

10th February 2012

Committee Secretary
Senate Education, Employment and Workplace Relations Committees
PO Box 6100
Parliament House
Canberra ACT 2600
Australia

**Senate Education, Employment and Workplace Relations Committees –
The shortage of engineering and related employment skills**

I write in reference to the Senate referring to the Committee an inquiry into the nexus between the demand for infrastructure delivery and the shortage of appropriate engineering and related employment skills in Australia.

The Australian Technology Network of universities (ATN) is not seeking to provide a comprehensive response to the committee's terms of reference, rather it will comment on strategies to develop and retain the engineering talent of women in the private and public sectors. This submission relates to the work of a Project Steering Committee established across the ATN in relation to women in science, technology and engineering (STE) to increase their involvement in STE pathways and university study and to increase their recruitment and retention as academics.

It is a wonderful coincidence that the ATN makes this submission just after the announcement of the Australian of the Year Awards and the awarding of the Young Australian of the Year 2012 to engineering visionary Marita Cheng¹ who founded Robogals Global in 2008, as a response to the traditionally low levels of participation by women in engineering and technology. Robogals now has 17 chapters across Australia, New Zealand and the United Kingdom.

Over the last forty years, the opportunities for tertiary education and professional employment for women have expanded substantially and females now comprise over 50% of university undergraduate populations.

However there are too few domestic female students in science and engineering in a population with too few people wanting to be scientists and engineers, too few women academics in these fields and despite considerable diagnosis of what is needed progress remains slow. While there is demand for scientists, mathematicians and engineers these professions are struggling to attract and/or retain the number or quality of candidates they require and this is multi factored including the understanding of and regard with which the professions are held, the career opportunities perceived by students (and parents) and employees, the lack of student interest in maths and science in high schools, the culture of the organisations where people study and work.

¹ <http://www.australianoftheyear.org.au/recipients/?m=marita-cheng-2012>

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In Australia, only 16.6% of engineering graduates in 2008 were female, and this proportion has been steadily decreasing since a peak of 17.4% in 2003. Women's representation in the engineering workforce is lower still: 11% in Australia. In Australia it is estimated that women are leaving the profession at a rate nearly 40% greater than men.²

Analysis of Award Course Completions for Domestic Students indicates that in 2009 across all higher education courses in 'Engineering and Related technologies' women were 15.6% of the total cohort of completions. In 2009 there appears to be a positive relationship between percentage of women completing by the level of the course - ranging from 14.2% of the cohort being women for a Bachelor's Pass, 19.5% for Bachelor's Honours and 21.1% for Doctorate by Research.

Organisational culture is crucial to women's participation beginning in school rooms for maths and science classes, then in university lectures and tutorials and ultimately in workplaces. Known causes of women's dissatisfaction in the engineering workplace include limited promotion opportunities, unequal pay, sexual harassment and the difficulties of combining work and family responsibilities. Research from the University of SA indicates that where engineering is associated with a 'blokey' culture this is not conducive to women engineers remaining in the profession. Related research shows that higher retention rates for a group of women civil engineers were associated with satisfaction with workplace conditions, availability and utilisation of family friendly provisions, and reduced gender discrimination. A significant finding about the group that stayed was the high proportion of public sector employment, with associated high availability and acceptance of family-friendly workplace practices.³

The situation is mirrored in the USA where research suggests that women leave engineering because of engineering culture.

This is not a story of poor women who can't make it – they have options and they don't want to put up with male engineers who don't feel comfortable with women around them. This starts according to (Professor) Seron, at university and continues in the workplace, with women feeling their competencies are undervalued by men.⁴

Positive experiences working with industry can encourage young women to join those organisations as demonstrated by this profile of a recipient of a Hypatia scholarship at UniSA.⁵

I began University as a Hypatia Scholarship student in 1999, and continued to receive the scholarship throughout the entire three years of my course. For that time I was a

² Ayre, M.E, Mills, J.E & Gill, J. 2011, "Not all women leave: Reflections on a cohort of 'stayers' in civil engineering" *American Society for Engineering Education Annual Conference*, Vancouver, Canada, June 26-29, 2011

³ Ayre, M.E, Mills, J.E & Gill, J. 2011, " 'I like the challenge': A Study of women engineers who have stayed in the profession" *15th International Conference of Women Engineers and Scientists*, Adelaide, Australia, July 19-22, 2011

⁴ <http://www.theaustralian.com.au/higher-education/giving-the-hard-hat-away-why-women-engineers-quit/story-e6frgcjx-1226142605381>

⁵ <http://www.unisa.edu.au/math/studprofiles/Katie.asp>

vacation student at DSTO for the three inclusive summers and was lucky enough to gain full time employment in the Land Operations Division - DSTO once I had finished my Honours year. I have been working at DSTO for 16 months and am continuing to gain vital work knowledge and experience every day. I have now also commenced further study by enrolling in a Masters degree in Defence Operations Research, which is fully funded by my employer.

Positive work experience can also provide female students with experiences of the applicability of a broader set of skills, such as teamwork, and their contribution to real world problems, reinforcing their 'professional role confidence'

that he or she has the right expertise for a given profession, and that the corresponding career path meshes with his or her interests and values.⁶

While Universities can prepare students for careers in industry, we cannot determine their career paths. The Government could direct incentives to women in the profession e.g. the Government could consider expanding the HECS-HELP benefit to write off part of graduates' HECS' loan for each year of work.

More businesses are recognising that to overcome shortages of STEM professionals more women need to study, be recruited and remain employed in these fields and some have adopted diversity strategies. The ATN would welcome opportunities for collaboration between industry and universities to recruit more women to STEM studies e.g. via tertiary scholarships, vacation programs, internships, promotion of career opportunities in schools etc.

Anecdotal evidence suggests that there is a very high level of representation of women in Engineers Without Borders and by more broadly marketing its contribution to society, together with changing organisational cultures, the engineering profession might have broader appeal to women. Engineers Australia is taking up that challenge⁷ and the ATN had government support for a campaign Engineers Make it Happen⁸ and would be pleased for that to be used more broadly. However women will continue to leave the profession if there is a mismatch between their perceptions and the reality of working in the profession.

Yours sincerely

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⁶ <http://chronicle.com/article/Lack-of-Confidence-as/129528/>

⁷ <http://www.youtube.com/watch?v=UwkwDpm-E08> and <http://www.makeitso.org.au/>

⁸ <http://www.atn.edu.au/>