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Senate Education, Employment and Workplace Relations Committees
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Submission: The shortage of Engineering and related Employment skills

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Introduction

Defence Industry requires access to the highest quality engineers in order to generate capabilities in support of the Australian Defence Force (ADF). The current and future shortage of high-quality engineers, therefore, not only affects the defence sector but ultimately Australia's national security. The inter-connectedness of Australia's economy is such that policy settings that can improve the supply of engineers in any sector will benefit the economy as a whole.

Whilst various studies have been undertaken by a range of groups there is still the need to better understand the factors that affect skill shortages domestically and globally. Similarly, there is no shortage of proposed solutions such as increased government funding to tertiary education offering engineering placements, industry incentives to employ and develop young engineers and increased diversity.

This submission will seek to broaden the range of solutions considered in any future policy settings. As such, whilst generated from within Defence Industry, this paper will not limit itself to defence centric solutions but rather those that warrant further examination in the development of a multi-tiered approach to increasing the supply of high-quality engineers.

Understanding the factors behind poor engineering completion rates within tertiary sector

The current engineering degree completion rates highlight a failure to maximise the use of the available talent. In accordance with an Engineers Australia report on Specialised Engineering Occupations, released on 10 Mar 2010, in 2008/2009 Australian born Engineers represented only 38.6% of new Engineers starters over that period.[1] In real-terms, 5,914 new domestic degree graduates out of a potential flow of new graduates to Engineering of 9,880 took up engineering employment within Australia. Over the same timeframe Australia accepted 5,204 Engineers as permanent migrants with an additional 4,210 migrant Engineers accepted under temporary visas.[2]

[1] Engineers Australia, Specialised Engineering Occupations, Submission to Skills Australia, 31 Mar 10, p6.

Whilst the completion rates are of concern, insufficient qualitative data has been gathered to support an evidence based approach to any policy solution. The senate should give careful consideration to the funding of additional studies and modelling into the broad factors effecting engineering completion such as those called for by the Australian National Engineering Taskforce (ANET). ANET has proposed further investigation into the effectiveness of various strategies to improve the education system's supply of high-quality Australian Graduates and technicians.[3]

Addressing systemic weakness in the identification and mitigation of skills shortages

When considering the factors influencing the current engineer shortfall it is often easy to overlook how Australia allowed the shortfall to manifest. Part of this explanation lies in the lack of a dedicated workforce development strategy. Central to such a strategy would be an education and skills white paper that outlines a declaratory intent for the creation of a sustainable and qualified workforce. The white paper would serve to minimise the apparent lack of strategic alignment between Governments, industries and the education system. The cyclical white paper development process would provide a frequency of strategic updates, such as the five-yearly Defence white paper process. Through the application of such a strategy it is likely that Australia will be better positioned to develop policy based upon lead rather than lag indicators. The United Kingdom is one such nation that has sought to provide strategic direction to its education and skills departments and industries through the release of its Skills for Sustainable Growth (SSG) strategy document. The SSG sets out the direction for skills policy and the shared responsibility of Government, employers and individuals to create a system for skills in which all parties can invest with confidence and benefit with consistency.[4]

[2] Loc cit.
[3] Australian National Education Taskforce, Scoping Our Future, Addressing Australia's Engineering Skills Shortage, October 2010, p32.
[4] Department for Business Innovation and Skills, Skills for Sustainable Growth – Strategy Document, http://www.bis.gov.uk/assets/biscore/further-education-skills/docs/s/10-1273-skills-for-sustainable-growth-strategy-summary.pdf, accessed 19 Jan 2012.

Additional consideration should also be given to the review of federal structures and processes designed to provide strategic guidance on areas such as engineering. Central amongst these is the Prime Minister's Science, Engineering and Innovation Council, established in 1987 by the Hawke Government.[5] A review of the Council's extant terms of reference, resources, and authority is necessary to ascertain whether the advisory function is suitable or whether it requires modification to make it more effective in the development of policy recommendations to mitigate future skills shortages in science and engineering.

Defence procurement, research and development

The Capability Life Cycle provides opportunities for defence industry to gain sufficient experience to maintain a suitably qualified and skilled workforce. The current criticism of the Defence Capability Plan (DCP), centred on the gaps between introduction-into-service dates, does not sufficiently factor in the capacity for Australian defence industry to retain skills during through life support. Whilst criticisms such as those made by ASPI[6] regarding stop-start scheduling appear valid they undersell the importance of the ongoing maintenance of capabilities as a means of maintaining vital knowledge and skills between productions. When viewed through a holistic Capability Life Cycle perspective the scheduled major projects offer sufficient opportunities to defence industry to both maintain and develop young engineering talent.

Although the current schedule of projects provides opportunities for the development of engineers, research and development (R&D) remains a specialist area where Australia can make better use of its available engineering expertise to lead to greater innovation. The United States Advanced Development Program (ADP) run by Lockheed Martin, affectionately known as Skunkworks, is an initiative without an Australian equivalent at present. The ADP makes effective use of scarce, high-quality engineering skills in the areas of conceptual design, systems engineering and integration, complex project management, software development and rapid prototyping.[7]

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[5] Australian Government, Department of Industry, Innovation, Science, Research and Tertiary Education, http://www.innovation.gov.au/Science/PMSEIC/Pages/default.aspx, accessed 19 Jan 12.
[6] Davies, Andrew Dr. Introductory Paper, Mar 2010, http://www.aspi.org.au/research/spf_article.aspx?aid=72, accessed 17 Jan 12.
[7] http://www.lockheedmartin.com/us/aeronautics/skunkworks.html, accessed 19 Jan 2012.

The establishment of a Cooperative Research capability such as Skunkworks within Australia would draw together similarly scarce engineering expertise in a coherent effort to support priority and strategic capabilities identified by the Defence Materiel Organisations (DMO). The automotive sector has undertaken such an approach with its Cooperative Research Centre for Advanced Automotive Technologies.[8] The level of federal funding to support automotive industry research through the Automotive Industry Competitiveness and Investment Scheme is likely to be $1 billion over the 2011-15 timeframe.[9] By contrast the defence industry sector will receive $44.9 million from the federal government via its Priority Industry Capability (PIC) Innovation Program.[10] The level of investment in technological and engineering innovation within Defence must be reviewed to ensure that the defence industry sector receives sufficient funding support to develop strategic led research to improve defence capabilities.

Expanding global supply of high-quality engineers through education investment

At present Australia can readily access engineering talent from nations that are co-signatories of either the Washington or Sydney Accords. Whilst the aforementioned accords provide an invaluable mechanism to recognise foreign engineering qualifications and experience they do not recognise nations such as China, India and Indonesia. These omissions make it difficult for Australia to attract and utilise the skills of any engineer that gained either tertiary qualifications or experience in these countries.

The lack of recognition of these nations is likely due to the apparent reduction in engineering graduate quality brought about by the need to rapidly increase engineering supply. In India alone the higher education system has responded to the increased demand for engineers by massively expanding its production of engineers. The number of Indian students enrolled increased 800 percent from 1998 to 2008. [11] This quantitative

[8] Automotive Review Secretariat, Review of Australia's Automotive Industry, 22 Jul 2008, p 44, http://www.mskills.com.au/DownloadManager/Downloads/Bracks%20report%20on%20auto%20industry.pdf, accessed 16 Jan 12.
[9] Op cit, 31.
[10] Australian Government, Department of Defence, Building Defence Capability: A Policy for Smarter and more Agile Defence Industry Base, 2010, p8.
[11] MHRD, Ministry of Human Resource Development, 1998-2008. Annual Report. New Delhi, India.

expansion in India is widely perceived to have led to an average decline in the quality of the graduating engineers due to a lack of domestic educational resources.[12]

In order to increase the global supply of high-quality engineers to meet global demand it may be necessary to extend the scope of Australian educational investment both at home and offshore. In 2011-12, Australia's offshore investment in education is expected to be $842 million (19 per cent of total Overseas Development Assistance (ODA)).[13] The establishment of bi-lateral and multi-national educational trade agreements seeking an open global education market would provide a mechanism for the increased establishment of Australian campuses in countries such as India, Indonesia and China.[14] Such an approach would not only provide enhanced viability of Australia's tertiary sector but would better support host country development of high-quality graduates for use within the global labour market. Similarly, Future education investment through ODA to stimulate secondary and tertiary education would further improve developing nation's contributions to the global labour market in areas such as science and engineering.

Conclusion

This paper has sought to broaden the range of options for consideration by the Australian Government in its development of future solutions to the engineer shortage. The paper advocates the investment in both ongoing studies and modelling into the engineer shortage and the effectiveness of past and present education strategies with a view to providing reliable, actionable data for use in evidence based policy formulation. Similarly, additional reviews into federal structures and agencies such as the Prime Minister's Science, Engineering and Innovation Council are recommended to ascertain their effectiveness in both the identification and formulation of solutions for inclusion into both Commonwealth and State policy.

[12] Blom, A. Saeki, H. Employability and Skill Sets of Newly Graduated Engineers in India, Policy Research Working paper 5640, World Bank South Asia Region, April 2011, p 2.
[13] Australian Government, AUSAid, http://www.ausaid.gov.au/keyaid/education.cfm, accessed 17 Jan 12.
[14] Australian Government, Department of Foreign Affairs and Trade, Education without borders: International Trade in Education, http://www.dfat.gov.au/publications/eau_education/index.html, accessed 20 Jan 12.

Within a Defence context it is assessed to be unnecessary to dramatically re-schedule major defence capital procurement within the DCP. Rather, careful consideration be given to the optimisation of scarce engineer resources available to both PIC and SIC elements within the Australian defence domain through shared government and industry investment in an Australian ADP capability. Additionally, a review of the levels of federal funding to stimulate ongoing defence innovation through the PIC Innovation Program is recommended.

Finally, the paper has explored the requirement to support ongoing development of effective education sector reform in nations such as India and Indonesia. Australia stands to gain in the increased quality of engineering graduates from nations currently outside the recognised engineering accords (Washington and Sydney). If Australia cannot rectify its domestic supply challenges then this recommendation is conducive with a broader strategic hedging approach to the mitigation of the engineer shortage.