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Diversity in STEM Call for Evidence: Royal Society of Edinburgh response

Dear Secretariat of the Science and Technology Committee,

1. I write to you on behalf of the Royal Society of Edinburgh (RSE), Scotland's National Academy, and as Chair of its 2018 progress review into the status of women in science, titled *Tapping All Our Talents*, which has informed this consultation response.¹
2. The RSE is pleased that the House of Commons Science and Technology Committee is launching an inquiry into diversity in STEM. Notwithstanding the actions that have already been implemented and the positive results they have generated, there are still strides that must be made to increase the STEM workforce's diversity. Due to the remit of our previous research and corresponding report, our evidence will primarily focus on the issue of women's representation across the STEM landscape.
3. The RSE is well placed to provide evidence in support of this inquiry, given our longstanding interest in STEM education and the STEM workforce. While the RSE is not a STEM employer, as Scotland's National Academy, it has used its extensive expertise and practitioner experience across its Fellowship and Young Academy of Scotland, as well as its convening power, to explore the issues around women's representation in STEM. Through our inquiries into women in science, we have sought to understand how the presence and profile of women in Scotland's science sector can be further advanced. Alongside this, we have continued to celebrate and promote their innumerable achievements through an extensive programme of public engagement activities.

¹ <https://rse.org.uk/expert-advice/inquiries/tapping-all-our-talents-2018/>.

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

Throughout our response, we have focused on the underrepresentation of women in STEM, rather than also examining ethnic minorities, people with disabilities and those from disadvantaged socioeconomic backgrounds. Of course, these other attributes will intersect with, and layer upon, the experiences of women as outlined below; nonetheless, our findings presented here focus on evidence relating to women in STEM.

4. Through public consultation, a series of roundtable discussions and a review of the available literature and data, the RSE revisited its 2012 inquiry into women in STEM in 2018 to determine if and how the context had changed in the intervening years. **The 2012 report showed that a worryingly high proportion (roughly three quarters) of female graduates are lost along the STEM ‘pipeline’ from school to employment, especially leadership positions.** The 2018 report pointed to some encouraging signs of improvement; for example, between 2012 and 2017, the overall proportion of female graduates working in the STEM sector showed a slight but steady increase. However, the 2018 data reaffirms that there is still an unacceptably high loss of women along the pipeline, particularly at higher levels of education and in senior academic roles. The 2018 review showed that female uptake of STEM education and careers remains a nuanced picture, with enrolment and recruitment figures varying depending on the discipline, with particularly notable declines in Computer Science and IT. The below paragraphs discuss the representation of females across pupil cohorts and within academia itself in more detail.

Academia:

5. **There is considerable variation in the uptake of STEM courses by females in tertiary education, depending on the subject and the level of study.** While some areas have seen incremental improvements, others have witnessed stagnation or even declines, indicating that the quest for gender parity in higher and further education is far from over. Unfortunately, female admissions into Computer Science and IT courses have recorded a decline in recent years, with further education institutions reporting a total of 54% female admissions in 2012 and only 43% in 2018. For undergraduate courses in related disciplines, figures show a similar decline from 19% to 16%. Engineering has seen improvements in the number of female students enrolled in college STEM frameworks, increasing from 13% in 2012 to 28% in 2017. However, enrolment rates for higher education engineering programmes failed to reflect the same growth, with only a 3% climb in female students during the same period. Higher education mathematics programmes have seen a decrease in admissions, from a total of 44% in 2012, falling to 38% in 2017. However, there has been a marginal increase in the proportion of graduate degrees that females pursue across some STEM disciplines, such as Physics, having experienced a rise in female admissions from 20% to 23% during the same period.
6. **This drop off along the academic pipeline is also seen within the academic workforce.** Recent trends show a notable improvement in the number of female professors in Mathematics and Chemistry, with figures showing an increase in female Mathematics professors from 3% to 10% and a doubling of the number of female chemistry professors from 5 to 10% between 2012 and

2017. Encouragingly, Biology remains the outlier for female representation in academic STEM posts, with 20% of the professors being women. However, **the overall representation of women in top academic roles such as professors remains low at around 10 to 15%**. The most notable drop off point for women in academia is the progression from academic reader/lecturer to professor, with women missing out on senior roles.

Industry:

7. **Overall, the number of females recruited into STEM-related industries has increased, although this increase is subject to variation across the workforce.** In 2017, it was reported that 23% of individuals employed in core STEM professions were female. This figure increased from 2012, when only 13% of those working in the STEM sector were female. Further modest increases have been reported in the number of female graduates entering STEM fields, with a rise of 3% during the same period. Despite this improvement, **male STEM graduates are still overrepresented in terms of how many go on to work in STEM industries, with 57% of male STEM graduates working in STEM industries in 2017 compared to 30% of female STEM graduates.**

2. The reasons why these groups are underrepresented.

8. Our 2018 *Tapping All Our Talents* review pointed to various reasons why women are underrepresented in the STEM workforce. **Many of the findings recorded were related to broader cultural issues that are not only present in the workplace but are mirrored in broader society. However, some barriers directly relate to the nature of STEM careers and lack of supportive resources,** such as lack of quality childcare provisions. The barriers females face are apparent in both recruitment and retention along the STEM career path, and these issues have remained broadly the same since the initial report in 2012.

Recruitment

9. For females, the barriers become apparent from an early age, during the primary and secondary stages of education. The current cultural zeitgeist has supported the ideological notion that gender determines career options. Young girls have unfortunately been influenced by the dominant stereotype that STEM roles are ‘men’s jobs, or that the subject is too ‘difficult’ and only offers roles in specific and limited areas of work. **The people who influence females during developmental stages (i.e., teachers, parents) continue to exhibit unconscious bias, which allows these gender-based occupational ideals to flourish.** This renders STEM an ‘unattractive’ career option at an early stage, leaving females less likely to select STEM subjects in secondary education. Therefore, they are unlikely to gain the required qualifications to study related courses at a higher level and to progress onwards to employment in STEM roles.
10. This ideology continues to be ‘reinforced’ in the job market, with **the same unconscious bias being visible in recruitment advertisements of STEM roles.** Marketing materials generated for work and training positions have evidenced stereotypical imagery and language, shaping the perception of ‘male’ occupations. This further influences the career choices among females and acts as a barrier to them selecting roles in STEM.

Retention

11. For the minority of women who choose a STEM-related career, further barriers become apparent when employed in the sector. The often male-dominated workplaces they encounter can present **workplace culture and environmental challenges**:

- The lack of female representation in STEM workplaces means that females are **less likely to have the ability to utilise meaningful peer support networks and role models**. Alongside this, **'micro-inequalities'** such as casual jokes that question females' ability to perform required tasks have also been cited as potential barriers.
- The behaviour of colleagues can also be a significant problem. Reports suggest that **gender-based violence and harassment is still prevalent** in workplaces and educational settings.
- **Practical challenges such as equipment being catered to the physical needs of males**, i.e., workbench height and protective uniforms, can make for physically uncomfortable work environments.

12. Another issue is the nature of STEM career pathways and the culture of the occupation itself. Careers in science and technology are often characterised by long periods of qualification, international travel, high levels of job insecurity and a lack of part-time positions. **Women can find themselves unevenly impacted by these challenges, particularly the many who take on the majority of caring responsibilities in the family home**. To add to these challenges, there were concerns that insufficient and unaffordable childcare provisions also impact women's ability to maintain meaningful employment in the STEM sector.

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

13. **The lack of equal representation in the STEM pipeline has consequences for both the company/organisation and the broader UK economy.**

Organisations/businesses

14. For individual companies, **the absence of a diverse workforce can restrict its potential**. A business that is open to recruiting from diverse groups offers employers a broader range of choices from a larger 'talent pool' that brings new perspectives, experience, and skills to the company. Teams of diverse nature offer a greater understanding of customer, client, or investor needs; more productive debate; better problem-solving ability; and improved creativity. The failure to increase diverse representation among staff means companies can restrict the skills and experience of their resource pool.

15. **Research suggests that women are innovating faster than their male counterparts**. In our initial 2012 *Tapping All Our Talents* report, key findings indicated that females were more likely to create new products for the market, use technology in their products and services and have a product on the market that was developed within the previous year. This research shows that companies can miss out on new products and services that could boost their revenue.

16. **There is a real need to recruit more people into STEM roles, and women could help alleviate the growing gap in skilled employment**. A report from consultancy firm McKinsey and Co also suggests that further action on gender equality can secure employment for an additional 840,000

female employees.² This could be crucial given that the Home Office Occupation Shortage List reveals that most labour shortages come from STEM-related roles or industry³, with forecasts of jobs in science, engineering and technology set to rise at double the rate of any other industry according to the UK Industrial Strategy. The **‘skills gap’ has been cited as the ‘main’ threat to the UK labour market.** The implications of women being underrepresented have the potential to leave women disadvantaged in the job market and have the potential to leave businesses short of the labour and skills they require.

UK economy

17. **Equal representation can help secure prosperity for Scotland’s and UK’s economies.** The same report from consultancy firm McKinsey and Co found that closing the gulf of the gender gap in the economy can add an additional £150 billion to the UK GDP forecasts in 2025.
18. **The STEM skills gap can disrupt the UK’s Industrial Strategy that requires a ‘thriving’ STEM base.** The value that STEM-based industries have to the economy was noted in the Scottish Enterprise 2018/19 Business Plan, with ‘major economic opportunities’ being realised through high-value manufacturing, the digital economy and the low carbon transition.⁴ The government needs to ensure that enough people fill these roles to realise its economic potential and increasing female representation could help bridge the gap.

3. What has been done to address the underrepresentation of particular groups in STEM roles?

19. **The inquiry highlighted several case studies of successful Scotland-based initiatives to improve gender representation and inclusiveness in the STEM workplace** (categorised according to business and industry, academia, or government policy). These include:

Business and industry

20. **Equate Careerhub** (<https://equatecareerhub.org.uk/>) is the first website in Scotland to focus on recruiting women to science, engineering, technology and built environment careers. The website provides the latest job opportunities across these vital sectors. It supports progressive employers to reach out to women, encouraging them to apply for traditionally male-dominated roles. **The website acts as a first step for many employers to pursue further positive action measures and assists them to review their recruitment processes.** The initiative aims to radically increase the number of women in STEM roles, encourage employers to consider their recruitment processes, and implement more flexible, fairly paid, and quality part-time work. Careerhub actions include:
 - a. Developing a network of employers who are keen to recruit women in new and inclusive ways
 - b. Providing job advertising space on Equate Scotland’s dedicated site and social media
 - c. Reviewing job adverts and descriptions for gender-biased language and imagery
 - d. Encouraging employers to offer flexible or part-time roles

² Hunt, V., Dobbs, R., Gibbs, E., Madgavkar, A., Woetzel, J., Arora, S., Hong, W., Krishnan, M., Arora, R., Barnett, C., & Brookhouse, C. (2016). *The power of parity: advancing women’s equality in the United Kingdom*. McKinsey Global Institute. <https://www.mckinsey.com/featured-insights/gender-equality/the-power-of-parity-advancing-womens-equality-in-the-united-kingdom>

³ Home Office. (2021). *Immigration Rules Appendix Shortage Occupation List*. <https://www.gov.uk/guidance/immigration-rules/immigration-rules-appendix-shortage-occupation-list>

⁴ Scottish Enterprise. (2018). *Business Plan 2018-19: Operating Year Update*. <https://www.scottish-enterprise.com/media/1955/business-plan-2018.pdf>

- e. Training employers in using language more inclusively and taking proportionate positive action measures
21. A collaboration between Equate Scotland, City of Glasgow College and partners in the Netherlands and the Basque Country, **ENGENDERING STEM** (<https://www.engenderingstem.co.uk/>) **offers support to SMEs in the STEM sector to take steps to enhance gender equality.** This support takes the form of a free online self-assessment tool and one-to-one consultation support, which identifies manageable and incremental steps that employers can take to improve their gender balance. In addition, the scheme offers SMEs the opportunity to showcase and learn from good practices on equality on the European stage.

Academia

22. Scotland's universities undertake a range of initiatives to minimise gender-related disadvantages. These range from **providing explicit support to female academics at the junior level considering promotion** (Edinburgh and Glasgow) to **providing funds to cover childcare when staff are attending external conferences or training events** (Strathclyde and Aberdeen). A number of universities **offer support to staff returning from extended periods of leave.** These include the Academic Returners' Research Support Scheme at the University of Glasgow and mini sabbaticals at the University of the Highlands and Islands. Some universities operate 'core hours', meaning that meetings and seminars should occur when staff with external caring responsibilities or those who work part-time usually are at work. **Equality and diversity are an explicit part of the job roles of senior academics** at the Universities of Edinburgh and Glasgow, a welcome development as **embedding equality in senior positions was highlighted by many of those who responded to our call for evidence.**
23. **Many respondents to this review cited Athena SWAN as one of the main drivers of progress towards gender equality in the academic workforce.** Engagement with Athena SWAN demands greater buy-in from senior management, broader conversations about equality issues, more robust processes, and better data collection. Some suggest that the data lays bare the problems within departments and/or institutions that have the greatest impact and is the primary catalyst for change. For others, Athena SWAN has a role in focusing minds, setting expectations for gender parity, embedding equality across universities, and as a mechanism through which best practice can be shared. While there was clear, if not universal, support for Athena SWAN, **there was also clear consensus on the need for reform** (e.g., through a reduction in administrative burden).
24. The **Aurora leadership programme**, a women-only programme run by Advance HE, was cited as an example of good practice in using positive action to impact equality positively.

Government policies

25. The UK Government has implemented **shared parental leave (SPL)**, which allows eligible parents to share leave over the remaining 50 weeks of the child's first year. This is a welcome change that aims to combat gender-biased childcare responsibilities. However, its impact must be monitored to ensure it achieves the desired effects.

26. **The Scottish Government has continued to support funding for third-sector organisations** that address occupational segregation, including Equate Scotland.
27. **The Fair Work Framework for Scotland (2016)** sets out recommendations for employers to promote a fair workplace culture.
28. **An increase in free childcare from 600 to 1140 hours per annum** for children ages two (if eligible) to four is, among other policy aims, intended to ease the burden of securing sufficient childcare for working parents and women in particular.
29. **The Workplace Equality Fund** provides grants to private businesses to reduce inequalities, discrimination, and barriers for protected groups, such as women, ethnic minorities, and people with disabilities.
30. **Scotland's Enterprise Agencies** have been duty-bound to report on equalities and outcomes.

4. 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.

31. Our 2018 report sets out a series of recommendations categorised according to academia, government or business and industry.

Key recommendations to universities, research institutions and research funders:

- **Monitoring and publishing data** on female representation, separated by STEM subject and level of seniority;
- Readdressing **gender balance in senior management**;
- **Establishing equity committees** to review data and report on equality.
- **Increasing provision of high-quality, on-site, affordable childcare.**

Key recommendations for government

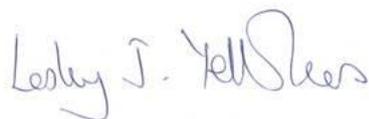
- **Leaders need to use their political influence to foster cultural change in gender equality views** by collaborating with all sectors and delivering gender competence training.
- Government must **lead a 'step-change' in society's views of parental roles**, using legislation, funding, and policy to drive the acceptance that childcare is the responsibility of both parents.
- **Investment in STEM-specific data collection and publication** to have a more accurate understanding of intersectionality, sectoral differences, and regional variations. In addition, we need more data that help us understand what works to progress gender equality in STEM. This could be done through an **'intervention tool'** that can monitor the evidence's strength, impact, and cost-effectiveness.
- **The government must target critical influencers of children and young people to challenge gender stereotypes**, focusing on the unconscious bias toward gender that influences the next generation.

Key recommendations for Industry and business

- Employers must enact **zero-tolerance policies on misogynistic behaviour and sexual harassment**, alongside **fostering a culture that minimises unconscious bias** through high-quality training with a particular focus on training senior staff or staff involved in the recruitment and promotion process.
- Employers should **create high-quality part-time roles and flexible working** positions. This recommendation has been cited as a move that would have the most significant impact.
- More employers should move **from rhetoric to decisive action on gender equality** by participating in evidenced, legal and positive action, including creating placements solely for female graduates and increasing representation within key decision-making bodies.
- Employers should develop good practices on **work-life balance**.
- **There should also be effective dissemination of information about policies and processes**, including parental leave, provision for part-time employment and promotion criteria.

We look forward to seeing the outputs of the inquiry when they become available. We would also be pleased to engage further with the Science and Technology Committee on this topic in the future, perhaps in the form of a joint roundtable or other engagement work. *To follow-up*, please contact Stephanie Webb, Policy Advice Officer, at swebb@therse.org.uk. Thank you, and I wish you all the best as you conduct your inquiry.

Yours sincerely,

A handwritten signature in blue ink that reads "Lesley J. Yellowlees". The signature is written in a cursive, flowing style.

Professor Lesley Yellowlees, CBE HonFRSC FRSE.