone to perform to their full potential and work together effectively (CIPD, 2021).
Equality	Treating everyone the same. An equality emphasis often ignores historical and structural factors that benefit some social groups/ communities and harms other social groups/communities (YWCA, 2016).
Equity	Giving everyone what they need to be successful. An equity emphasis seeks to consider structural factors that benefit some social groups/communities and harms other social groups/communities (YWCA, 2016).
Intersectionality	Coined by Kimberlé Crenshaw (1989) to describe the complex, cumulative way in which the effects of multiple forms of discrimination (such as racism and sexism) combine, overlap, or intersect especially in the experiences of marginalised individuals or groups (Merriam-Webster, 2020).
LGBTQ+	Lesbian, Gay, Bisexual, Transgender, Lesbian, gay, bisexual, transgender, queer (or sometimes questioning), and other sexual and gender minorities.
Minoritised	A community of people whose access to institutional and structural power has been severely limited regardless of the size of the population. As a result, the community is constantly being disenfranchised and disempowered by the Majoritised population (YWCA, 2016).
NS-SEC	National Statistics Socio-Economic Classification.
Protected characteristic	The Equality Act 2010 sets out nine 'protected characteristics' (EHRC, 2020). It is illegal to discriminate against someone on these grounds, except in the case of specific exemptions such as religious tradition.
SOC	Standard Occupational Classification.
STEM	Throughout this report this acronym is used to refer to the science, technology, engineering, maths, and health workforce.
STEMM	Respondents to the inquiry used this acronym to refer to the science, technology, engineering, maths and medicine workforce.
Systemic/Structural inequality or inequity	Inequality or inequity that is built into all levels of society and social structures, through the education system to the workforce.
Underrepresented	A subset of a population that holds a smaller percentage within a significant subgroup than the subset holds in the general population.
Working culture	Work culture is a collection of attitudes, beliefs and behaviours that make up the regular atmosphere in a work environment (Indeed, 2021).

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Appendices

Appendices

Appendix 1 – Methodology

Call for evidence

An open call for evidence was sent out by the APPG Secretariat, the British Science Association, inviting interested parties to provide evidence on the following points:

- Demographics of STEM workers in their organisation and gaps in quality of reporting and organisational data.
- Where inequity exists for different minoritised communities across the STEM sector, STEM organisations and throughout a STEM career.
- Best practice inclusive behaviours for recruitment and retention in the STEM workforce.
- UK policy activity undertaken by the UK Government and its agencies that advance or inhibit inclusive cultures within the STEM workforce.
- The short and long-term impact of COVID-19 on different groups in the STEM sector.

Over 85 written responses were received, the analysis of which contributed to the basis of this report.

WE RECEIVED SUBMISSIONS FROM THE FOLLOWING:

Academy of Medical Sciences
Advance HE
Alex Perry
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AVEVA
BCS, The Chartered Institute for IT
BIG STEM Communicators Network
British Dental Association
British Heart Foundation
British Interplanetary Society
British Medical Association
British Neuroscience Association
British Pharmacological Society
British Society for Haematology
British Society for Immunology
British Sociological Association
Cancer Research UK
Centre for Research into Energy Demand Solutions (CREDS)
CFA UK Inclusion and Diversity Network
Cogent Skills/ Science Industry Partnership
E.ON
Engineering Construction Industry Training Board (ECITB)
EDIS (Equality, Diversity and Inclusion in Science and Health)
Employment Lawyers Association
Energy & Utility Skills
EngineeringUK
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Equate Scotland
Evidence Base, University of Edinburgh, Inclusion Matters
Health and Safety Executive
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Nuclear Decommissioning Authority
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Science Council
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Sir Robert McAlpine
Social Mobility Commission
Society for Applied Microbiology
Space Skills Alliance
Stockholm Environment Institute, University of York
Stonewall
Tech Talent Charter
The Careers & Enterpise Company
The Daphne Jackson Trust
The Equilibrium Network (EQN Ltd)
The Inclusion Group for Equity in Research in STEMM (TIGER in STEMM)
The Open University
Towards Vision
UK Atomic Energy Authority
UK Research and Innovation (UKRI)
University of Hull
University of Nottingham
STEMM-Change at University of Nottingham, University of Reading
University of Strathclyde
Universities UK
Victrex PLC
Wellcome Trust
Women's Engineering Society (WES)

Evidence roundtables

Four evidence roundtables were held virtually, with over 40 expert attendees from across the STEM sector and the field of Diversity and Inclusion. The roundtables focussed on the following themes:

- Mapping inequity across the STEM workforce and Protected Characteristics.Chaired by Baroness Verma, 3 February 2021
- Data, demographics, and diversity: improving the quality of evidence and reporting on representation in the STEM workforce.Chaired by Baroness Brown of Cambridge, 18 February 2021
- Inclusive recruitment and retention in the STEM workforce.Chaired by Baroness Garden of Frognal, 24 February 2021
- How does the UK Government advance and inhibit equity and inclusive cultures.Chaired by Baroness Morgan of Huyton, 4 March 2021

The resultant discussions contributed to the basis of this report.

CONTRIBUTORS

- Dr Addy Adelaine, Ladders4Action
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- Mayokun 'Mac' Alonge, The Equal Group
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- Dr Halima Begum, Runnymede Trust
- Dr Alfredo Carpineti, Pride in STEM
- Dr Nira Chamberlain, Institute of Mathematics and its Applications
- Mike Clancy, Prospect Union
- Nadine Dyer, Deloitte
- Jon Elliot MBE, AstraZeneca
- Dr Anton Emmanuel, NHS Workforce Race Equality Standard
- Dr Ollie Folayan, Assoc. for Black and Racially minoritised Engineers
- Lori Frecker, Royal Society
- Cat Hudson, Glaxo SmithKline
- Dr Eugenie Hunsicker, Athena Forum
- Dr Lilian Hunt, EDIS
- Payal Jain, Women in Data
- Nancy Kelley, Stonewall
- Diane Lightfoot, Business Disability Forum
- Dr Mark McBride-Wright, Equal Engineers
- Liz McKeown, Office for National Statistics
- Dr Beth Montague Hellen, University of Nottingham and LGBTSTEM founder
- Isa Mutlib, The BAME Apprenticeship Alliance
- Dr Laura Pallett, British Society for Immunology
- Lopa Patel, Diversity UK
- Dr Karen Salt, UKRI
- Keith Siew, Physiological Society
- Sarah Simcoe, EMBED Inclusion
- Mr Surash Surash, Consultant Neurosurgeon
- Clare Taylor, Society for Applied Microbiology
- Paul Thornton, Kier Group
- Gemma Tracey, Wellcome Trust
- Adam Travis, Elsevier
- Professor Kiran Trehan, University of York
- Veronica van Heyningen, Royal Society
- Professor Seralynne Vann, University of Cardifff
- Tom Welton, Royal Society of Chemistry
- Deborah Westfield, Glaxo SmithKline
- Polly Williams, Royal Academy of Engineering
- Dr Becca Wilson, UKRI Innovation Fellow with HDRUK, University of Liverpool

Policy group

The Secretariat convened a group of policy experts for a recommendation forming session on 13 May 2021. The suggestions raised in this session helped to shape the final recommendations in this report.

CONTRIBUTORS

- Mike Archer, AstraZeneca
- Dr Jason Arday, Durham University
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- Stephen Howse, Enginuity
- Ellie Ikiebe, Runnymede Trust
- Martin McIvor, Prospect

Critical reviewers

Drafts of the report were sent for critical review to a select group of reviewers. In addition, the draft was reviewed by our sponsors and Members of the APPG.

- Dr Idris Ajia, TIGER in STEMM
- Tomi Akingbade, Black Women in Science
- Dr Jason Arday
- Doyin Atewologun, Delta Alpha Psi
- Catherine Brown, British Science Association Council
- Joe de Sousa, British Science Association Council
- Dr Patrizia Kokot-Blamey, Centre of Research in Equality and Diversity (CRED) at QMUL
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- Dr Rachel Oliver, TIGER in STEMM
- Louise Skinner, Employment Lawyer's Association
- Mr Surash Surash, Consultant Neurosurgeon
- Dr Tessa Wright, Centre of Research in Equality and Diversity (CRED) at QMUL

Desk research and additional contributors

The Secretariat undertook further review of the existing literature to form this report, the full extent of which can be found in the References section. Additional information was also received from the following organisations:

- Business in the Community
- Royal Academy of Engineering
- Stonewall
- Women Returners

The British Science Association provides the Secretariat for the All-Party Parliamentary Group on Diversity & Inclusion in STEM

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