

CHAPTER 12

STEM PATHWAYS: ENGINEERING AND RELATED TECHNOLOGIES

WHAT IS ENGINEERING AND RELATED TECHNOLOGIES?

In this report, we use the term Engineering to refer to all ASCED fields of education under the broad field of Engineering and Related Technologies. The main purpose of studying and working in Engineering is to understand and apply knowledge of the conversion of materials and energy, the measurement and representation of objects, and the operation of plant, machinery and transport systems (ABS, 2001).

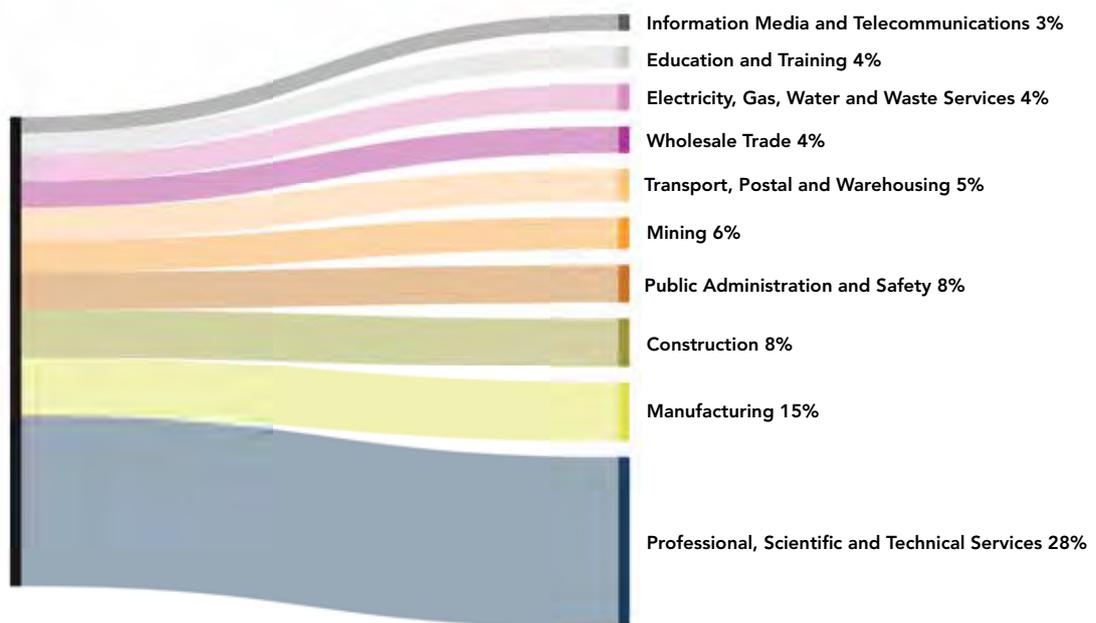
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STEM PATHWAYS: ENGINEERING AND RELATED TECHNOLOGIES

KEY FACTS

- 1 In 2011, there were 257 380 Engineering graduates, the majority of which were male (86 per cent).
- 2 Around one fifth of graduates held postgraduate qualifications—15 per cent masters and 4 per cent doctorates.
- 3 Half of all female and one-third of all male Engineering graduates were aged under 35.
- 4 The private sector employed 84 per cent of all Engineering graduates—varying from 87 per cent of bachelors to 53 per cent of doctorates.
- 5 Twenty eight per cent worked in the Professional, Scientific and Technical Services industry, and the second most common industry was Manufacturing (15 per cent).
- 6 The majority (57 per cent) were employed as Professionals, and a further 22 per cent worked as Managers.
- 7 A larger proportion of Engineering graduates had a yearly personal income in the highest bracket (more than \$104 000) than in either the STEM or Non-STEM cohorts. (32, 25 and 15 per cent, respectively).

Top ten industry sectors of employment for Engineering graduates



HOW MANY ENGINEERING GRADUATES ARE THERE IN AUSTRALIA?

In 2011, there were 257 380 Engineering graduates in Australia. The majority of graduates were male (86 per cent). Around one fifth of Engineering graduates had postgraduate qualifications (50 318), with 15 per cent holding masters degrees and four per cent doctorates. The majority of graduates with postgraduate qualifications were male (86 per cent).

Almost one-fifth of graduates (47 944, 18 per cent) were either not in the labour force or were unemployed (15 and 3 per cent, respectively). Of these, 20 per cent were female.

The field of Engineering has 11 sub fields; however just under one half (47 per cent) of Engineering graduates recorded their field of study as Engineering and Related Technologies n.f.d. (not further defined). As a result of this lack of specificity, sub-fields cannot be analysed accurately, and thus this chapter reports on the workforce characteristics of the broad field of Engineering and Related Technologies as a whole.

HOW OLD IS THE ENGINEERING GRADUATE WORKFORCE?

The age distribution of the Engineering graduate workforce shows some differences to that of the Non-STEM workforce, particularly for females (Figure 12.1). For male Engineering graduates, the age distribution is similar to that of the male Non-STEM workforce.

The female workforce with Engineering qualifications was younger than those with Non-STEM qualifications, with half of the female Engineering graduates in the workforce younger than 35, compared to 40 per cent for Non-STEM graduates. One third of males were younger than 35 for both the Engineering and Non-STEM qualified workforce. At the other end of the age spectrum, approximately 40 per cent of male and only 20 per cent of female Engineering graduates in the workforce were aged over 45, compared to 41 per cent and 35 per cent for male and female Non-STEM graduates, respectively.

WHERE DO ENGINEERING GRADUATES WORK?

The private sector employed 84 per cent of all Engineering graduates. The proportion employed in the private sector varied with qualification as follows:

- ▶ Bachelor level: 87 per cent
- ▶ Postgraduate level: 75 per cent
 - Masters: 81 per cent
 - Doctorate: 53 per cent

Figure 12.1: Age distribution of employed Engineering and Related Technologies graduates at bachelor level and above, by field and gender

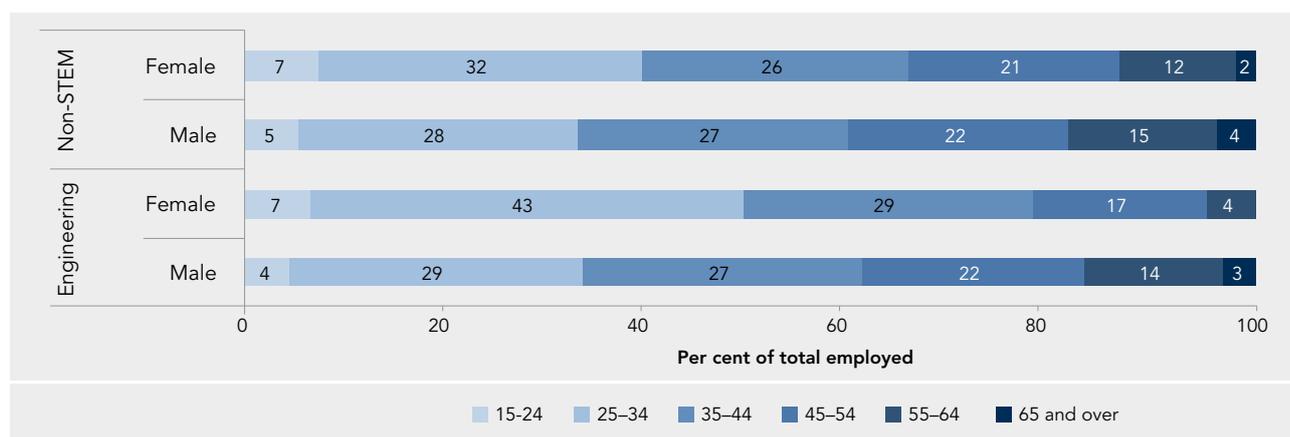


Figure 12.2: Top ten industry divisions of employment for Engineering and Related Technologies graduates with qualifications at bachelor level and above, by gender

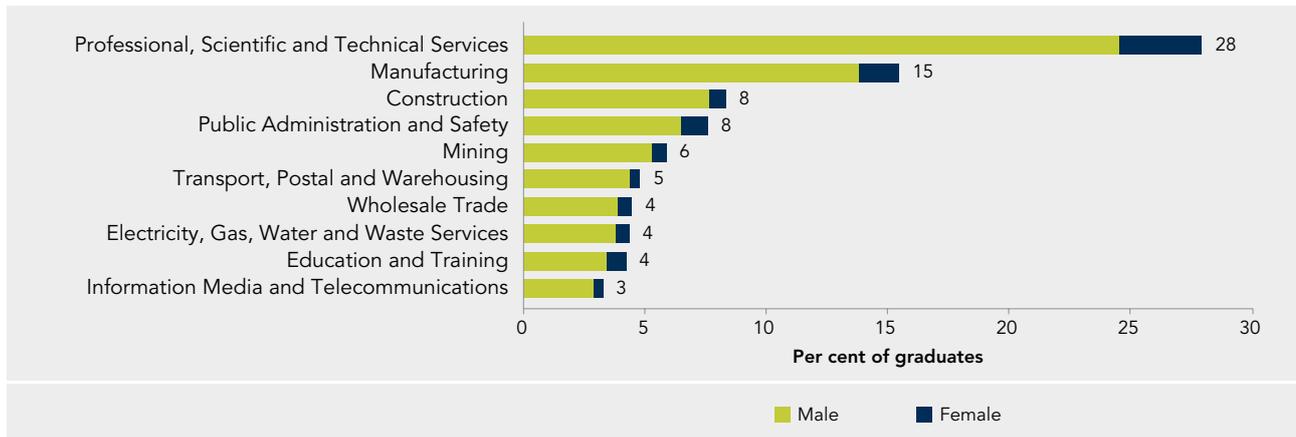


Figure 12.3: Top ten industry divisions of employment for Engineering and Related Technologies doctoral graduates, by gender



Industries are classified in four levels (ABS, 2006a):

- ▶ Divisions (the broadest level)
- ▶ Subdivisions
- ▶ Groups
- ▶ Classes (the finest level)

See Appendix B for a detailed list.

INDUSTRY SECTORS OF EMPLOYMENT

The industry division which employed the highest percentage of Engineering graduates from all qualification levels was Professional, Scientific and Technical Services, which employed almost 28 per cent of all graduates (almost 58 000) (Figure 12.2). This was the top destination of employment for both males and females, employing 28 per cent of male and 26 per cent of female graduates. The next most common industries were Manufacturing, followed by Construction, and Public Administration and Safety (15, 8 and 8 per cent, respectively).

Figure 12.4: Top ten industry classes of employment for Engineering and Related Technologies graduates with qualifications at bachelor level and above, by gender

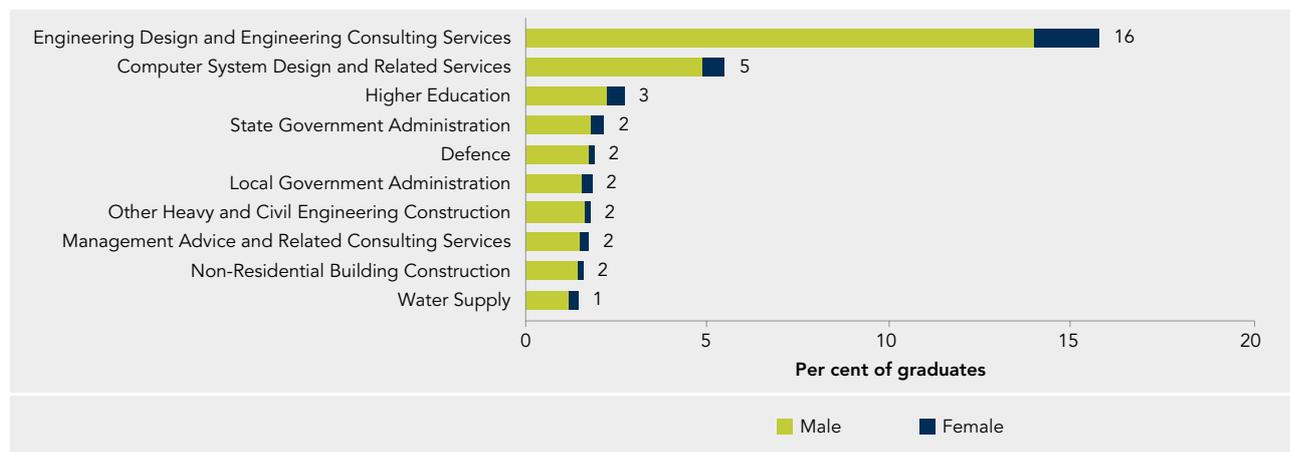
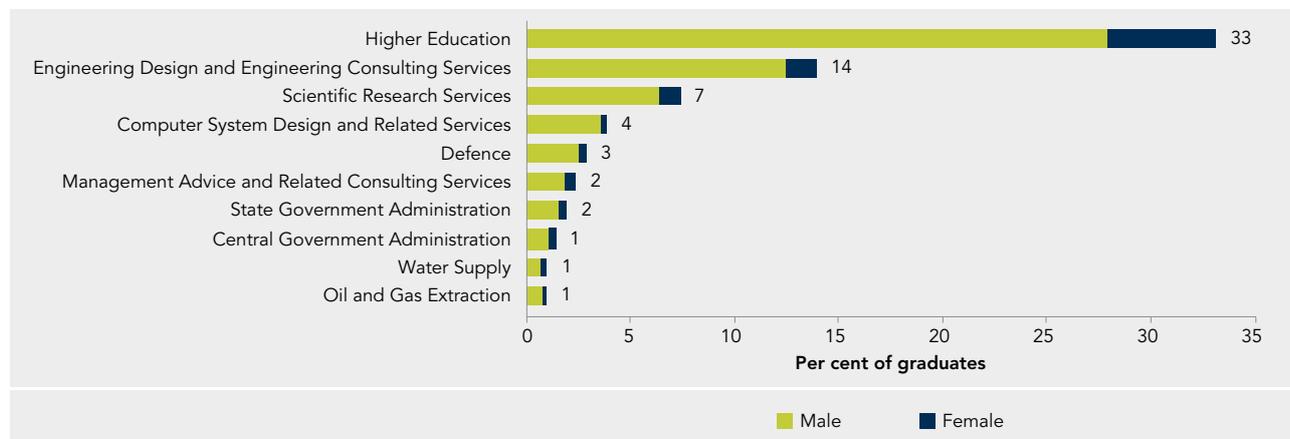


Figure 12.5: Top ten industry classes of employment for Engineering and Related Technologies doctoral graduates, by gender



At the doctoral level of qualification, the Education and Training industry division employed the highest proportion of graduates at 35 per cent (Figure 12.3). This is contrast to consideration of all Engineering graduates, where Education and Training employed just 4 per cent of the total cohort of Engineering graduates at the bachelor level and above (however, it is important to keep in mind that the total cohort was 257 000 graduates, while the doctoral cohort was 11 000 graduates). Professional, Scientific and Technical Services, and Manufacturing were the next most common industries of employment for Engineering doctoral graduates (30 and 9 per cent, respectively).

The industries of employment can be broken down to the class level to show more detail on the destinations of graduates, as shown in Figure 12.4 and Figure 12.5. At this finer level of detail, the most common industry class of employment for Engineering graduates was in Engineering Design and Engineering Consulting Services, which employed 16 per cent of all graduates. The second most popular industry class was Computer System Design and Related Services, which employed 5 per cent of all graduates. The rest of the top ten industry classes are then quite broadly dispersed across a range of industries, including Higher Education, Defence and various construction areas.



At the doctoral level, graduates were more concentrated in fewer industry classes, with one third employed in Higher Education, and 14 per cent in Engineering Design and Engineering Consulting Services. The third highest industry class was Scientific Research Services (7 per cent of doctoral graduates).

WHAT ARE THE OCCUPATIONS OF ENGINEERING GRADUATES?

The majority (57 per cent) of all Engineering graduates were employed as Professionals, which was the most common major group occupation for both males and females, employing 56 per cent of females and 57 per cent of males. The next most common occupation was as Managers, which employed 21 per cent of all graduates 22 per cent of males and 14 per cent of females.

At the doctoral level, an overwhelming majority of graduates were employed as Professionals (79 per cent), while only 15 per cent were employed as Managers.

Occupations are classified in five levels (ABS, 2013):

- ▶ Major group (broadest level)
- ▶ Sub-major group
- ▶ Minor group
- ▶ Unit group
- ▶ Occupation (most detailed level)

See Appendix C for a detailed list.

Figure 12.6: Top ten sub-major group occupations for Engineering and Related Technologies graduates at bachelor level and above, by gender

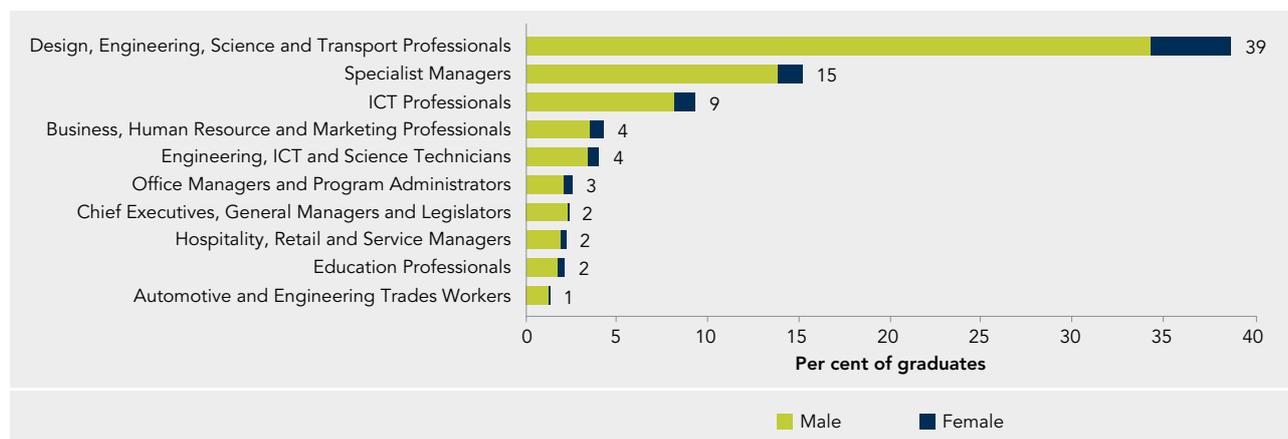
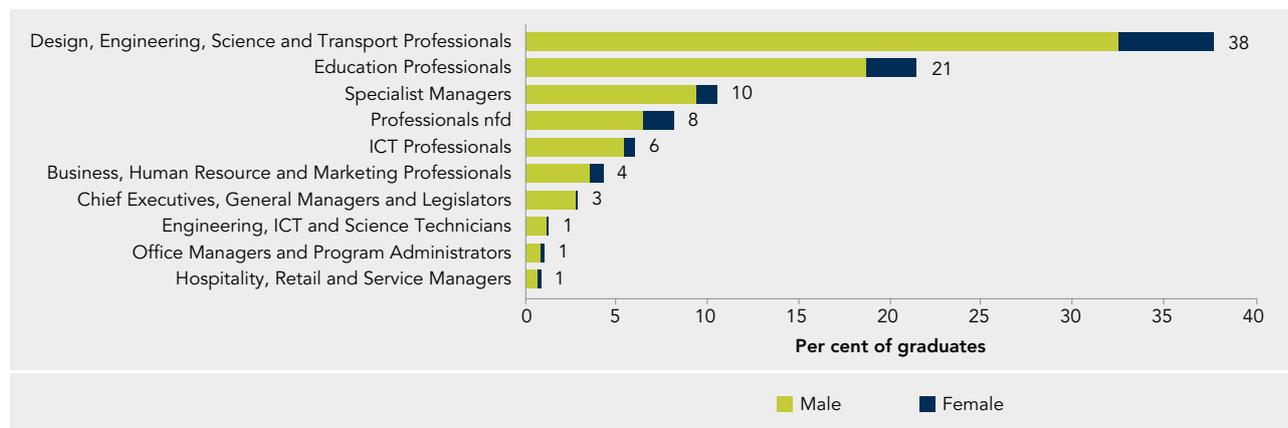


Figure 12.7: Top ten sub-major group occupations for Engineering and Related Technologies doctoral graduates, by gender



At a more detailed sub-major occupation level, over two-thirds of Engineering graduates worked in only four occupations (Figure 12.6). The most common occupation was Design, Engineering, Science and Transport Professionals (39 per cent). This was followed by Specialist Managers, ICT Professionals, and Business, Human Resources and Marketing Professionals (15, 9 and 4 per cent, respectively). The top five sub-major occupations were the same for males and females. Of the male graduates, 3 per cent were employed as Chief Executives, General Managers and Legislators, which was the sixth most common occupation; however it was only the 23rd most common occupation for females, with 1 per cent employed in this same role.

Engineering doctorate holders were employed in similar occupations compared to the total graduate cohort, and also most commonly worked as Design, Engineering, Science and Transport Professionals (38 per cent) (Figure 12.7). A key difference with doctorate holders is that the second most common occupation was as Education Professionals (21 per cent of doctorate graduates), whereas only 2 per cent of the total Engineering graduate cohort were employed in this role.

Figure 12.8: Top ten unit group level occupations for Engineering and Related Technologies graduates with qualifications at bachelor level and above, by gender

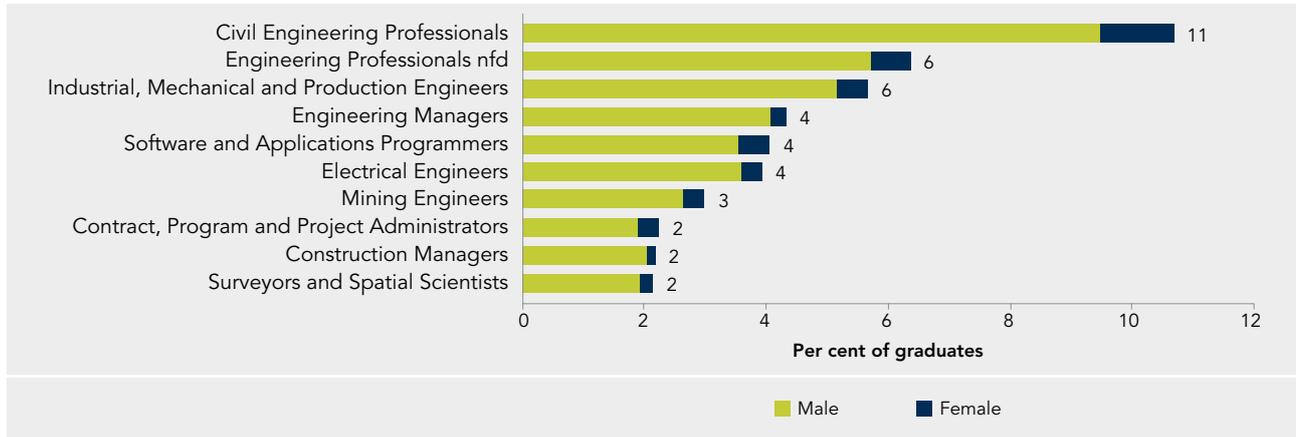
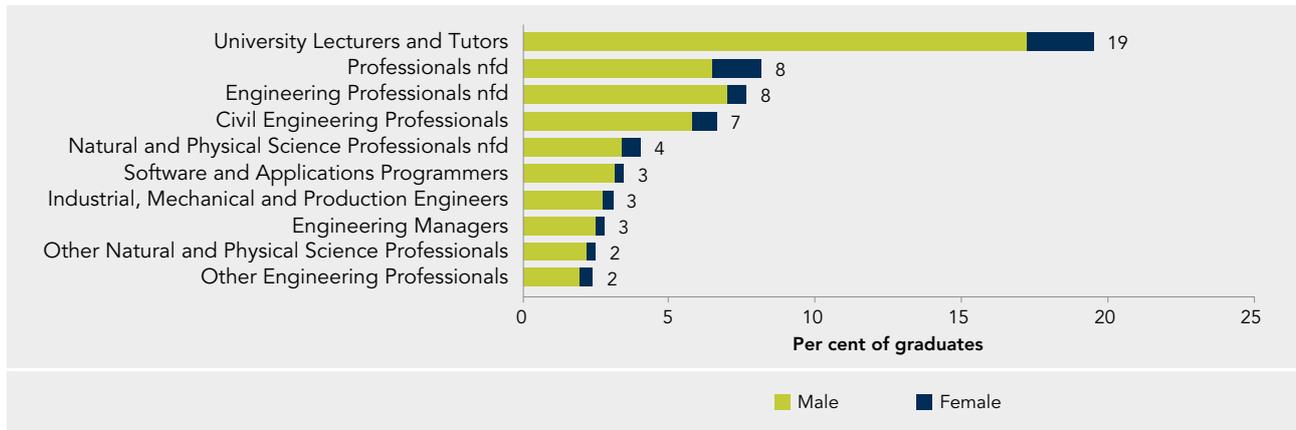


Figure 12.9: Top ten unit group level occupations for Engineering and Related Technologies doctorate graduates, by gender



The occupation groups can be broken down further to the unit group level to provide more detail on the destinations of graduates (Figure 12.8). Six of the top ten unit group occupations were drawn from the broader category of Design, Engineering, Science and Transport Professionals. The most common unit group occupation was Civil Engineering professionals, with 11 per cent of the total Engineering graduate cohort in this group. The second most common occupation was the poorly defined occupation of Engineering Professionals n.f.d (not further defined). The top ten occupations were broadly the same for males and females.

The unit-group level occupations for Engineering graduates at the doctoral level were different to those of the whole graduate cohort (Figure 12.9). The most common occupation was as University Lecturers and Tutors, with one in five doctorate holders employed in this occupation. In contrast, only one per cent of the total Engineering graduate cohort was employed in this occupation. Another difference is that Electrical Engineers, Mining Engineers, and Surveyors and Spatial Sciences do not feature in the top ten unit-group level occupations for doctorates.

Figure 12.10: Personal annual income of graduates, by field and level of qualification

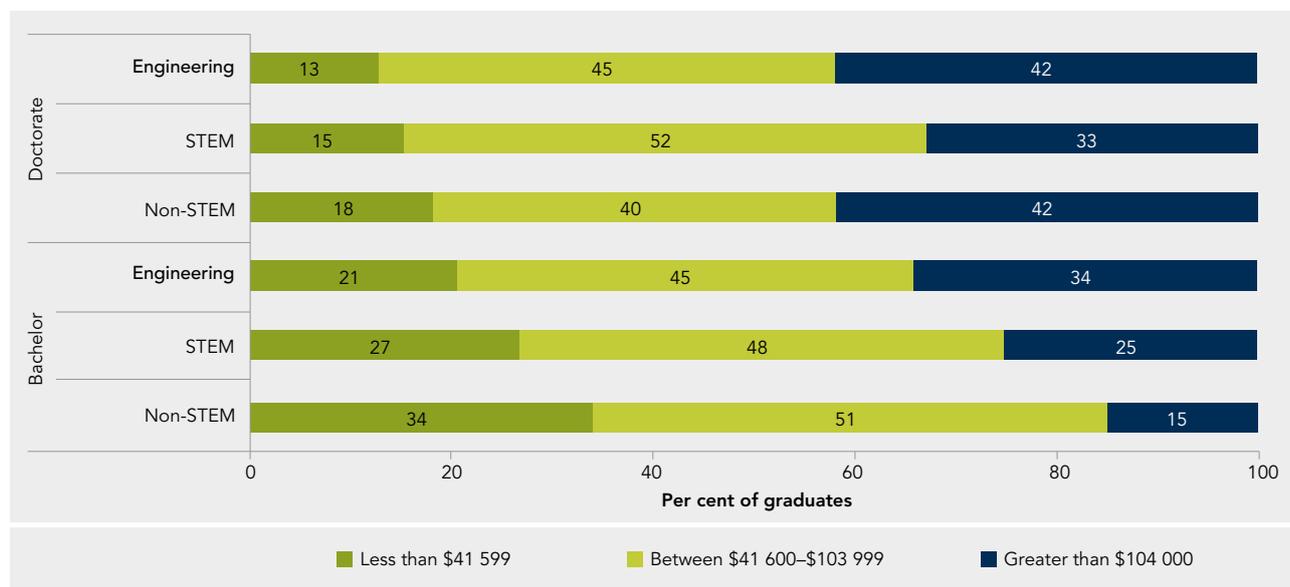
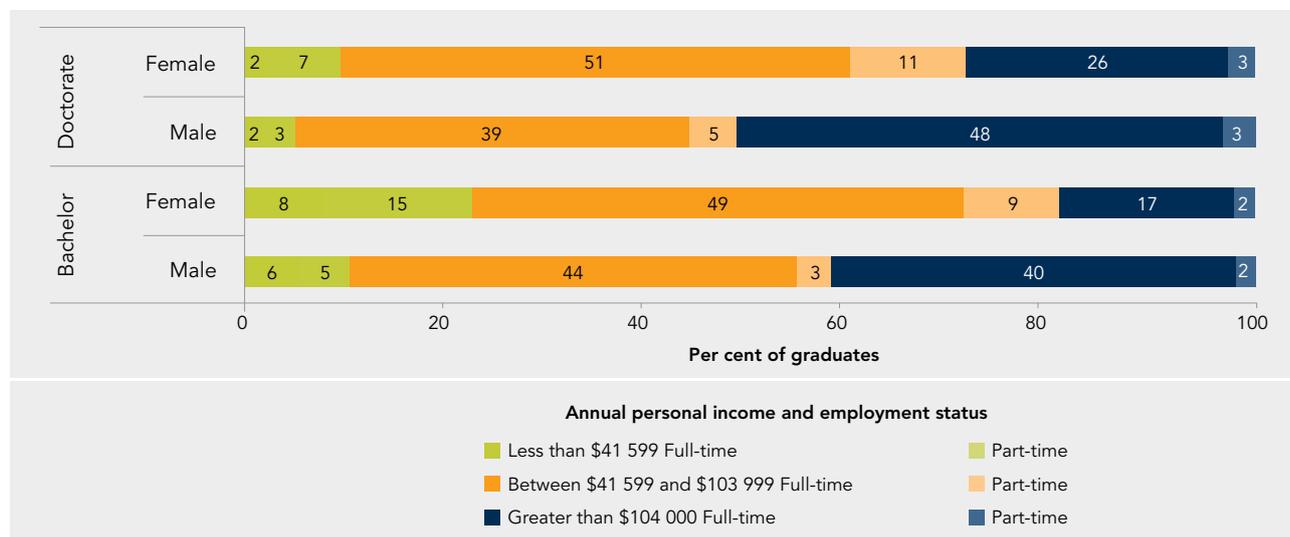


Figure 12.11: Personal annual income of Engineering and Related Technologies graduates working full-time and part-time, by gender and level of qualification



ARE ENGINEERING GRADUATES HIGH EARNERS?

A larger proportion of Engineering bachelor graduates had a personal income in the highest bracket (more than \$104 000) than in either the STEM or Non-STEM cohorts (34, 25 and 15 per cent, respectively) (Figure 12.10). At the bachelor level, there were fewer Engineering graduates with a personal income in the lowest bracket (less than \$41 600),

compared to both the STEM and Non-STEM cohorts (21, 27 and 34 per cent, respectively).

At the doctorate level, there was a higher percentage of Engineering graduates with incomes in the highest bracket compared to the total STEM cohort; and an equal percentage compared to the proportion of Non-STEM doctorates (42, 33 and 42 per cent, respectively). Completing a doctorate in Engineering can be financially rewarding, as



shown by the higher percentage of doctorates in the highest income bracket (42 per cent), and fewer in the lowest income bracket (13 per cent) compared to graduates with bachelor degrees in Engineering (34 and 21 per cent, respectively).

Graduate income levels were dependent on both gender and full-time or part-time employment. Fewer females and fewer part-time workers earned an income in the highest bracket for both bachelor and doctorate holders (Figure 12.11).

While 51 per cent of male doctorate graduates had a personal income in the highest bracket, only 29 per cent of females at the same level of qualification were in this earning bracket. Similarly, only 19 per cent of female Engineering graduates with bachelor level qualifications had a personal income in the highest bracket, compared to 42 per cent of male graduates.

A higher proportion of women than men worked part-time across both qualification levels and at all income levels. At the bachelor level, 26 per cent of women and 10 per cent of

men worked part-time, while at the doctorate level 21 per cent of women and 11 per cent of men worked part-time.

Across all age groups, a higher percentage of male Engineering graduates reached the highest income bracket compared to the total STEM and Non-STEM cohorts at both the bachelor and doctorate levels, peaking at 51 per cent for the 40 to 44 age group at the bachelor level and at 59 per cent for those aged 45 to 49 at the doctorate level (Figure 12.12).

Lower proportions of female engineering graduates reached the highest income compared to males across all age groups at both the bachelor and doctorate level of qualification (Figure 12.13). The percentage of female graduates in the highest bracket peaked at 21 per cent for the 35 to 39 age group at the bachelor level and at 46 per cent for the 55 to 59 age group at the doctorate level.

Figure 12.12: Percentage of bachelor level graduates earning greater than \$104 000 annually, by field, gender and age group

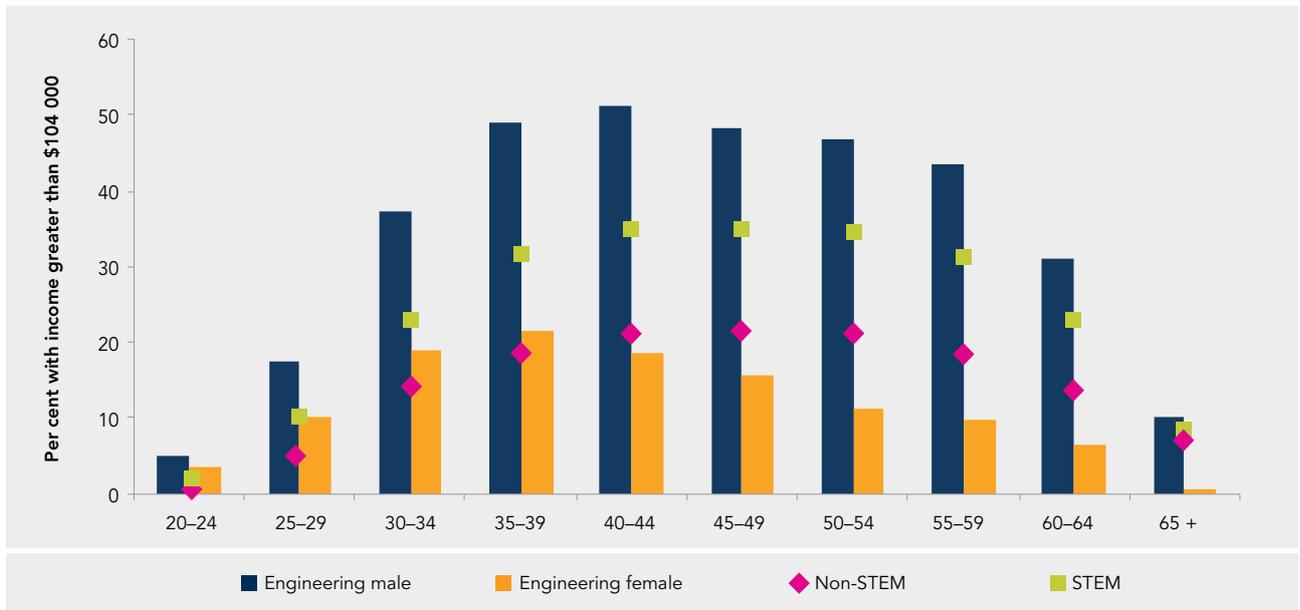


Figure 12.13: Percentage of doctoral level graduates earning greater than \$104 000 annually, by field, gender and age group

