More students attracted to engineering but still not enough

by Andre Kaspura

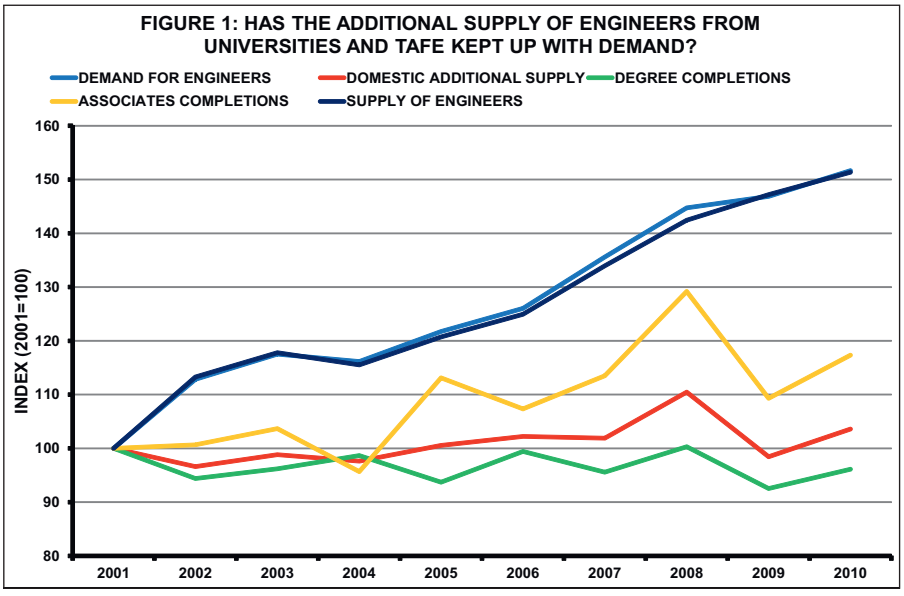
Engineers Australia has been advocating for many years that there should be more places in university and TAFE engineering schools. Engineers Australia also runs many programs to encourage school students to take up engineering. In the past, places in engineering were the result of government decisions but this environment has changed as a result of the Bradley recommendations for a more demand driven system. Against this background it is useful to review how the education system has responded to the enormous increase in the demand for engineers in Australia and what more needs to be achieved. This article looks at education outcomes for the engineering team over the past decade to consider this issue.

The first signs of progress in Engineers Australia's advocacy will be evident in engineering course commencements. Statistics on commencements are available for degree courses leading to professional engineer and engineering technologist status but not for the qualifications leading to engineering associate status. In 2001, 10,786 domestic Australian students commenced bachelor degree courses in engineering.

The focus is on domestic students because overseas students studying these courses in Australia cannot join the Australian engineering workforce without first obtaining permanent or temporary immigration visas.

In the first half of the decade commencements fell and by 2005 were down to 9920. One factor in this fall was a reduction in the proportion of women from 14.7% in 2000 to 12.7% in 2005. Since 2005, commencements have increased, slowly at first, but more rapidly in the last couple of years. By 2009, commencements were at an all-time high at 12,057, an increase of over 21% over 2005, but only 12% higher than the start of the decade. These are encouraging signs but what about further along the education process?

Such a large increase in commencements begs the question, has this change occurred because less able students have been admitted to courses? This is unlikely because the profile of student tertiary entrance scores for engineering students accepting places in 2009 was superior to the corresponding profile for non-engineering students. The proportion of well qualified students accepting engineering places was much higher than in non-engineering disciplines. For example, in engineering, over 67% of acceptances had tertiary entrance scores over 80 compared to just under 51% for other disciplines. In absolute terms, engineering had more acceptances with tertiary entrance scores 90 and over than any other discipline, including medicine.



The downside risk to further progress, however, is the male bias in course acceptances. For some years it has been apparent that more girls than boys are remaining in high school until year 12. This trend is now evident among the year 12 population seeking university entrance. In 2009, 10,262 men had scores of 90 or higher and 24.3% accepted places in engineering degrees – a very high share and one that will be difficult to grow. In contrast, there were 13,515 women with tertiary entrance scores 90 or higher and only 4% accepted places in engineering. The bulk of recruitment of good students for engineering courses comes from the smaller and decreasing gender group. Reliance on these traditional patterns poses serious risks for future commencement numbers.

At this stage, increased commencements have not translated into increased degree completions. In 2001, there were 6061 completions of bachelor degrees (three years, four years and double degree) in engineering. The trend over the past decade has been static, with only small annual fluctuations and in 2009 completions were still only 5608. This is illustrated by the green line in figure 1. Recent research by Robin King and Elizabeth Godfrey (Understanding and reducing attrition in engineering education; strategies to maximise bachelor degree completions, ACED, 2011) suggests that the national average retention rate for engineering courses started in 2003 is about 65%. The study also found that engineering students take longer to graduate than expected and that most attrition occurs in the first two years. These findings and others are part of efforts seeking to identify best-practice ways to support student retention in universities to support graduation numbers so that increased commencements can lead to increased completions in the future.

Figure 1 shows that most of the growth in new additions to the engineering team over the last decade has come from completion of qualifications leading to engineering associate status. A small number of completions come from the university sector but most come from TAFE colleges. In 2001, there were about 3300 domestic

completions of associate degrees, diplomas and advanced diplomas in engineering, about 35% of the new additions to the engineering team. Progress was uneven but by 2005 a definite upwards trend was evident, illustrated by the yellow line in figure 1. By 2008, associate completions had grown to 4254, over 41% of new additions to the engineering team. Since then, completions have fallen away, possibly influenced by economic conditions.

The net effect of degree and associate completions is summarised by the red line in figure 1. In four out of ten years, completions were below the level at the start of the decade. In one year, completions were 10% above the level at the start of the decade and in the remaining years the increase was less than 5%.

In the meantime, the demand for engineers has increased strongly and persistently. In figure 1, demand for engineers is measured by employment and is illustrated by the light blue line. During the past decade, the demand for, or employment of the engineering team has increased by 52% compared to 20% for the Australian economy overall. The tightness of the engineering labour market was also evident in very low unemployment rates.

The demand for engineers in Australia has grown substantially faster than the capacity of Australian universities and TAFE colleges to produce new members of the engineering team. Although the increase in university commencements in degree courses is encouraging, the growth in demand is for people with completed qualifications and figure 1 shows that there is a growing gap between demand and new supply.

The supply of engineers in figure 1 is measured by the engineering labour force, that is, members of the engineering team who are employed plus those willing to work but unemployed. The increase in the supply of engineers over the past decade is shown by the dark blue line.

Policies to stimulate engineering education have long lead times and the above analysis shows a structural discontinuity between demand growth and educational outcomes. Successive governments have dealt with the situation by increasing skilled migration. Statistics obtained by Engineers Australia relate to degree qualified migrant engineers and show that in the past decade about 55,000 migrant engineers joined the engineering workforce in Australia.

The consequence of reliance on skilled migration to meet the demand for engineers has been a major shift in the composition of the engineering workforce. In 2001, overseas born engineers made up 41.8% of the engineering workforce, growing to 45.2% by 2004. The earliest statistics for equivalently qualified people in other disciplines are for 2004 and show a much lower share of overseas born people at 32.6% and the share is even lower at 24.9% for the entire Australian workforce. Although overseas born does not mean an individual is an overseas trained migrant, it is the closest surrogate available to measure the effect of skilled migration. In the first half of the decade engineering was already more dependent on skilled migration than other disciplines and the workforce overall.

The rapid rise in the demand for engineers over the past decade has seen this dependence increase so that now the majority of the engineering workforce is overseas born. Figure 2 shows the trends in the overseas born shares for the three groups referred to in the previous paragraph. For the Australian workforce as a whole, continued high levels of migration have meant that the proportion of overseas born people grew to 26.8% in 2010. General skills shortages across non-engineering disciplines have seen the overseas born share for this group increase to 36% in 2010. In engineering the change was more pronounced with the overseas born share increasing to 52.6% in 2010.

As an aside, this analysis provides some insights into the dynamics of the engineering workforce. The level of annual completions in engineering may be relatively low but, cumulatively over the decade, completions added 94,495 members to the engineering team. The actual increase in supply, that is, growth in the engineering workforce was 124,400. Over 55,000 migrant engineers also joined the Australian engineering workforce. The balancing factor is retirement from the labour force, an area where more work on the age structure of the engineering team and its retirement intentions is necessary.

This brief review shows that Australia has made little progress in dealing with the structural shortage of skilled engineers from within its own resources. Engineers Australia's advocacy has helped to increase the number of students commencing bachelor degrees in engineering but this trend has not yet converted into completions. There has been some progress with a rising trend in completions of associate qualifications but the numbers involved remain quite low. However, the relatively high share of associate qualifications in engineering completions emphasises the importance of increasing the penetration of Engineers Australia's accreditation processes in associate engineering programs. Engineers Australia is contributing to programs designed to improve retention in engineering courses, but it will take time for these efforts to pay off. In the meantime, analyses like the one in this article provide a more factual basis to continue to advocate the importance of engineering education and the risks and exposures associated with inadequate policies and progress. ■

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FIGURE 2: THE PROPORTION OF EMPLOYED OVERSEAS BORN INDIVIDUALS IN THE ENGINEERING, COMPARISON AND AUSTRALIAN LABOUR FORCES