Senate Education, Employment and Workplace Relations References Committee

Inquiry into the Shortage of Engineering and Related Employment Skills

March 2012

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ENGINEERS
AUSTRALIA

Executive Summary

The market for engineering labour in Australia has been tight in the past decade, despite a lull in 2009 due to the 'global financial crisis' (GFC). It has since recovered and demand for engineering skills is stronger than ever. Every year roughly 9,500 people gain tertiary qualifications in engineering but demand still outstrips supply. This gap in the market is filled by skilled immigration, particularly through the use of the temporary skilled migration (457) visa, the use of which grew by over 300% from 2003-04 to 2010-11. In conjunction with temporary visas, it is important that engineering remains on the Skilled Occupation List to retain a much-needed skilled migration pathway which has to-date been an important tool in alleviating skills shortages.

The reaction of employers to the tight engineering labour market has been gauged through Engineers Australia's *Salary and Benefits Survey.* The data show a logical pattern: when unemployment is low, employers report difficulties finding engineering staff and *vice versa.* Employment difficulties are faced primarily in civil, mechanical, structural and electrical disciplines, and employing engineering staff in Queensland is the most difficult, followed closely by Western Australia. Employers have responded by increasing salary incentives but this has not been sufficient to ease the difficulty of finding suitably qualified engineers.

Part of the explanation for the engineering skills shortage is the dramatic increase in Australia-wide infrastructure investment and construction since the early 2000s. The spike in infrastructure spending has been chiefly government driven, therefore government has a central stake in ensuring effective planning and delivery. Infrastructure planning must be robust and transparent, providing for long-term economic and social benefits to avoid boom/bust cycles in infrastructure delivery. The National Infrastructure Construction Schedule (NICS), which will commence in May 2012 and provide a national database of planned government infrastructure investment, is supported in principle by Engineers Australia as a first step toward effective infrastructure planning and delivery. It should contribute to better labour planning, resource development and infrastructure investment.

Engineering education is in a solid position, with tertiary enrolments and graduations steadily increasing over last decade. One of the biggest issues faced by engineering education is the large disparity between the numbers of male and female students and graduates. Strategies need to be investigated to lift the female participation rate and their subsequent entry into the engineering workforce.

A government-wide reduction in internal engineering capability throughout the 1980s and 1990s has led to a reduced ability to effectively manage engineering procurement contracts. To remedy this, government agencies must endeavour to retain critical engineering knowledge at all levels. Creation of senior technical specialist roles are suggested as a way to provide career progression while preserving engineering knowledge.

A national consistent scheme of engineering registration is strongly supported by Engineers Australia. This will provide a mechanism to assist in the overcoming of skills shortages, enhance mobility between jurisdictions, provide competency benchmarks, improve productivity and reduce red tape. This could be accomplished by COAG through its ongoing 'transition to a seamless economy' reform process.

1. Introduction

1.1 About Engineers Australia

Engineers Australia is the peak body for engineering practitioners in Australia, representing all disciplines and branches of engineering. With membership of approximately 96,000 Australia wide, Engineers Australia is the largest and most diverse professional engineering association in Australia. All Engineers Australia members are bound by a common commitment to promote engineering and to facilitate its practice for the common good. Engineers Australia maintains representation in every state and territory.

1.2 The Engineering Profession

The collective membership of Engineers Australia is referred to in terms of the 'engineering team'. The engineering team in Australia is comprised of three groups:

- Professional engineers.
- Engineering technologists.
- Engineering associates.

To qualify for the engineering team, individuals must have formal educational qualifications in engineering. The educational qualifications required are:

- Professional engineers, at least the equivalent of a four year full time bachelor degree in engineering.
- Engineering technologist, at least the equivalent of a three year full time bachelor degree in engineering.
- Engineering associate, at least the equivalent of a two year full time associate degree or a diploma or advanced diploma in engineering

Engineers Australia believes that academic qualifications alone are not sufficient to enable an individual to provide engineering services. As is the case for many other professions, practical skills and experience are also essential, including continuing professional development (CPD). Engineers Australia provides services and arrangements to its members to achieve these standards.

2. The Engineering Labour Market

2.1 Overview

Skills and skills development have been important topics in Australian policy forums for several decades, yet statistics for specific occupations and skills remain fragmented and patchy. The statistics discussed in this sector are extracts from Engineers Australia's Annual Statistical Overview and are derived from official sources.[1] We employ conventional labour market

[1] Engineers Australia, The Engineering Profession; A Statistical Overview, Eight Edition, 2011, www.engineersaustralia.org.au

definitions; thus the engineering population is the subset of the Australian population with formal qualifications consistent with the engineering team, and the engineering labour force is the subset of the engineering population that is employed or unemployed and actively seeking work.

The Australian engineering labour market has been very tight over the past decade. The demand for engineers, as measured by employment, has grown by an average 4.8 percent per annum up to 2010 (from 232,700 in 2001 to 352,900 in 2010). The supply of engineers, as measured by the engineering labour force, also grew at an annual average 4.8 percent (from 242,200 in 2001 to 366,600 in 2010). In 2010, both demand and supply grew faster than the 4.5 percent average annual growth in the engineering population.

The changes underlying this were a falling unemployment rate and a rising labour force participation rate. Labour force participation in the engineering labour market is exceptionally high, averaging more than 90 percent over the past decade, which is several percentage points higher than for comparable non-engineering groups.

Just prior to the 'global financial crisis' (GFC), engineering unemployment was 2.4 percent, a figure consistent with frictional unemployment, that is, the short periods of technical unemployment individuals experience when moving from one job to another. The GFC resulted in an increase in engineering unemployment to 4.1 percent in 2009 before recovering to 3.7 percent in 2010. This recovery is expected to continue in coming years but the structural changes in the economy favouring the resources sector is expected to include similar changes in the industry distribution of engineers.

The number of permanent residents completing courses in engineering in Australia has averaged approximately 9,500 since about 2006, comprised of about 6,000 new degree qualified engineers from the universities and about 3,500 associate degrees and diploma qualified engineers.

Firm statistics on retirements from the engineering labour force are not available but there are indications that about 5,000 to 6,000 engineers (annually) reach 65 years of age and most likely retire from the labour force. In other words, since about 2006, net domestic growth in the engineering labour force is about 10,000 per year. In comparison, the demand for engineers has been about 13,000 per year and as high as 22,000. The balancing factor has been skilled immigration.

2.2 Migration and the Engineering Labour Force

The best available proxy for the trend in skilled migration is the overseas born segment of the engineering labour force. This measure includes children born overseas to migrant parents but effectively raised and trained in Australia, and former migrants who have been resident in Australia for significant time.

While some of the changes in the overseas born engineering labour force can be attributed to these factors, the most important influence has been recent skilled migration. Average annual growth in employment for the overseas born engineering labour force has been 7.9 percent, three times average annual growth in employment for the Australian born engineering labour force (2.5 percent). The result has been a large increase in the dependence of the engineering labour force as a whole on persons born overseas.

In 2001, there were 41.8 percent overseas born individuals in the engineering labour force, and by 2010 this had increased to 52.6 percent. The overseas components of comparable non-engineering skills and the general labour force also increased over the decade but in 2010 were only 36.6 percent and 26.8 percent respectively.

The level of employer-sponsored (457) visas issued for engineering occupations are a useful indicator of the growth in demand for engineers. The number of employer-sponsored visas rose from 2,260 in 2003-04 to 6,940 in 2010-11;[2] an increase of over 300 percent.

The engineering labour market in Australia remains very tight despite record levels of skilled migration in recent years. Time series statistics from the Australian Bureau of Statistics' Education and Work surveys show that although the global financial crisis eased the engineering labour market, this was a temporary stay and since this disruption the engineering labour market has resumed the pre-crisis trend. When evaluating this view it is important to bear in mind that during the worst of the crisis engineering unemployment remained very low at a time when permanent immigration was at its highest in a decade. There has been some improvement in the number of domestic students commencing engineering courses and a corresponding increase in course completions is now emerging. However, this is minimal in relation to the excess demand for engineers, which is being covered by skilled migration.

Recommendation

- Engineers Australia considers that it is imperative that the Australian Government maintains an appropriate pathway for skilled engineering migration through continued inclusion on the Skilled Occupation List. With an increasing demand for skilled engineers it is crucial that Australia maintains this capacity.

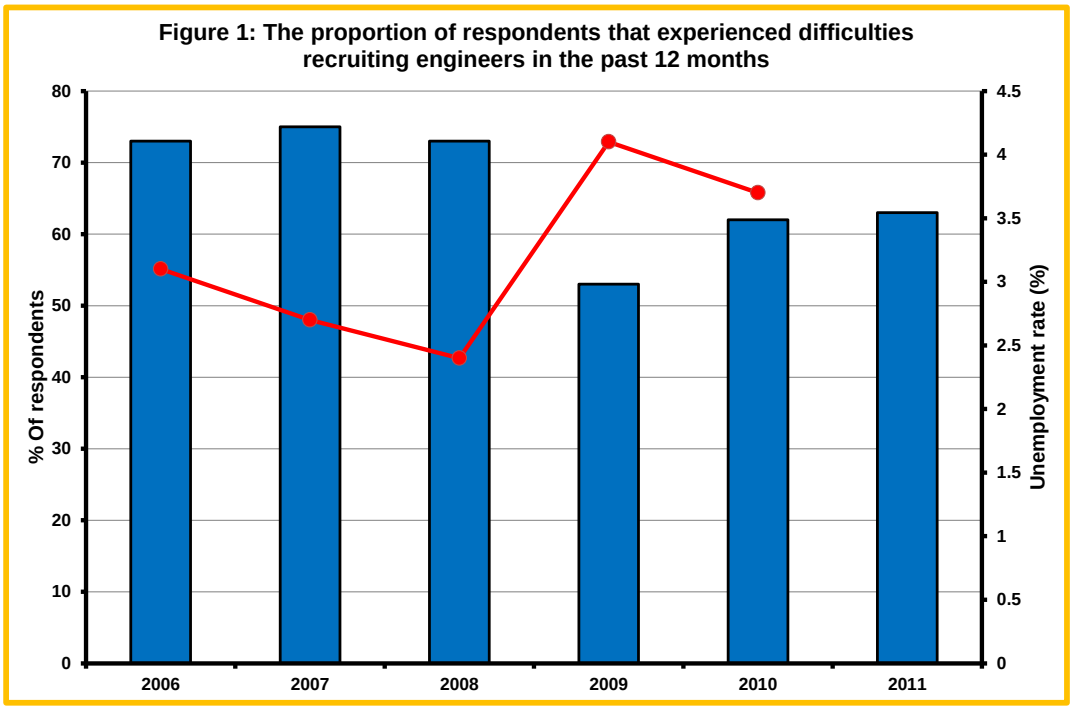
3. Employers' Perspectives of the Skills Shortage

3.1 Overview

Engineers Australia has used its *Salary and Benefits Survey* as a vehicle to monitor the engineering recruiting difficulties experienced by employers for the past six years. It is a key tool for developing an understanding of engineering recruitment confidence levels and remuneration across both public and private sectors. The survey provides a real-world view of the effects of engineering skills shortages that are often not picked up by macroeconomic indicators.

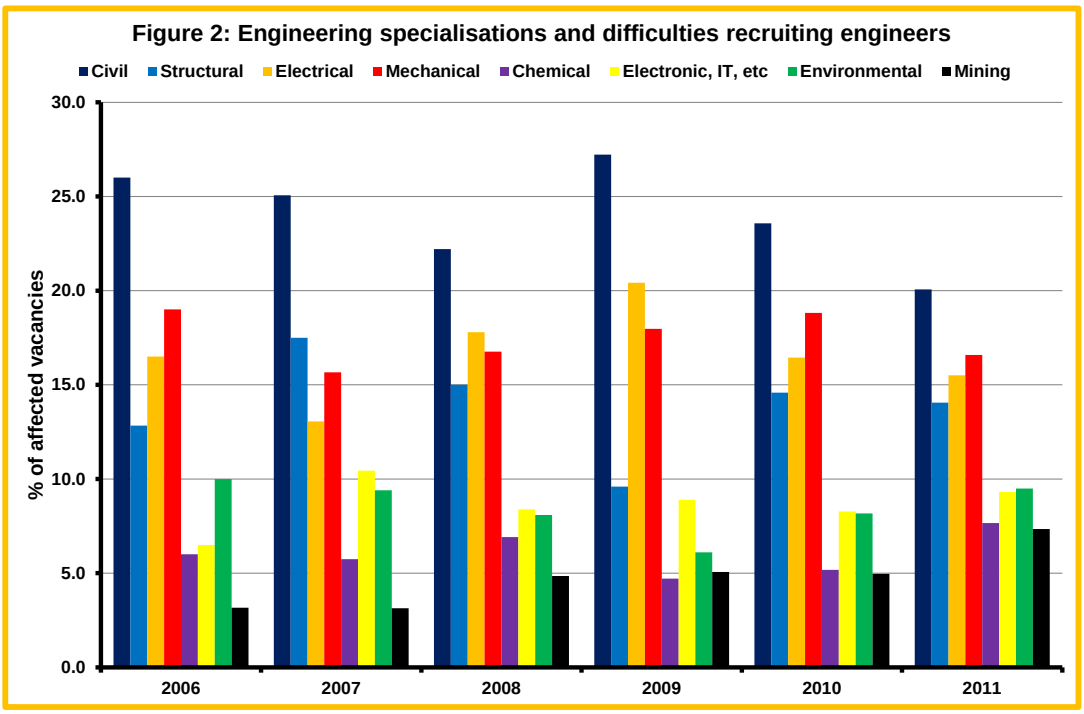
While engineering unemployment statistics for 2011 are not yet available, Figure 1 shows the relationship over the last six years between the unemployment rate and the proportion of engineering employers who reported difficulty recruiting engineers. The relationship is clear and logical: when unemployment is low employers report difficulty recruiting skilled engineering staff, and *vice versa*. As Figure 1 shows, in 2011, 63 percent of surveyed engineering employers reported difficulties recruiting suitably qualified engineers.

[2] Data provided by the Department of Immigration and Citizenship.



3.2 Shortages and Engineering Specialisation

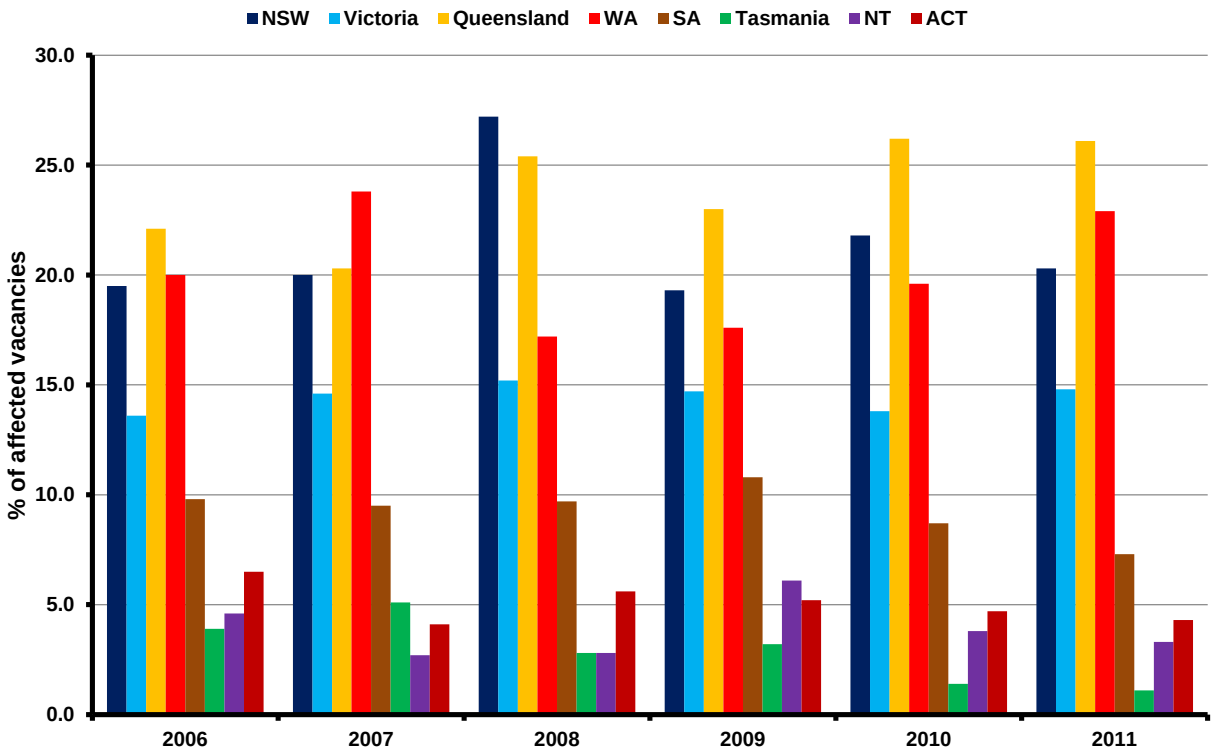
As the engineering profession contains a number of specialisations, it is useful to note the areas where shortages are most felt. Figure 2 shows that in 2011, shortages were most apparent across civil, mechanical, structural and electrical engineering. These specialisations accounted for almost three-quarters of the difficulties experienced by employers in recruiting engineers. This has been a relatively consistent trend across the last six years, with shortages of civil engineers being particularly notable.



3.3 Shortages and Geographic Location

In 2011, the *Salary and Benefits Survey* reported that employers had the most difficulty recruiting engineers in Queensland with 26.1 percent of vacancies affected by recruitment difficulties. Queensland was closely followed by Western Australia where 22.9 percent of vacancies were affected, and New South Wales where 20.3 percent of vacancies were affected by recruitment difficulties. Figure 3 displays the nature of reported recruitment difficulties across each state and territory over the last six years.

Figure 3: Location and difficulties experienced recruiting engineers



3.4 Adaptation to Skills Shortages

Findings from the 2011 *Salary and Benefits Survey* indicate that employers have responded to recruitment difficulties in part by increasing salary incentives. In 2006, about 42 percent of employers responded to recruitment difficulties by paying a higher-than-expected salary. This proportion steadily rose until the beginning of the GFC, where it fell to 32 percent. However, in 2011, the proportion of employers paying higher salaries increased to 43 percent. Another approach to recruitment difficulties adopted by employers is retraining staff members for specific roles.

3.5 Consequences of Skills Shortages on Infrastructure

Infrastructure investment and construction is affected by the shortage of engineering skills in a number of ways. Hiring engineers without the full complement of skills required can lead to inadequate planning and trial and error problem solving. The mid-project amendments resulting

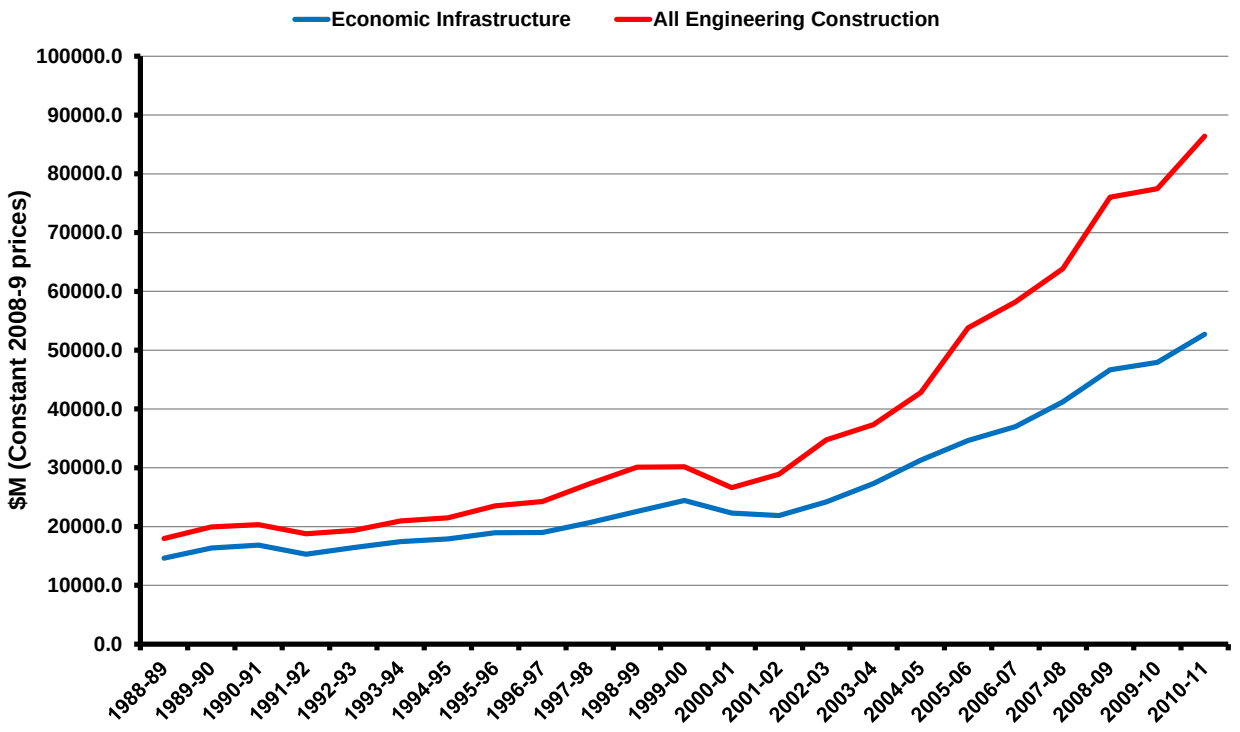
from this put undue pressure on timing and budgets. Some projects simply do not proceed, which has wider-reaching implications such as the loss of the jobs such projects create, as well as the loss of proposed infrastructure.

4. Engineering and Economic Infrastructure

4.1 Overview

Ultimately, shortages of any sort can be traced to some degree of imbalance between demand and supply. Reviewing the underlying drivers of demand for engineering can paint a useful picture of factors that have contributed to our current engineering skills shortage. Australia's investment in economic infrastructure over recent years is useful in this regard. Figure 4[3] shows the dramatic increase in economic infrastructure over the past decade, charted alongside the level of engineering construction in Australia.

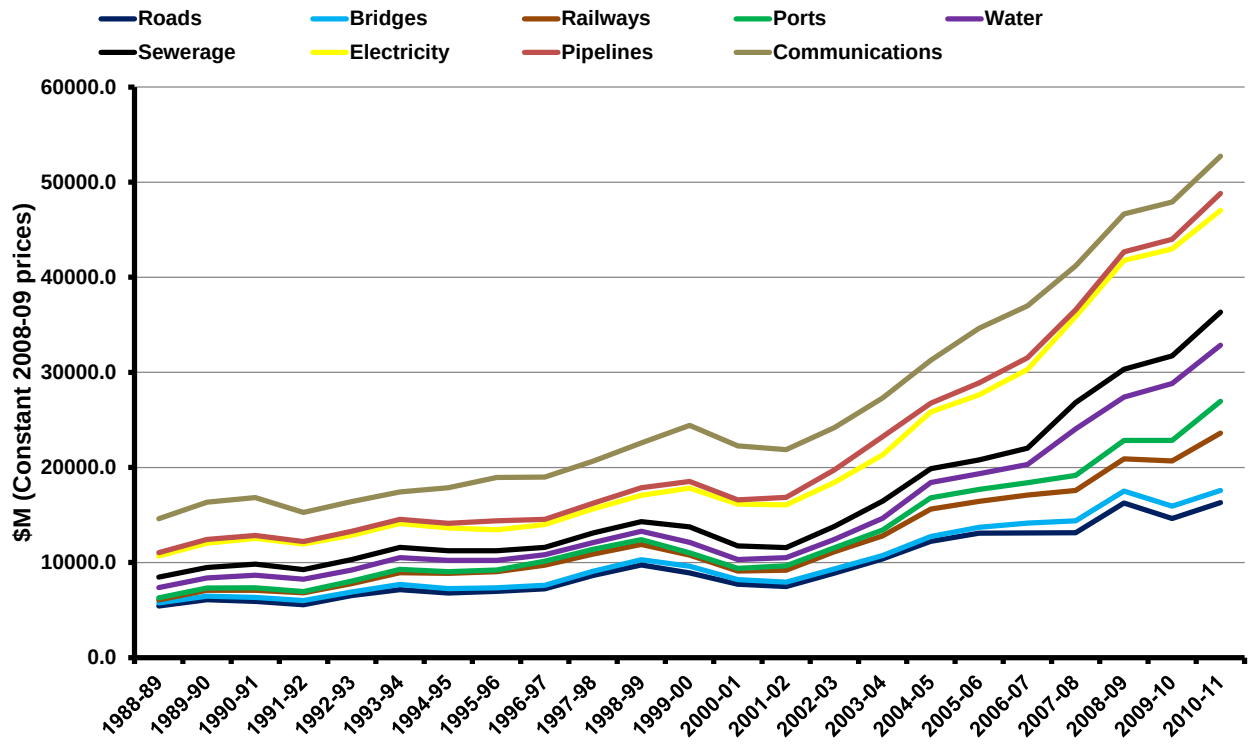
Figure 4: Trends in Economic Infrastructure and All Engineering Construction



[3] Derived from ABS, *Engineering Construction Activity, Australia*, *Sep 2011.* Cat. no. 8762.0, http://www.abs.gov.au/ausstats/abs@.nsf/mf/8762.0

The factors contributing to this recent growth in economic infrastructure are illustrated in Figure 5[4]. With government carrying the responsibility for initiation and delivery of the majority of these infrastructure projects, it is clear that federal, state and local governments alike have a central role in the scope, timing and delivery of these initiatives. Thus, it is fair to say that governments have a similarly important stake in planning and managing delivery of these projects to ensure optimal utilisation of labour force resources.

Figure 5: The cumulative contributions of components to growth in Economic Infrastructure



4.2 Infrastructure Planning and Information

Analyses of capital accounts are a well-established requirement of corporate accountability. Valuations of capital assets, their physical condition and longevity and rates of return on them are eagerly scrutinised by financial analysts, investors and ordinary citizens. Yet the corresponding information on economic infrastructure is rarely available, and even rarer still in a form that can be understood by the community at large. Instead the community is asked to tolerate a 'trust us' approach by Governments and government agencies.

As an example, in its 2010 report to COAG Infrastructure Australia argued that proposals to upgrade urban roads needed to demonstrate that all ways to make better use of existing road

[4] Derived from ABS, *Engineering Construction Activity, Australia*, *Sep 2011.* Cat no. 8762.0, http://www.abs.gov.au/ausstats/abs@.nsf/mf/8762.0

networks have been utilised.[5] Engineers Australia agrees with this view. However, the information necessary to verify whether this is the case simply does not exist in the public domain. Relevant state agencies may have asset management systems to facilitate planning of road maintenance, but these information sources are jealously guarded and not seen as information to be shared with the community.

The Engineers Australia Infrastructure Report Cards[6] are a response to the demand for infrastructure information by our members and by the wider community. For many years, Engineers Australia has expressed concern about the unsatisfactory level of infrastructure maintenance. In a similar vein, Infrastructure Australia has called for the establishment of a National Roads Portfolio Manager to independently verify asset management plans of local and State road authorities, to assist authorities experiencing difficulties to develop asset management systems, to assist with associated engineering support and to provide advice on emerging trends, on policy matters and on investment decisions. The objective of this proposal was to address the serious lack of information about the maintenance requirements of national roads. Engineers Australia supports this approach and notes that is necessary primarily to overcome a basic failure in infrastructure management.

Infrastructure decisions will affect the lives of several generations over several decades and effective planning decisions require informed input from all sections of the community. This is not possible with current restrictions on and approaches to infrastructure information. Engineers Australia believes that infrastructure planning, project development, and project evaluation must be robust, transparent and build confidence in the general community that all options have been seriously considered and evaluated and that infrastructure projects chosen to proceed offer the greatest economic and social benefits.

We understand that the National Infrastructure Construction Schedule (NICS), under the aegis of the Australian Government Department of Infrastructure and Transport, proposes to develop a website that outlines current and planned major infrastructure projects across the government sector. The implementation of the NICS in May 2012 is the first step toward providing a transparent, long-term view of infrastructure 'pipeline planning' and it is supported in principle by Engineers Australia.

NICS will assist the profession with career and labour force planning and allow for better government coordination of infrastructure projects to avoid acute demand spikes in specific locations or professions/vocations. It is crucial that this information is harnessed effectively by all levels of government to avoid 'boom/bust' cycles of infrastructure delivery.

Recommendation

- Delivery and planning of government infrastructure projects must be planned and coordinated across the various levels of government to avoid the boom/bust cycles of project delivery. Creating an identifiable 'pipeline' of infrastructure projects will assist the profession with career and labour force planning and allow better long-term resource deployment and investment. It is essential that this collaboration be cross-jurisdictional and involve federal, state and local

[5] Infrastructure Australia, Getting the fundamentals right for Australia's infrastructure priorities. June 2010, p19, www.infrastructureaustralia.gov.au.
[6] https://www.engineersaustralia.org.au/infrastructure-report-card

governments. This approach must necessarily be underpinned by improved availability of infrastructure-related information.

5. Engineering Education

5.1 Overview

The mainstay of supply for Australia's engineering workforce arises from universities and TAFE graduations, with the remaining demand met through immigration. While data from the Department of Education, Employment and Workplace Relations (DEEWR) show that enrollment and completion rates of engineering courses have been steadily increasing over recent years, this has been inadequate to meet the rapid increase in demand for engineering expertise seen over the last decade (see Figure 4, above, for example).

In order to affect any increase in engineering enrollments, it is essential that participation in science, technology, engineering and mathematics (STEM) subjects at secondary level is as high as possible. The STEM and non-STEM First Year Students report published by Universities Australia[7] shows that the quality of teaching in high school has a strong effect on the choices students make when enrolling at university.

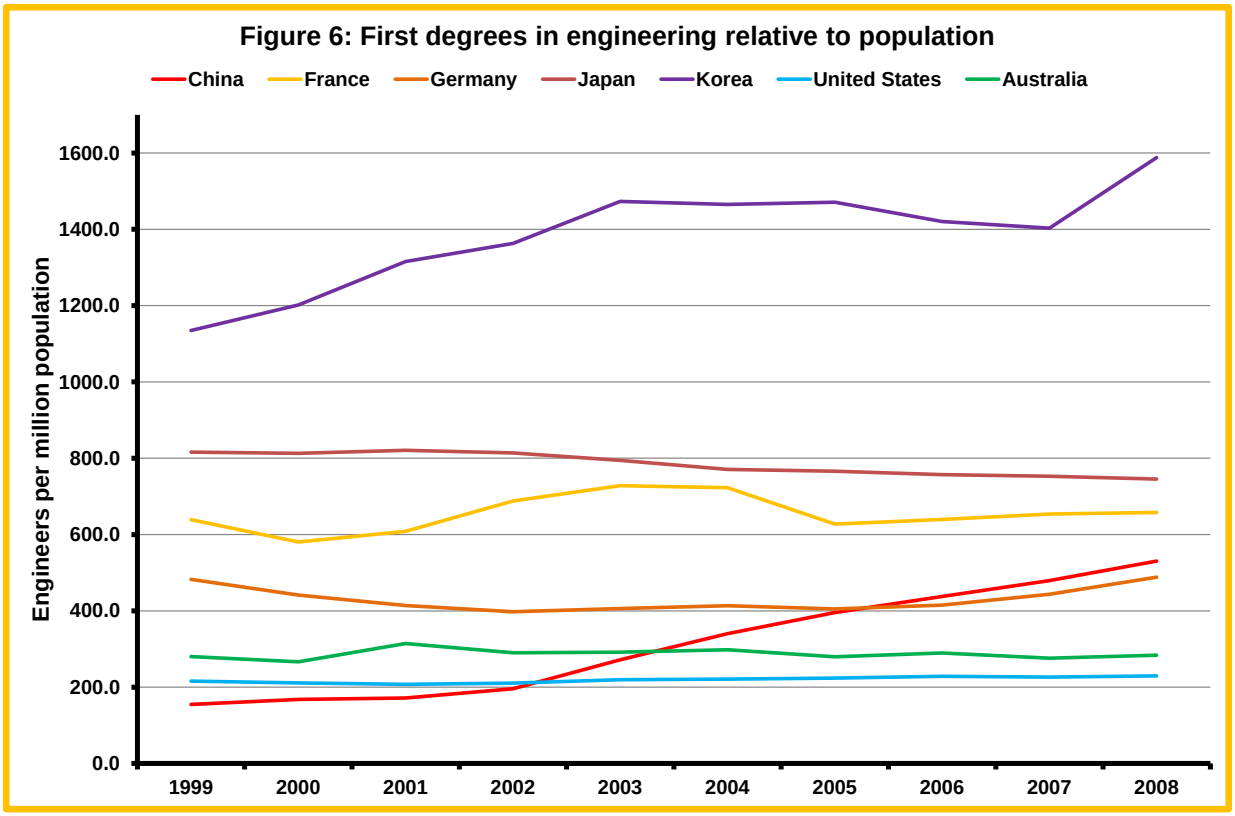
Statistics compiled from ABS sources and published by Engineers Australia in its eighth statistical overview display increased participation in STEM subjects. Students studying advanced mathematics, from 11.3 percent in 2001 to 10.2 percent in 2009, there are more students than ever studying this subject due to the climb in the the overall number of students entering year 12.

School retention to year 12 also increased from 74.6 percent in 2008 to 78 percent in 2010. As a result of this, more students are graduating from year 12 with engineering enabling subjects than ever before. Despite this increase, the percentage of these students as a proportion of the cohort as a whole has dropped slightly and more effort needs to be expended to attract secondary students to study enabling subjects.

5.2 National and International Context

Figure 6 shows that Australia's stock of engineers with bachelor degrees, on a per capita basis, has remained largely steady over the last decade. When viewed alongside data in Figure 4 (above) that outlines the sudden spike in infrastructure spending occurring in the early 2000s, it is clear that Australia's level of engineering graduations has been insufficient to cope with this increased demand, and is one of the primary causes of the engineering skills shortage experienced today.

[7].Universities Australia, *STEM and non-STEM First Year Students*, January 2012
http://www.universitiesaustralia.edu.au/page/submissions---reports/reviews-and-inquiries/stem-and-non-stem-first-year-students-/



5.3 Women in Engineering

One of the biggest issues in the engineering profession is the continuing disparity between men and women in commencements and completions, particularly among domestic students. Women starting engineering or related bachelor degrees in 2010 made up only 14.4 percent of all domestic commencements and 14.7 percent of completions.[8] This situation is reflected by a similar proportion of women in the engineering labour force. Encouraging a higher level of participation from women in engineering is vital for the future of the profession and would help mitigate the engineering skills shortage in the long-term. To this end, the Engineers Australia Women in Engineering National Committee is committed to continuing its vision to attract, retain and support women in the engineering profession.

Recommendation

- That governments investigate strategies for improving the participation rate, particularly of women, in engineering enabling subjects at a secondary and tertiary level.

6. Engineering Expertise in Government Procurement

During the 1980s and 1990s, engineering establishments in government agencies at all levels were seriously reduced. Engineers Australia drew attention to the risks associated with the

[8] Data provided by the Department of Education, Employment and Workplace Relations.

ensuing loss of engineering expertise in its 2000 report '*Government as an Informed Buyer*'[9] and in its policy on government purchasing agreed in 2003.[10] The risks identified included:

- The inability to manage engineering contracts because contracting staff lacked the necessary technical expertise.
- The inability of contract staff to adequately assess the engineering competencies of contractors and sub-contractors.

These risks open the possibility of large financial and human costs which have been detailed in coronial enquiries,[11] in Australian National Audit Office reports and in numerous Ministerial statements. In its policy statement, Engineers Australia proposed a set of recommendations[12] and methodological advice to ensure that government as a buyer of engineering, information technology and other technical goods and services adequately addressed technical and engineering risks.

The recommendations recognised the changes occurring in the public sector, in particular decentralisation of control and devolution of decision making, and the broader environment in which infrastructure procurement takes place, notably increasing technological complexity and the frequency of very large purchases. Engineers Australia believes that it is insufficient to rely on the significant contract management expertise that has been developed in engineering procurement. These skills are vital, but are not a substitute for technical engineering expertise.

Engineers Australia believes the issue of informed engineering decision making runs deeper than a simple numerical adequacy in the number of available engineers. Engineers Australia is firmly of the view that the engineering advice necessary to plan, design, develop and implement infrastructure programs is provided by engineers with appropriate work experience and a keen appreciation of the progress of engineering technology.

Undoubtedly, the engineering skills shortage will have had an effect on the ability of government agencies to attract and retain suitably qualified engineers. As we outline above, retaining engineering expertise is critical to effective engineering project delivery. Engineers Australia has been working with engineering employers, including the Department of Defence, to address retention issues through working, for example:

- To increase the number of engineers achieving chartered membership status to verify their commitment to continuous professional development and high engineering standards.
- To encourage greater participation in their initial and continuing professional development.
- To upgrade the engineering qualifications of existing staff through articulation programs to the levels appropriate to full participation in the engineering team.

However, Engineers Australia believes that more can be done to reinforce these efforts to ensure that technical and engineering elements of procurement are fully integrated into purchasing structures and arrangements.

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[9] Athol Yates, Government as an Informed Buyer, Recognising technical expertise as a crucial factor in the success of engineering contracts, Institution of Engineers, Australia, Canberra, 2000, www.engineersaustralia.org.au.
[10] Engineers Australia, Public Policy Guide, 2003, p15, www.engineersaustralia.org.au.
[11] See Appendix 2 in Yates, *op cit*.
[12] See Yates, *op cit*. pp. 7-8.

Recommendation

- Government agencies, at all levels, should work to retain internal engineering expertise in their workforce. This could be achieved through creation of senior technical specialist roles that would provide a technical career pathway (in tandem with traditional managerial/generalist career pathways) for those seeking to build specialist knowledge while continuing to enjoy career/hierarchical progression.

7. Registration of Engineers

Engineers Australia strongly supports a national system for the registration of engineers. The objectives for the national registration of engineers is to ensure that engineering services are delivered by individuals who hold appropriate educational qualifications, have work experience consistent with accepted and recognised international engineering standards and demonstrate a commitment to continuing professional development. Currently there is no uniform registration system covering engineers in Australia. Engineering services are regulated by more than a dozen different Acts, regulations, by-laws and orders-in-council in different jurisdictions. Many are not specific to engineering services and often relate to the building and construction industry.

Queensland is the only State where engineers must be formally registered to provide professional engineering services.[13] As well as underpinning the quality of engineering services, a national registration system offers additional benefits including:

- Enhancing the mobility of properly qualified engineers between jurisdictions and industries.
- Facilitating the productive integration of migrant engineers into the Australian labour market.
- Helping to overcome skill shortages by maximising the productivity of the existing engineering labour force.
- Providing competency benchmarks for clients and employers of engineers.
- Minimising the costs to clients resulting from sub-standard engineering services delivered by individuals who are not qualified to offer these services.
- Reducing the red tape involved with compliance arrangements.

As a professional organisation, Engineers Australia accredits the engineering courses taught in Australian universities using competencies that are regularly audited against international standards and is now transitioning these arrangements to the TAFE system. Engineers Australia applies the same competencies to assess the qualifications of prospective migrants under skilled migrant programs.

Engineers Australia believes that it is not sufficient to apply internationally recognised standards to the commencement of an engineering career. There are corresponding standards that apply to an engineer's work experience, especially in specialised fields of practice. Engineers Australia recognises this issue in the progressive structure of its membership culminating in Chartered status at the relevant engineering team level. Chartered status is defined by a higher set of

[13] National Engineering Registration Board, *The Regulation of Engineers: Finding the right approach for a national economy*, National Engineering Registration Board, http://issuu.com/engineersaustralia/docs/regulation_of_engineers_brochure_rev3_/1?mode=a_p

competencies than applied to degree accreditation and signifies the engineer offers all the attributes of professionalism required from an engineer. Chartered status qualifies individuals for voluntary registration with the National Engineering Registration Board.

Engineers Australia consistently applies its competencies and recognition framework to its members. Formal registration of engineers in a national registration scheme would apply similar standards to all practicing engineers, whether members of Engineers Australia or not. Engineers Australia believes that the work carried out by engineers is of fundamental importance to Australian growth and the well-being of Australians and that the assurance of national registration is essential to Australia's future.

Recommendation

- That Australian governments, through the COAG 'transition to a seamless economy' reform process, support the introduction of a nationally consistent registration system for engineers.

8. Engineering Capacity in Western Australia – A Case Study

The engineering capacity of Western Australia is a unique case in Australia's economic landscape. The resource sector boom has created a demand for engineering services, not only in mining but for other utilities and local government, in order to cope with population growth and infrastructure replacement.

A study prepared by the WA Division of Engineers Australia shows those engineering-dependent sectors of the economy, such as mining, construction, manufacturing and professional services, account for approximately 57 percent of WA's economic output. This is expected to continue into the next decade and addressing the demand for engineering skills is vital to sustained growth in Western Australia's economy. Consequences of this unprecedented demand placed on the engineering team include higher costs for services, loss of work to offshore providers, and the postponement of projects. At present, both short- and long-term migration is essential to address the situation, and further action needs to be taken to diversify the economy.

The two principle sources of engineering workforce growth in WA are tertiary graduates and migrants. Domestic and international students, primarily graduating from the University of Western Australia and Curtin University, as well as migrants from within Australia and abroad, are keeping the industry afloat. Research and Development (R&D) also contributes to the longevity of engineering in WA, with Australia's second highest expenditure on R&D as a proportion of Gross State Product, and the highest level of R&D business expenditure. The private sector shows a strong presence in research; both Chevron and BHP Billiton have headquartered their global technology centres in Perth. In addition to this, CSIRO Exploration & Mining and CSIRO Petroleum are now located in the Australian Resources Research Centre in Perth. This proximity to UWA and Curtin University has enabled the establishment of the WA Energy Research Alliance.

The WA Division of Engineers Australia has articulated a vision for taking the State's engineering capability and profession forward to 2020:

> *"WA has expanding local engineering capability focussing on servicing the operations of the resource sector, providing continuous productivity and reliability improvement in fit*

for purpose infrastructure and also facilitating broader industry development with capability to service a world market. Perth has established recognition as a world energy city and with its innovative industries is seen as a natural base to service Asia, India, the Arab Gulf and Africa. The State also has sufficient non-resource-dependent engineering industries which provide resilience in the event of a resource sector shock. WA's professional engineering workforce consists of engineers drawn from both local and international sources, provides globally competitive skills and knowledge, and is sufficiently flexible to operate in various roles in a variety of sectors due to their education on engineering fundamentals and ongoing professional development."

Addressing the issues and working towards this vision can be achieved in a number of ways.

- The WA Government must develop a State engineering capability strategic plan that leverages off demand from the resource sector and recognises the importance of developing more balanced engineering capabilities.
- WA's innovation system should become more strategic with a commitment to longer-term programs and integrating purchasers.
- Industry should provide increased in-house professional development opportunities for professional engineers in both project management and systems integration.
- Stakeholders need to form a working group to develop a mechanism to increase industry involvement in tertiary-level engineering education.
- International students graduating from WA institutions require more incentive to remain in WA.
- The WA Government and other stakeholders review the success of measures to increase the percentage of school students undertaking advanced maths and science, and focus on those that have worked.
- The WA Government, industry and Engineers Australia must work together to attract professional engineers to WA.

This vision and course of action is a long-term strategy for tackling the issues facing the engineering profession in WA. Rather than attempting to predict what the engineering landscape will look like in 2020, it aims to resolve current problems and better equip the profession to meet the challenges of the future.

The WA Division of Engineers Australia would welcome the opportunity to appear before the committee and present its views and information in person.

At this time we would be happy to furnish the committee with a complete version of our *Engineering WA 2020* report that has formed the basis for this case study.

9. Summary of Recommendations

- Engineers Australia considers that it is imperative that the Australian Government maintains an appropriate pathway for skilled engineering migration through continued inclusion on the Skilled Occupation List. With an increasing demand for skilled engineers it is crucial that Australia maintains this capacity.
- Delivery and planning of government infrastructure projects must be planned and coordinated across the various levels of government to avoid the boom/bust cycles of project delivery. Creating an identifiable 'pipeline' of infrastructure projects will assist the profession with career and labour force planning and allow better long-term resource deployment and investment. It is essential that this collaboration be cross-jurisdictional and involve federal, state and local governments. This approach must necessarily be underpinned by improved availability of infrastructure-related information.
- That governments investigate strategies for improving the participation rate of women in STEM subjects at a secondary and tertiary level.
- Government agencies, at all levels, should work to retain internal engineering expertise in their workforce. This could be achieved through creation of senior technical specialist roles that would provide a technical career pathway (in tandem with traditional managerial/generalist career pathways) for those seeking to build specialist knowledge while continuing to enjoy career/hierarchical progression.
- That Australian governments, through the COAG ‘transition to a seamless economy’ reform process, support the introduction of a nationally consistent registration system for engineers.