Written Evidence Submitted by the Department for Business, Energy and Industrial Strategy
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The Rt Hon Greg Clark MP
Chair of Science and Technology Select Committee
House of Commons
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14 JANUARY 2022

Dear Greg,

DIVERSITY IN STEM INQUIRY

I hope this paper is helpful in support of your evidence gathering.

Diversity - of enquiry, perspective, opinion, & approach to the great scientific challenges of our times is key. History shows us that science, at its best, is a powerful force for change. A science & innovation economy requires an equally open& dynamic society & culture.

That's why I am putting such a strong focus on people & careers at the heart of the Science Superpower & Innovation Nation mission. We need to do more through STEM outreach in schools, broadening the geographic access to opportunities on Innovation via Levelling Up, and empowering a new generation of more diverse & international young scientists.

But we need to be careful not to tie the science community up in a "tickbox" quotaculture of diversity compliance which doesn't tackle the root cause and risks undermining excellence which must be the fundamental building block of great science."

Yours sincerely,

George Freeman.

GEORGE FREEMAN MP

Minister for Science, Research and Innovation

Commons Science and Technology Committee: Diversity in STEM

Written Evidence: Department for Business, Energy and Industrial Strategy (BEIS) and Department for Education (DfE)

Minister: George Freeman MP (Minister for Science, Research and Innovation)

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i. In July 2020, the government published its Research and Development (R&D) Roadmap in which we committed to ensuring the UK is a global science superpower at the forefront of cutting-edge science and research. In July 2021, we then published our Innovation Strategy, setting out our ambitious vision to make the UK a global hub for innovation by 2035.

ii. The talented people and teams we are home to are at the heart of our research and innovation (R&I) ambitions. To achieve these, we must attract, develop and retain enough people of all ages, of all backgrounds and at all career stages within our system.

iii. In July 2021, we published our R&D People and Culture Strategy, which sets out a sector-wide vision for a more inclusive, dynamic, productive and sustainable UK R&D sector, in which a diversity of people and ideas can thrive.

iv. This vision recognises that more must be done to diversify the R&D workforce and to address underrepresentation, including within STEM, in all settings.

v. I recognise the importance of, and fully support, the work already being done in the sector to identify and address underrepresentation, such as the Royal Society's reports on ethnicity in STEM academic communities.[1] The government is fully committed to addressing underrepresentation and to deliver the R&D People and Culture Strategy.

Q1. The nature or extent to which women, ethnic minorities, people with disabilities and those from disadvantaged socioeconomic backgrounds are underrepresented in STEM in academia and industry;

1.1. The quality and availability of diversity data is mixed, depending on characteristic considered. The July 2021 report from the All-Party Parliamentary Group on Diversity and Inclusion in STEM (hereafter: APPG) found that while there are notable improvements in demographic data collection on diversity in STEM amongst large employers, professional bodies and funders in recent years, most data collection and analysis efforts have focused on gender.[2] Data on ethnicity, disability and socio-economic status and intersectionality statistics are more challenging to find.

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[1] https://royalsociety.org/topics-policy/publications/2021/trends-ethnic-minorities-stem/

[2] APPG on Diversity and Inclusion in STEM (2021). "Inquiry into Equity in the STEM workforce – Final report" (p. 30). https://www.britishscienceassociation.org/appg.
The findings of the report are based on written evidence from 85 organisations and individuals, four evidence round tables with over 40 attendees and additional research from over 150 relevant sources.

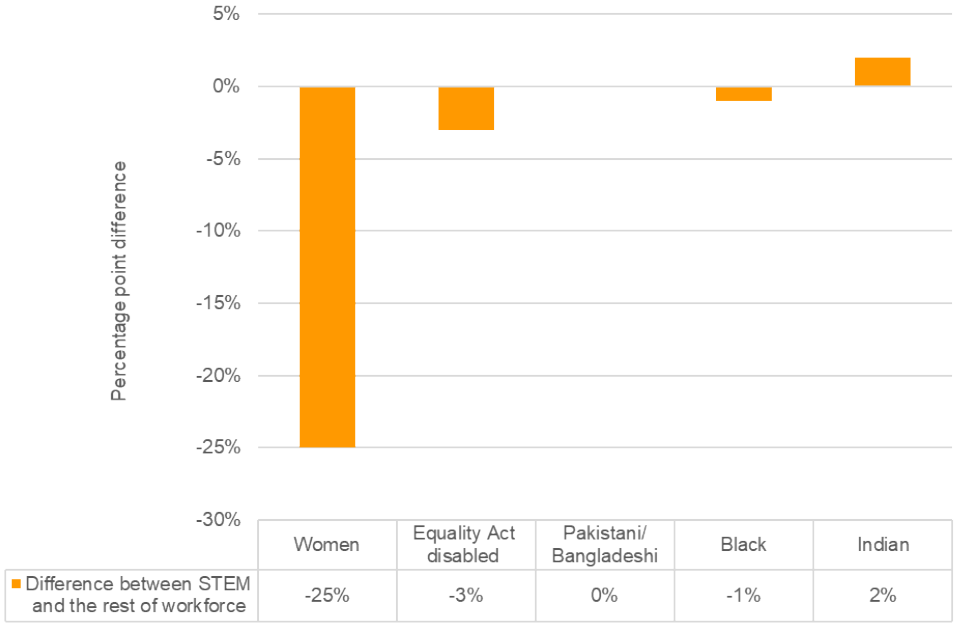
1.2. The APPG inquiry constitutes the most robust and up-to-date attempt to systematically gather data and wider evidence on diversity in STEM. As such it is referred to throughout this document.

1.3. Based on available data, the STEM workforce isn't representative of the wider workforce on gender – women represented only 27% of the STEM workforce in 2019, compared to 52% of the wider workforce. The proportion of disabled workers (Equality Act 2010) is 3 percentage points lower than in the wider workforce (11% vs. 14%). Ethnic minorities were better represented with 12% of the STEM workforce from ethnic minorities, a similar proportion to that in the rest of the workforce. However, the proportion of Black STEM workers is at a lower level than the rest of the workforce (2% vs. 3%).[3]

1.4. BEIS is preparing a new UK-wide R&I workforce survey, with findings due in mid-2022. This will improve the quality of diversity data (sex, gender, disability, ethnicity) of R&I occupations including many STEM occupations, and will allow Labour Force Survey (LFS) data on personal characteristics to be used to estimate R&I workforce diversity, as the new BEIS survey will find out how much R&I is done in each of the Standard Occupations recorded in LFS.

1.5. For an assessment of the diversity of the academic community based on UKRI and HESA data please refer to UKRI's submission to this inquiry.

Figure 1. Representation of ethnic minorities, disabled and women in STEM workforce compared to the rest of the workforce



Source: APPG (2020). [Labour Force Survey 2019].[4]

[3] APPG on Diversity and Inclusion in STEM (2020) The State of the Sector: Diversity and representation in STEM industries in the UK. https://www.britishscienceassociation.org/inquiry-equity-in-the-stem-workforce
[4] APPG on Diversity and Inclusion in STEM (2020), Op cit.

Gender

1.6. The UK has the highest proportion of female researchers in the OECD, but women are significantly underrepresented in STEM occupations compared to men.[5] Only 25% of the UK STEM workforce was female in 2020/21.[6] However, this is a significant improvement from 2010/11 when only 19% of the workforce was female.[7]

1.7. These improvements aren't equal across occupations. APPG reports that the proportion of women employed in engineering has increased from approximately 5% to 10% over the ten years from 2009, but the proportion of female ICT professionals has remained static at 16%. In construction, 'initiatives that have been run so far have had little impact, and there has been little evidence of change over the last twenty years'.[8]

1.8. Females working in STEM in the UK are more likely to work part-time (19% of females in 2020/2021 compared to 4% of males).[9]

1.9. In education, the proportion of women entering full-time undergraduate STEM courses has increased from 33.6% to 41.4% in 2020. In 2021, girls made up just over half of science A Level entries, with a 41% increase in the number of science A levels entries taken by girls in England between 2010 and 2021.

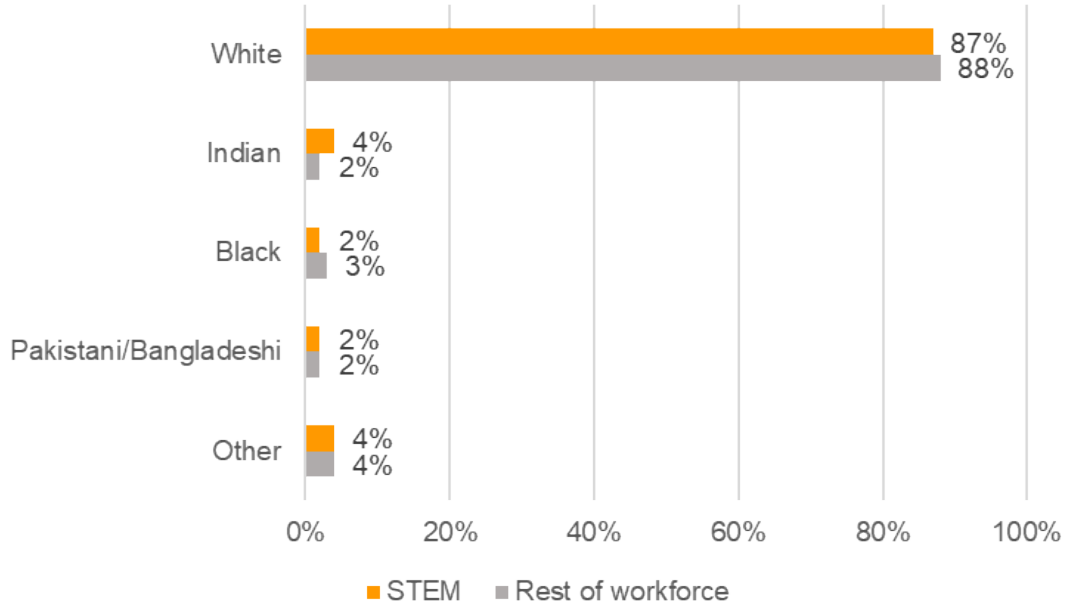
Ethnic minorities

1.10. 87% of the STEM workforce is White, which is 1 percentage point higher than in the rest of the workforce (Figure 2). When grouped together, the STEM workforce has a comparable share of Black, Asian and racially minoritised workers to the rest of the UK workforce (12%). However, looking at the data further shows that STEM has a lower share of Black workers (2% vs. 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% vs 2% in the rest of the workforce).[10]

1.11. The APPG report highlighted that amongst academic and other workplaces, there has been some progress in overall representation of racially minoritised groups in some sectors pre-COVID-19. 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. The Open University reported that the proportion of staff from Black, Asian and racially minoritised backgrounds in STEM roles has grown since 2014/5 from 11.4% to 13.7%.[11]

[5] ONS labour market statistics Q2 2015, Employment by gender in STEM occupations job families are as defined by UK Commission for Employment and Skills
[6] STEM workforce defined as working as Science, Research, Engineering and Technology Professionals and Science, Engineering and Technology Associate Professionals. Data from the Annual Population Survey https://www.nomisweb.co.uk/query/construct/submit.asp?forward=yes&menuopt=201&subcomp=
[7] The Annual Population Survey, Op cit.
[8] APPG on Diversity and Inclusion in STEM (2021). Op cit.
[9] The Annual Population Survey, Op cit.
[10] APPG on Diversity and Inclusion in STEM (2021). Op cit.
[11] APPG on Diversity and Inclusion in STEM (2021). Op cit.

Figure 2. STEM occupations and the rest of the workforce by ethnicity.



Source: APPG (2021), [ONS, Labour Force Survey Jul-Sept 2020][12]

People with disabilities

1.12. The STEM workforce, compared with the rest of the UK workforce, has a lower share of disabled people (11% compared to 14%).[13] The level of underrepresentation is even higher in the engineering workforce (10% compared to 14%) and science and maths workforce (10% compared to 14%).[14]

1.13. Evidence submitted to the APPG by Engineering UK suggests that a higher proportion of those working in engineering occupations in the public sector were disabled as opposed to those in the private sector. This evidence reported 11% of engineers in the private sector with a declared disability, compared to 16% of those in the public sector.[15]

Disadvantaged socioeconomic backgrounds

1.14. APPG reports that 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. It suggests that socio-economic disadvantage has 'a strong intersectional impact with many underrepresented groups also experiencing economic disadvantage'. However, many STEM employers don't collect data on the socio-economic backgrounds of their staff.[16]

Intersectional findings

1.15. The APPG report attempts to take an intersectional approach to analysis where possible, looking across multiple protected characteristics to identify those who are particularly marginalised in STEM. Disabled people (who declared disability) of all ethnicities are less represented in the STEM workforce than the wider UK workforce. The gap in representation between STEM workers and the rest of the workforce, is larger for disabled women than disabled men. The majority of disabled workers in the

[12] APPG on Diversity and Inclusion in STEM (2021). Op cit.
[13] APPG on Diversity and Inclusion in STEM (2021). Op cit.
[14] APPG on Diversity and Inclusion in STEM (2020), Op cit.
[15] APPG on Diversity and Inclusion in STEM (2021). Op cit.
[16] APPG on Diversity and Inclusion in STEM (2021). Op cit.

wider workforce are women (59%), in the STEM workforce only one third (33%) of disabled workers are women. [17]

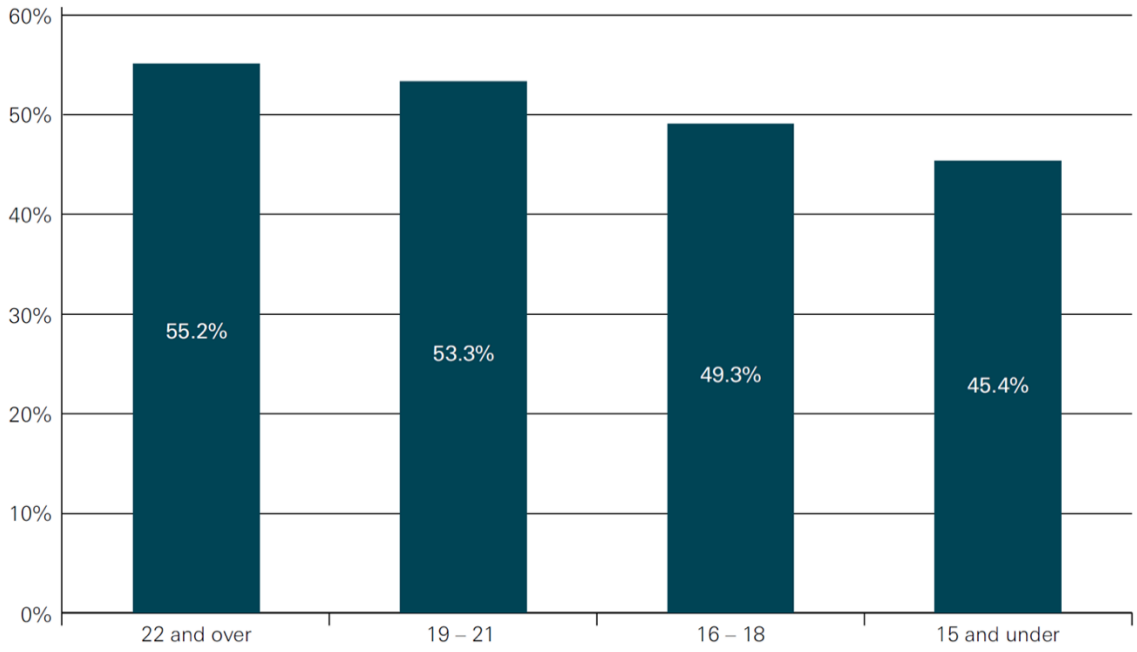
Q2. The reasons why these groups are underrepresented;

2.1. Misconceptions linked to broader negative societal attitudes towards STEM can cause underrepresentation, as these subjects can be seen as only for 'clever' students. This impacts more negatively on girls, students from ethnic minority backgrounds and those from less advantaged backgrounds. Perceptions about STEM can begin at an early age: children as young as 3-4 years show preferences for gendered work roles, and these can be reinforced in schools where male pupils are more likely to be called upon by teachers to get actively involved in STEM.[18] [19]

2.2. Cognitive psychologists such as Steven Pinker have argued against 'blank slate' theory, which states that humans are shaped entirely by their experiences, including through education, and instead argued broader factors more substantially shape human nature – such as innate cognitive ability, and familial socioeconomic status.[20]

2.3. For example, when measuring socioeconomic background in terms of parental social class or education, research (Figure 3) shows that the higher these are, the more likely the individual is to work in science.

Figure 3. % entering science by parents' age upon leaving continuous full-time education



Source: Kirby, P. (2016). *Leading people 2016: the educational backgrounds of the UK professional elite. Sutton Trust.*

[17] APPG on Diversity and Inclusion in STEM (2021). Op cit. p. 15
[18] Fawcett Society (2019). Gender Stereotypes in Early Childhood https://www.fawcettsociety.org.uk/news/fawcett-research-exposure-gender-stereotypes-child-causes-harm-later-life
[19] Women in Science and Engineering (WiSE) Campaign (2019)
[20] Pinker, S. (2002). The Blank Slate: The Modern Denial of Human Nature

2.4. When considering difference in geographical location, research illustrates that – in England – pupils in the South (including London) are twice as likely to have opportunities to take part in an invention scheme as those in the Midlands, and 1.6 times as likely as those in the North. On the other hand, England has six times as many opportunities to take part in invention schemes per pupil as Wales, and 4.5 times as many as Northern Ireland.[21]

2.5. Disadvantaged students' engagement in STEM can be reduced due to fewer resources for tutoring, extra-curricular clubs, facilities, and practical activities. These students are less frequently exposed to enrichment activities, contributing to underrepresentation.

2.6. A further cause is the pipeline from education systems into work. More women than men are lost throughout STEM education (from GCSEs to A Levels, and undergraduate to postgraduate).[22] Female STEM participation decreases as seniority of positions increases. Reasons to leave HE research include: 52% wanting to do something other than research (compared to 39% of males); 58% looking for a better work environment.[23]

2.7. No STEM-specific evidence has been identified as reasons why disabled workers are underrepresented, but the Innovation Caucus highlighted that people reporting disability state the following barriers to joining the innovation workforce: financial and educational disadvantages may limit the ability of disabled people to innovate; attitudes and stigma around disability affect disclosing their status or approaching business advisors; lack of access to networks, role models and mentors.[24]

2.8. Qualitative evidence from interviews in 2019 with 20 of the 25 UK Black female professors found that 'culture of explicit and passive bullying persists across higher education along with racial stereotyping and racial microaggressions.'[25]

2.9. The evidence collected for the R&D People and Culture Strategy suggested that the constant competition for funding increases precarity of R&D careers, particularly at early career stages, and increases the difficulty of securing long-term roles. This instability, particularly in academia, is exacerbated by team structures and the short-term contracts that typify post-doctoral research roles. This environment can discourage many – particularly women and those from less advantaged backgrounds – from pursuing long-term careers in research as people may be driven to consider other careers to increase financial security and enjoy more stability in their family life.[26]

Impact of COVID-19

2.10. While the impact of the pandemic and public health measures on diversity in STEM is still uncertain, APPG found widespread concerns that some groups' careers have

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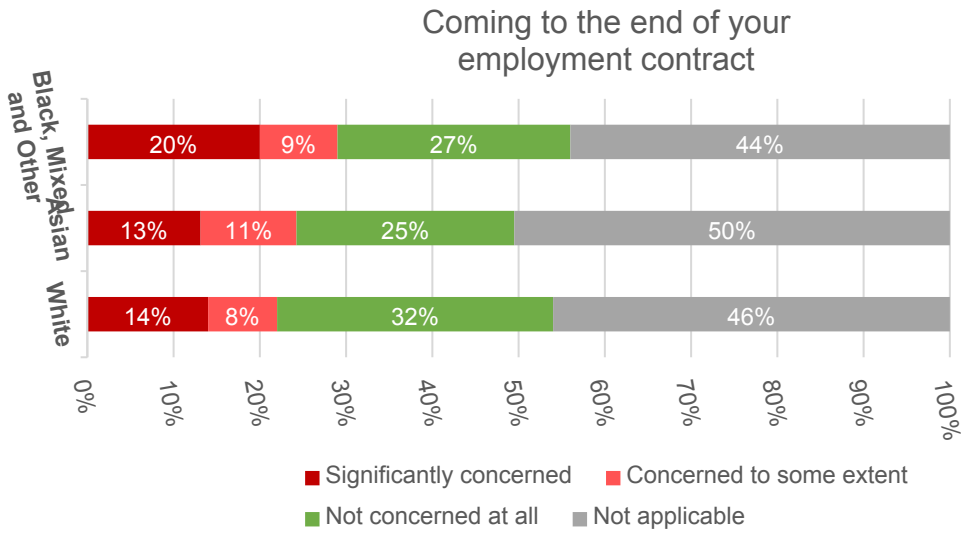
[21] Kirby, P. (2016). Leading people 2016: the educational backgrounds of the UK professional elite. Sutton Trust.
[22] This is the case for the most, but not all, STEM subjects (e.g. Biology has higher female representation) Source: HESA
[23] Vitae (2016). What do research staff do next? 2016. https://www.vitae.ac.uk/vitae-publications/reports/vitae-what-do-research-staff-do-next-2016.pdf
[24] Innovation Caucus (2020). Supporting Diversity and Inclusion in Innovation. https://www.gov.uk/government/publications/supporting-diversity-and-inclusion-in-innovation-study
The Innovation Caucas supports sustainable innovation-led growth by promoting engagement between the social sciences and the innovation ecosystem. Their members are leading academics from across the social science community and they connect the social sciences, Innovate UK and the Economic and Social Research Council (ESRC), by providing research insights to inform innovation policy and practice. The initiative is funded and co-developed by Innovate UK and the ESRC.
[25] Rollock, N. (2019). Staying Power: The career experiences and strategies of UK Black female professors. https://www.ucu.org.uk/media/10075/Staying-Power/pdf/UCU_Rollock_February_2019.pdf
[26] BEIS (2021) R&D People and Culture Strategy: People at the heart of R&D. https://www.gov.uk/government/publications/research-and-development-rd-people-and-culture-strategy

been most affected by restricted access to workplaces and their career progression stifled. These include those with young children or caring responsibilities, people from working-class backgrounds, and people from minority ethnic backgrounds.[27]

2.11. The pandemic forced many STEM employers and employees to experience more homeworking and flexible working. In general, benefits – such as increased time with families and for leisure, and lower commuting costs coupled with homeworking 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, negative impacts – such as isolation, increase in unpaid responsibilities, and unsuitable homeworking spaces – are more likely to have affected junior employees and minoritised groups, including women, racially minoritised groups, disabled people, and carers.[28]

2.12. The Vitae/BEIS COVID-19 survey of researchers in the UK found that 29% of respondents of Black, Mixed or Other ethnicity were concerned about their contract ending compared to 22% of White respondents and 24% of Asian respondents.[29]

Figure 4. Vitae COVID-19 survey of researchers. Question: If social distancing restrictions are in place for the next six months, to what extent are you concerned about the following?



Source: Vitae (2021).[30]

Q3. The implications of these groups being underrepresented in STEM roles in academia and industry;

3.1. Diversity can increase innovation.[31] Gender diversity has been shown to be associated with greater innovation, and higher efficiency in knowledge-intensive industries. Similarly, evidence suggests that ethnic diversity has a positive impact on innovations in knowledge-intensive and internationally-oriented sectors.[32] Ethnic minority-led firms are

[27] APPG on Diversity and Inclusion in STEM (2021). Op cit.
[28] APPG on Diversity and Inclusion in STEM (2021). Op cit.
[29] Vitae (2019). Impact of Covid-19 on researchers & UK research base survey. https://www.vitae.ac.uk/impact-and-evaluation/impact-of-covid-19-on-researchers-and-uk-research-base-survey-questions
[30] Vitae (2019). Impact of Covid-19 on researchers & UK research base survey. Op Cit.
[31] Schneider, Eckl (2016), The Difference Makes a Difference: Team diversity and innovative capacity. *Paper empirically identify localised spillover benefits of workers who are underrepresented in the firm*

also found to engage more often in certain types of innovation than non-ethnic minority-led firms.[33]

3.2. Evidence also indicates that diversity increases opportunities for creativity within firms, improving problem-solving and decision-making.[34] Greater diversity of backgrounds, and career/life experiences brings new and different perspectives and diversity of opinion to these scenarios, and is a necessary part for driving innovation in industry settings. In academia, diversity of thought creates new proposals and approaches to research activity such as those that are multidisciplinary, which in turn develop wider skills of the research workforce.

3.3. Underrepresentation of these groups within various stages of the innovation process can be costly to productivity and the economy – both now and in the future if underrepresented groups don't take up STEM subjects and careers. Greater participation of women and minorities in the innovative process could increase GDP per capita by 0.6% to 4.4%.[35] 19% of revenue uplift has been found to accrue as a consequence of innovation.[36]

3.4. "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."[37]

3.5. An annual shortfall in domestic supply of around 40,000 new STEM skilled workers has been estimated.[38] The R&D People and Culture Strategy also suggests that the R&D sector needs at least an additional 150,000 researchers and technicians by 2030 to sustain the UK's target of 2.4% R&D intensity. Diversifying and widening routes into R&D and inspiring people from all backgrounds to consider these careers are critical to addressing these challenges.

Q4. What has been done to address underrepresentation of particular groups in STEM roles;

4.1. To reach the UK's full potential, we must draw on all our available talent. Government funds STEM Inspiration programmes to encourage young people from all backgrounds to consider studying STEM subjects and aspire to STEM-related careers. UKRI also actively supports increased diversity in the STEM workforce.

4.2. DfE is aiming to improve take-up and teaching quality of STEM subjects in schools. This includes funding of the Stimulating Physics Network which provides tailored support to schools, designed to increase the uptake of A level physics from students in underrepresented groups, including girls.

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[32] Department for Business, Energy and Industrial Strategy (2021), Evidence for the UK Innovation Strategy. https://www.gov.uk/government/publications/evidence-for-the-uk-innovation-strategy
[33] BCG, 2017, *from* ERC SOTA No47 (2021)
[34] BCG, (2017). Op cit.
[35] Cook, Lisa D. (2020), Policies to Broaden Participation in the Innovation Process; https://www.brookings.edu/wp-content/uploads/2020/08/Cook_PP_LO_8.13.pdf
[36] BCG, 2018, *from* ERC SOTA No47 (2021)
[37] APPG on Diversity and Inclusion in STEM (2021) "Inquiry into Equity in the STEM workforce – Final report". https://www.britishscienceassociation.org/appg
[38] CaSE, KCL (2014) Improving Diversity in STEM https://www.sciencecampaign.org.uk/resource/ImprovingDiversityinSTEM2014.html

4.3. DfE has also invested £84 million into a programme to improve computing teaching and participation at GCSE and A Level – particularly amongst girls – and £76 million into the maths Teaching for Mastery programme, aiming to reach 11,000 schools across England by 2023 equipping all young people, regardless of background, with mathematical skills they will need for employment, further study, and everyday life.

4.4. Government funds STEM Inspiration programmes to promote engagement with STEM and tackle misconceptions. These include the STEM Ambassadors programme, a nationwide network of over 30,000 volunteers from a wide range of employers, who engage with underrepresented young people to provide stimulating and inspirational informal learning activities in school and non-school settings.

4.5. UKRI's Future Leaders Fellowships programme supports early career researchers and innovators with outstanding potential and has been designed to welcome applicants from diverse career paths. It is clear within the applicant guidance that there is no expected "standard" career path applicants must have followed and specific briefing is provided to the reviewers and assessment panels to take this into account.

4.6. UKRI has also have taken steps to widen participation, including embedding EDI as a requirement in grant applications, including those for Centres for Doctoral Training and Doctoral Training Partnerships, and larger centre investments. In addition, EPSRC have undertaken work on flexible working on all of its grants, including covering caring responsibilities to attend workshops as well as "Have your say" surveys to understand what the community knew about the support available and to promote this more widely.

4.7. EPSRC have invested £5.5m in eleven research projects to improve equality, diversity and inclusion (EDI) within engineering and the physical sciences at universities across the UK. This call was the first initiative launched as part of UKRI's collective approach to promoting EDI.

4.8. Innovate UK's Women in Innovation campaign was launched in 2016 to address the underrepresentation of women engaging with Innovate UK, to get more women with excellent ideas innovating in UK businesses and boost the economy. Since then the number of women leading applications for grants to Innovate UK has increased by 70%. and over 1700 women have joined the Women in Innovation community.

4.9. The REF 2021 has a strong focus on fostering EDI, seeking to ensure excellent scientists and researchers get credit for their work regardless of background or working pattern. There is a firm commitment to embedding EDI in all aspects of REF policy and decision-making.

Q5. What could and should be done by the UK Government, UK Research and Innovation, other funding bodies, industry and academia to address the issues identified.

5.1. The R&D People and Culture Strategy sets out the actions that will be taken to address the issues identified with underrepresentation, building on the important work already being undertaken by the sector.

5.2. We are conducting a review of youth engagement and its impacts as well as working with funders and the wider sector to co-design a joined up talent offer that is open to the full diversity of people in the UK across all career stages. This requires working closely with the sector to diversify entry routes into careers and removing barriers to mobility across the system to ensure that careers are dynamic, varied and sustainable.

5.3. To retain a diversity of talented individuals, collective action must be taken to foster a positive, inclusive and respectful culture. Through the creation of a 'Good Practice Exchange' we will bring together people from different communities and across the sector to develop ideas to improve culture – including across bullying and harassment, recruitment, and leadership practices.

5.4. We will drive adoption of the 'Résumé for Researchers' narrative CV, which allows for a better description of activities and experiences that are difficult to highlight in 'traditional' academic CVs. Wider recognition and reward of a broader range of people and contributions will help address issues around diversity.

5.5. We will ensure that our research system at an institutional level, through its frameworks, assessment and incentives, encourages the behaviours that support a positive and inclusive culture. The Review of Research Bureaucracy and the Future Research Assessment Programme will help to improve the working lives of all individuals and teams undertaking R&D activity by reducing bureaucracy and ensuring our research system has a healthy assessment model at its foundation.

5.6. Action must be taken forward jointly by government, funders, academia, industry and individuals in order to drive lasting change. BEIS will establish a Ministerial Coordination Group comprising of senior R&I organisations working with the wider sector to oversee and coordinate sector-led actions that will address underrepresentation. Further details on the Group will be published in due course.

5.7. Action in the education pipeline to encourage more students into STEM education and training at all stages from primary school to higher education is also crucial. STEM education should be more relevant to the lives of all young people, and DfE is working to ensure it appeals to a wider section of young people. DfE is committed to working with the sector and STEM industries to explore ways to address inequity and teacher shortages in STEM subjects.

5.8. DfE have also introduced T Levels and several of those now being taught relate to STEM, including Construction and Science. They are working with employers to promote apprenticeships to give more opportunities for pupils to pursue STEM training and careers, whether they come via a technical or academic route.

5.9. The new UK-wide R&I workforce survey will be an important tool in measuring the progress of actions being taken to address underrepresentation.

(January 2022)