



ENGINEERS
AUSTRALIA

Women in STEM Decadal Plan

Response to the discussion paper

October 2018

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Introduction



About Engineers Australia

Engineers Australia is the peak body of the engineering profession. We are a professional association with about 100,000 individual members. Established in 1919, Engineers Australia is a not-for-profit organisation, constituted by Royal Charter to advance the science and practice of engineering for the benefit of the community. Engineers Australia represents the engineering team, comprising Professional Engineers, Engineering Technologists and Engineering Associates.

About this response

This response to the Women in STEM Decadal Plan discussion paper provides some insight into the challenges faced in the engineering profession with regards to attracting and retaining women. It identifies some cohorts of female engineers who may be underutilised, and it explores issues important to increasing girls' participation in STEM (Science, Technology, Engineering and Mathematics) based study. Finally, it provides short responses to the eight questions posed in the discussion paper.

Contact details

To discuss the issues raised in this response further please contact Justine Romanis, National Manager for Professional Diversity and STEM, on (02) 6270 6552 or JRomanis@engineersaustralia.org.au.

The importance of engineering in STEM

Throughout the world, analysts have argued that the way to achieving a technologically based economy is to develop the mathematical, technological and scientific skills of the future workforce. In launching the National Innovation and Science Agenda, the Prime Minister said he was ushering in 'the ideas boom'¹. New and innovative ideas are the beginning of technological advance, but it is engineers that translate new ideas into new products and services that are commercially attractive in domestic and overseas markets. Engineering and its continuous development over recent decades effectively uses knowledge of mathematics and science to solve real world problems. Australia's ideas boom depends on the skills of engineers to bridge the gap between idea and practical products and services that will drive productivity and economic growth.

Australians have a positive impression of engineers², but few in the community and few political decision makers understand what engineers do, how this contributes to community well-being and prosperity, and the critical role played by engineers in achieving technological progress.

Innovative environments do not just happen, they are outcomes of interaction between individual and corporate ideas, entrepreneurship, risk taking and investment and government policies to foster these factors and address barriers to innovation. Therefore, building Australia's engineering capability must be an indispensable element of the government's innovation strategy. Our contention is the role of engineers is pivotal and without sufficient, and the right type of, engineers, many good ideas will continue to be just that – good ideas that have gone nowhere.

No profession unleashes the spirit of innovation like engineering. From research to real world applications, engineers constantly discover how to improve our lives by creating bold new solutions that connect science to life in unexpected, forward thinking ways. Few professions turn so many ideas into so many realities. Few have such direct and positive effect on people's everyday lives. We are counting on engineers and their imaginations to help us meet the needs of the 21st Century"³. In short, engineers make things happen.

1 Prime Minister of Australia. Launch of the National Innovation and Science Agenda. Media release 7 December 2015, www.pm.gov.au

2 See www.roymorgan.com and www.businessinsiders.com.au/ranked-australias-20-most-trusted-professions. The Roy Morgan image of professions survey consistently ranks engineers highly for honesty and ethical standards, 4th in 2016 with 78 per cent, only surpassed by nurses, pharmacists and doctors.

3 Changing the conversation; Messages for improving public understanding of Engineering. National Academy of Engineering 2008. www.nap.edu/catalog/12187.html



The issue starts at school

The Women in STEM Decadal Plan discussion paper addresses several issues facing gender equity within STEM career pathways. The equitable participation of women in STEM careers will ensure that Australia is drawing on all available STEM talent across the country and that all Australians are equipped for the jobs of the future.

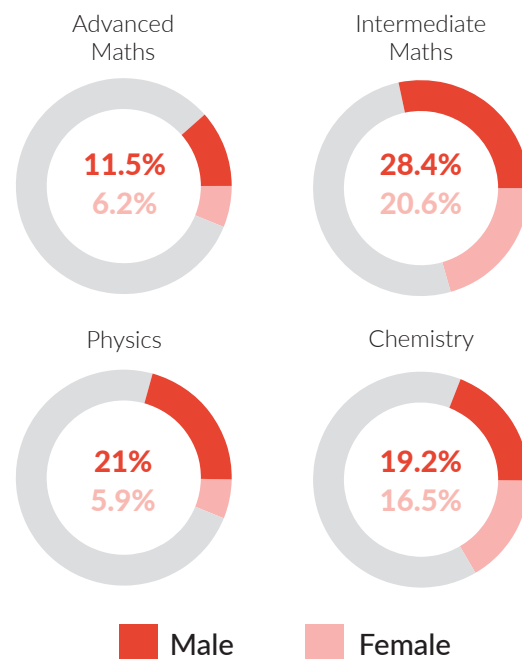
As the paper mentions, the problem of gender equity in STEM careers is well known. The challenge starts at school, and from a young age. Primary school education, high school education, subject selection and career awareness are key to increasing the participation of women in STEM based careers. The challenge is educating our young women on the importance of foundation STEM skills in context of problem solving and future innovation. The message we deliver currently to our students is they need to study maths and science subjects, without helping them understand the 'why'. It is critical we put context around STEM skills as foundations for innovative thinking and real-world problem solving. This would present a challenge, potentially for a high percentage of teachers too. We need to invest in upskilling our valuable teaching staff, so they are informed and confident in communicating the 'why'.

Engineers Australia launched a report 'Engineers Make Things Happen' in 2016 where it stated, 'the importance of science, maths and technology for our future development has received widespread attention, but high school participation in these subjects continues to fall'⁴.

Firm grounding in science and mathematics is important in a number of fields, but particularly so for engineering because science and maths are the tools used by engineers to solve problems. Participation in these subjects is typically far lower among young women than young men.

Participation by young women in critical foundation subjects for engineering such as advanced and intermediate maths, physics and chemistry is alarmingly low and is in stark contrast to their participation in higher education which is 30% higher than young men, an outcome that is not receiving the attention it deserves⁵.

Student at year 12 in each subject (2015)



In effect, this low participation has created an environment in which engineering recruits most engineers from half the population, a situation that is unsustainable given our national agenda.⁶

⁴ Engineers Make Things Happen, Engineers Australia, 2017 Page 8. www.engineersaustralia.org.au/sites/default/files/resource-files/2017-03/Engineers%20Make%20Things%20Happen.pdf

⁵ Engineers Make Things Happen, Engineers Australia, 2017 Page 8. www.engineersaustralia.org.au/sites/default/files/resource-files/2017-03/Engineers%20Make%20Things%20Happen.pdf

⁶ Engineers Make Things Happen, Engineers Australia, 2017 Page 36. www.engineersaustralia.org.au/sites/default/files/resource-files/2017-03/Engineers%20Make%20Things%20Happen.pdf



Potential pool of female engineers

Engineering is not known as a gender-diverse profession, and indeed the percentage of women in the engineering profession is low. Just 13.6% of the engineering labour force is female, and it's even lower at 11.2% when only those who are employed in engineering roles are counted. However, the numbers involved are nonetheless significant, at almost 45,000 in the labour force.

There are two issues regarding female engineers, retention of female engineers, and workplace participation of overseas born engineers.

The rates of decline in terms of retention of women employed in engineering roles with age suggest well embedded structural issues that need to be addressed. Figures show a decline in Australian-born female engineers in engineering occupations from 69% at 20-24 years down to 14% at 65-69 years (compared to Australian-born male engineers going from 74% at 20-24 years down to 59% at 65-69 years). The decline in overseas-born female engineers in engineering occupations is from 42% at 20-24 years, down to 20% at 65-69 years. Australia cannot fully capitalise on its engineering capability by recruiting most engineers from one gender⁷.

The unemployment and workforce participation rates for Australian-born women are comparable with Australian-born men. The situation for overseas-born women is very different. For example, in 2016 they are much less likely to be in the labour force: 81.1% participation for the Australian-born women, compared with 70.8% for the overseas born. Of those women who are in the workforce, they are much more likely to be unemployed: 3.8% for Australian-born women, and 11.3% for overseas-born women⁸.

The causes for this are not known, but it identifies a cohort of engineers who are currently underutilised, and they could form a large pool of potential talent.

⁷ Engineers Make Things Happen, Engineers Australia, 2017 Page 29, Figure 2, and page 31. www.engineersaustralia.org.au/sites/default/files/resource-files/2017-03/Engineers%20Make%20Things%20Happen.pdf

⁸ Engineers Make Things Happen, Engineers Australia, 2017 www.engineersaustralia.org.au/sites/default/files/resource-files/2017-03/Engineers%20Make%20Things%20Happen.pdf

The opportunity



There are three key areas of opportunity to increase female participation in STEM study and careers.

BUILD – The need to build capability and availability of STEM based female talent through primary and high school participation. We need to ensure that numbers of girls participating in critical STEM subjects are increased, using the context of ‘why’ (humanitarian, problem solving) and increasing young women’s awareness of STEM based careers with the use of female role models.

ATTRACT – The need to attract more women into STEM based careers, increasing public awareness of the variety of STEM careers and debunking the gender stereotypes, providing women with clear career vision using mentors and role models, by having more women in leadership roles in STEM disciplines, by providing workplaces that encourage and promote diversity, and environments that are flexible and inclusive.

RETAIN – The need to retain the female STEM talent throughout their careers, providing more flexibility around different life stages in the workplace, keep women connected with the workplace whilst on parental leave, structured professional development programs for women returning to the workforce from an extended period of time, incorporate structured and positive career planning for female STEM professionals into senior leadership roles, using sponsors and mentors to engage and enable career advancement.

Responses to questions posed in the discussion paper

1. What changes need to occur to enable more girls and women to participate in STEM education at any level (primary, secondary or tertiary)?

We need to change the dialogue from 'enable' to 'encourage', 'engage' and 'empower' girls and women to participate in STEM education. Recent research of 1600 students conclude girls are more successful at maths and science study than boys in high school. The issue is not capability, its encouragement, engagement and empowerment for girls and women to follow STEM education. Some areas to address include:

- One of the most powerful influences are female role models. Industry, Government and Academia need to put forward their best and brightest female STEM talent to engage and excite girls and women into pursuing STEM based careers. "If I can see it, I can do it".
- An education/community awareness program educating parents and carers about the benefits of STEM education and study, and in turn the broader career prospects for women in STEM disciplines.
- Reposition STEM education as problem solving and humanitarian. Research has shown this focus will resonate more with young women.
- An education system that encourages and rewards STEM subject selection and we encourage the DET to undertake a full review.
- Industry to take the lead to eradicate sexism in the workplace and provide inclusive and supportive work environment, especially in traditionally male dominated STEM professions like engineering.
- Upskilling teachers to confidently teach STEM subjects in context of real world problems and solutions
- Broader promotion of current resources available nationally that girls can get involved in ie: promotion through schools of the STARportal resource.
- Engineering camps/projects at primary and high schools

2. What are the most effective things we can do to change inaccurate stereotypes about STEM professionals and the range of STEM careers?

- Raising awareness through our educators of the range and nature of STEM based careers
- Promoting female role models in STEM ie: female engineers speaking in High Schools
- Increase the number of women in leadership positions across all STEM professions
- Broader community awareness of STEM based skills and the importance of those skills in the workforce of the future

3. What measures should we be using to determine eligibility for career recognition and progression?

Some ideas to pursue are outlined below:

- Formalised career planning
- Sponsorship opportunities across all STEM disciplines
- Return to work internships for women that have been out of work for more than 5 years
- Quotas for females in short lists for recruitment
- Reviewing job descriptions so they attract more female applicants
- PhD grants for women that also include mentoring

4. Australia has more than 330 different initiatives to foster the participation of girls and women in STEM. What type of initiatives are demonstrating the most impact in your area of interest?

Australia has many initiatives and activities available to foster participation of girls and women in STEM. The challenge is measuring the success of these initiatives. Whilst individual programs will have their own anecdotal and local measures of success in place, there needs to be a more streamlined approach nationally.

The decadal plan needs to address measurement criteria so that the impact of these initiatives can be adequately evaluated over time. When this happens, the successful programs can be identified, and correct funding allocated to ensure they are available nationally (scaled up where necessary) to all girls and women interested in STEM.



5. What societal and regulatory issues (ie: non STEM specific) will have the greatest impact on women in STEM, and how should we address those barriers?

Gender bias. A review of early childhood education to ensure elimination of gender bias from our education system at the beginning of children's education is fundamentally important to affect the societal issue of gender bias.

6. Progress towards gender equity in STEM will require changes. How do we address the challenge of backlash and resistance to these changes?

Education is key. For businesses and the community to understand the value of gender equity, the positive outcomes, in both financial and cultural deliverables is important.

Industry needs to get on board and address this resistance to change within their own workforce. They need to be held accountable for educating their workforce, and it must be embraced from the most senior of leaders, all the way through the organisation. The resistance to change needs to be the exception, not the norm.

7. If Australia is to take a strategic approach to improving the participation of girls and women in STEM, where would effort best be placed?

- Develop a national female role model and mentoring program for girls and women across all STEM disciplines.
- An awareness program around female STEM careers.
- More women in Leadership roles in STEM
- Review the education system to;
 - Eliminate gender bias from the beginning of a child's education
 - Encourage and value participation in STEM based subject selection in high school
 - Upskill our educators to enable greater engagement in STEM study

8. Is there anything else you have not yet covered in your response which could improve gender equity in STEM?


The discussion paper is high level and has a science and research skew. In developing the Women in STEM decadal plan, Engineers Australia would encourage those stakeholders to ensure that it represents the needs of all STEM professionals, not just those in the sciences.


With the majority of the STEM qualified population holding engineering qualifications, Engineers Australia would like to offer further interaction and consultation in developing a decadal plan that meets the needs of all STEM disciplines.







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