Australian Government

Office of the Chief Scientist

AUSTRALIA'S STEM WORKFORCE

Science, Technology, Engineering and Mathematics

MARCH 2016

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We thank Matthew Brown, Ian Chubb, Robin King, Barbara van Leeuwen and Leon Sterling for reviewing the content.

FOREWORD

As time moves on it becomes increasingly difficult to decide who is and isn't a 'STEM worker'. After all, how many of us rely on new technologies to manage all the tasks we've got to fit in a working day? How many of these technologies had we imagined when we made our year 12 subject choices? How might technologies we can't imagine now be part of our daily experience tomorrow?

There's no opting out from the forces of change. They're too powerful, too widely dispersed, too slippery to catch. But even if I had the choice, I wouldn't take it. I hope all Australians would say the same.

When I look to that future I see a world of opportunity for Australians with STEM training. I see a STEM-powered economy that Australians can forge, if we have the confidence and the capability combined.

So I look to this report as one important measure of the national potential.

Much of the analysis is based on the 2011 Census, which is the most comprehensive and detailed data set of this type available to date. It also establishes a valuable benchmark for comparison with Census data that will be collected in 2016. Once these data are available and analysed (in late 2018), the impact of reforms in the years from 2011 to 2016, such as the demand-driven higher education system, can be investigated.

For today, this STEM skills index will be a valuable resource for students, as well as an important evidence base for public policy.

The most striking finding in my mind is the range of occupations that people with STEM qualifications have pursued. We have people with physics doctorates working as financial analysts. We have chemistry graduates running farms and making wine. We have ICT graduates planning cities. There are no limits on

what a STEM graduate can do, and we shouldn't impose them.

Do we impose them? I suspect we do, perhaps particularly on women with the talent and passion for STEM. The pay gap between men and women revealed in this report is significant, it is longstanding and it is unacceptable. No clever country under-serves half its people.

And no clever country would encourage its most STEM-literate people to pursue only traditional research paths, in universities or public sector research agencies.

I know from my own experience that the opportunities rarely lie in the expected places. Our STEM community, and most of all our young people, should be given every encouragement to find new applications for their skills across the economy.

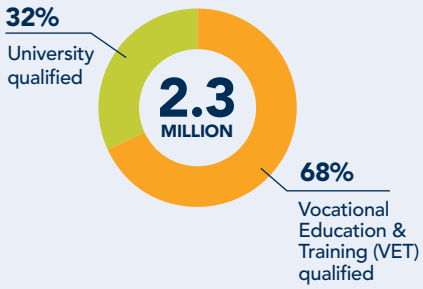
Our best future is a future that builds on technology, innovation, ideas and imagination. It is a future with STEM. And it is a future that is ours to build.

Alan Finkel AO
Australia's Chief Scientist

KEY FACTS

TOTAL STEM WORKFORCE

STEM qualified population



16% of STEM qualified people are female

29% University qualified

9% VET qualified

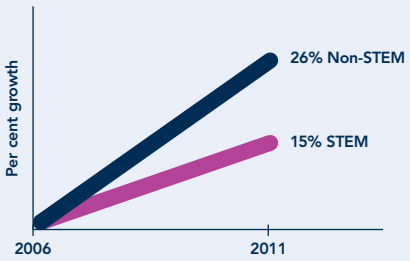
Unemployment rate

STEM = 3.7%

Non-STEM = 4.1%

Growth of STEM vs non-STEM qualified population

Between 2006 and 2011:



STEM UNIVERSITY GRADUATES

Industries and occupations

STEM graduates work across the economy in a wide variety of industries and largely as professionals (55%) and managers (18%).

Top six industries
(65% of STEM graduates)

% of STEM graduates earning in the top income bracket ($104 000 or above)

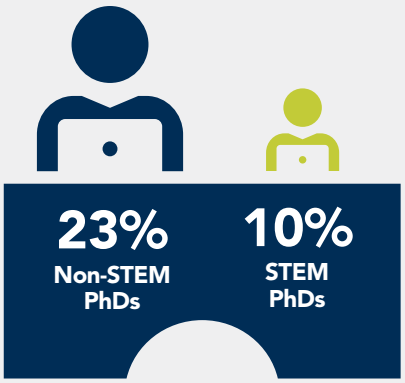
32% male **12% female**

% of employed STEM graduates in the private sector

All STEM graduates **STEM PhDs**

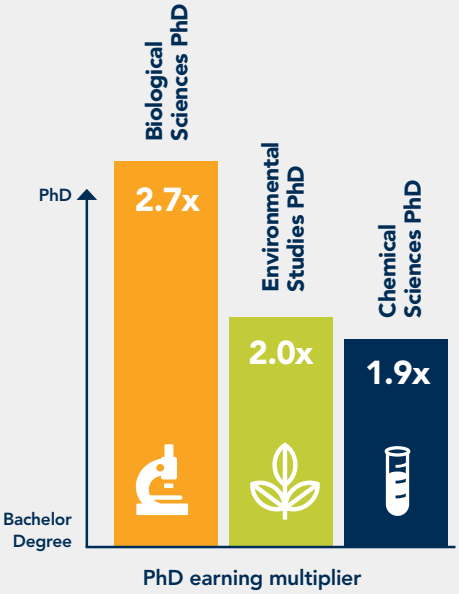
STEM PhD GRADUATES

Business ownership



10% of STEM PhDs owned a business compared to 23% of non-STEM PhDs.

A PhD can provide an earning premium



In every STEM field, higher proportions of PhDs earned in the top income bracket compared to bachelor graduates.

Source: Australian Bureau of Statistics, Australian Census of Population and Housing, 2006 and 2011.

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CHAPTER 1

INTRODUCTION

1

INTRODUCTION

Australia's future will rely on science, technology, engineering and mathematics (STEM)—disciplines at the core of innovation. Our businesses will rely on STEM to compete in the emerging sectors that new technologies will create, as well as in the existing sectors which new technologies will transform. Our workforce will require specialised skills in STEM as well as high STEM literacy across the board to sustain economic growth.

We know that STEM will be critical; and yet we know very little about who possesses these skills in Australia, where they work or how their careers progress from graduation.

This report is a comprehensive overview of the data we have; and as such a measure of our capability for STEM-led change.

It is also a foundation for the important decisions which need to be made about the skills base we develop through public policy and individual action.

Preliminary data on the qualifications, industries, occupations and wages of STEM graduates was published in Appendix B of *Benchmarking Australian Science, Technology, Engineering and Mathematics*, (the Benchmarking report) (Office of the Chief Scientist, 2014). This report builds on the data presented in the Benchmarking report.

WHAT IS STEM?

STEM, or science, technology, engineering and mathematics, refers collectively to a broad field of distinct and complementary approaches to knowledge (Chief Scientist, 2014).

Each has a critical role to play in its own right, but also enables discovery and progress in other fields. While definitions vary, for the purposes of this document:

Science encompasses disciplines within the natural and physical sciences, and selected disciplines from agriculture and environmental studies: astronomy and the earth sciences, physics, chemistry, the materials sciences, biology, agricultural and environmental science. These sciences are characterised by systematic observation, critical experimentation, and the rigorous testing of hypotheses.

Technology provides goods and services to satisfy real world needs; operating at the cross-section of science and society. Information and communications technology is playing an ever increasing role in our society and provides enabling capacity to the other STEM disciplines. The output of the technology provided must eventually stand the test of users and the marketplace.

Engineering draws on scientific, mathematical and technological knowledge and methods to design and implement physical and information-based products, systems and services that address human needs, safely and reliably. Engineering takes into account economic, environmental, and aesthetic factors.

Mathematics seeks to understand the world by performing symbolic reasoning and computation on abstract structures and patterns in nature. It unearths relationships among these structures, and captures certain features of the world through the processes of modelling, formal reasoning and computation.

A STEM education does not merely impart content knowledge in these fields—it seeks to provide frameworks in which new problems can be tackled.

STEM graduates cite higher order skills in research, logical thinking and quantitative analysis as the return on their degrees; alongside the qualities of creativity, open-mindedness, independence and objectivity.

WHY STEM?

WHY IS STEM IMPORTANT TO AUSTRALIA?

Science, research and innovation are widely recognised as key to boosting productivity, creating more and better jobs, enhancing competitiveness and growing an economy (Bell, et al., 2014).

Their importance has been accepted in mainstream economic theory for some time, despite the difficulties of quantifying phenomena so pervasive and dynamic in the modern world. In the US, scientific and technological advances were estimated to account for roughly half of all national economic growth in the 50 years to 2004 (Jobs for the Future, 2005). More recently, a number of studies on the impact of specific STEM fields on the economies of Australia, Italy, the Netherlands and the United Kingdom have revealed the significant contribution of these fields. As summarised in Table 1.1 below, it is estimated that the advanced sciences (biological, physical and mathematical sciences) directly underpinned around 14 per cent of Australian economic activity in 2012-13 (Australian Academy of Science, 2016). When flow on effects are considered, the impact of these STEM fields amounts to over 26 per cent of Australian economic activity, or about $330 billion per year. (Australian Academy of Science, 2016).

The data in Table 1.1 has been extrapolated to suggest that in advanced economies, advanced science directly underpins between 10 per cent and 15 per cent of economic activity, and this relationship is independent of the overall structure of the economy (Australian Academy of Science, 2015).

The critical engine of this growth is a workforce equipped with STEM skills and knowledge.

Table 1.1: Direct economic impact of selected STEM fields

Economy	Fields investigated	Size of science-based sector (share of economy)	Source
Australia	Physics, chemistry, mathematics, earth sciences, biological sciences	14 per cent	Australian Academy of Science, 2015
Italy	Physics	7 per cent	Deloitte, 2014
Netherlands	Mathematics	10 per cent	Deloitte, 2014
UK	Physics	9 per cent	Deloitte, 2012

Adapted from Australian Academy of Sciences (2015), Table 11.1

WHY ARE STEM SKILLS VALUABLE?

STEM skills are critical to the management and success of R&D (research and development) projects as well as the day-to-day operations of competitive firms.

They are the lifeblood of emerging knowledge-based industries—such as biotechnology, information and communications technology (ICT) and advanced manufacturing—and provide competitive advantage to established industries—such as agriculture, resources and healthcare.

Strong performance in STEM is also critical to our education sector—now Australia's fourth largest export industry.

An education in STEM also fosters a range of generic and quantitative skills and ways of thinking that enable individuals to see and grasp opportunities. These capabilities—including deep knowledge of a subject, creativity, problem solving, critical thinking and communication skills—are relevant to an increasingly wide range of occupations. They will be part of the foundation of adaptive and nimble workplaces of the future (Chief Scientist, 2014).

The importance of STEM skills to the prosperity of economies is not only recognised by governments, but also by employers.

The Australian Industry Group reports:

"Australia's productivity and competitiveness is under immense pressure. A key way to meet the emerging challenge of developing an economy for the 21st Century is to grow our national skills base – particularly the Science, Technology, Engineering and Mathematics (STEM) skills of our school leavers. Our relative decline of STEM skills is holding back our national economy and causing real frustration for employers." (Australian Industry Group, 2013).

The relationship between STEM skills, innovation and competitiveness is well documented. Businesses that report using these skills are 33 per cent more productive than those that do not (Palangkaraya, Spurling, & Webster, 2014). Innovative businesses and exporters have significantly higher use of STEM skills than non-innovators (Office of the Chief Economist, 2014). It is estimated that labour productivity in the advanced physical and mathematical sciences sector is 75 per cent higher than productivity in other parts of the economy (Australian Academy of Science, 2015).

In a recent survey of employers, respondents agreed that people with STEM qualifications are valuable to the workplace, even when their qualification is not a prerequisite for the role. Employers value the workplace skills that STEM-qualified employees offer, particularly in providing innovative solutions and their ability to adapt to changes in the workplace (Deloitte Access Economics, 2014). This reflects the value of the generic or transferable skills that an education in STEM fosters.

In addition to the benefits of specialised STEM skills, a general understanding of scientific ideas and technologies is increasingly important to enable individuals to participate fully in the modern workplace. As the Royal Society has observed, "*science and mathematics are at the absolute heart of modern life. They are essential to understanding the world and provide the foundations for the UK's future economic prosperity*" (The Royal Society Science Policy Centre, 2014).

Similar sentiments are expressed in many other advanced economies of the world and most OECD and G20 countries have policies in place to develop their STEM skills base.

ABOUT THIS REPORT

This report is divided into two parts. To plan for future STEM skill demand, we first need to evaluate the current STEM-qualified population in Australia. **Part One** analyses the demographic characteristics and employment outcomes of STEM skilled people in Australia.

To plan for the future, students, policy-makers, industry and universities need an understanding of the employment prospects of STEM graduates and which industries employ graduates in what occupations. **Part Two** investigates and compares the workforce destinations of graduates from different STEM fields.

DEFINING THE STEM-SKILLED WORKFORCE

In this report, the term 'post-secondary qualifications' includes qualifications obtained at the following levels as defined in the Census Dictionary (ABS, 2011b):

- Doctoral degree
- Masters degree
- Graduate diploma and graduate certificate
- Bachelor degree
- Advanced diploma and diploma
- Certificate III & IV

Certificate to advanced diploma qualifications are grouped as vocational education and training (VET) qualifications, while the remainder are grouped as Higher Education, or university qualifications.

In **Part One** of this report the term **STEM-qualified** refers to those members of the Australian population with a post-secondary qualification at the level of Certificate III or above in any of the following fields of education as defined by the Australian Standard Classification of Education (ASCED) (ABS, 2001):

- Natural and Physical Sciences (NPS)
- Information Technology (IT)
- Engineering and Related Technologies (ERT)
- Agriculture, Environment and Related Studies (AERS)

The field of Mathematical Sciences has been extracted from the Natural and Physical Sciences.

Table 1.2: Terms used in this report to describe the STEM fields

STEM component	Discipline	ASCED field
S	Science	Natural and Physical Sciences (excluding Mathematical Sciences)
	Agriculture and Environmental Science	Agriculture, Environmental and Related Studies
T	Information Technology, or IT	Information Technology
E	Engineering	Engineering and Related Technologies
M	Mathematics, or maths	Mathematical Sciences

The term **Non-STEM-qualified** refers to people with post-secondary qualifications in all other fields, including mixed fields programs.

Appendix A provides a summary of the STEM fields of education which are referred to in this report. A comprehensive list of the fields of education and the corresponding Higher Education and Vocational Education and Training (VET) discipline groups can be found in the Australian Standard Classification of Education (ABS, 2001).

For the purposes of this analysis, terms used to describe the STEM fields have been simplified from the ASCED fields and aligned to the component parts of STEM as outlined in Table 1.2.

This report does not include qualifications in Health in the definition of STEM. However, it is a closely related field and is often included in other, broader definitions. It is important to note that the field of Other Natural and Physical Sciences (which is included in this report) is comprised of Medical Science, Forensic Science, Food Science and Biotechnology and Pharmacology, Laboratory Technology, and Natural and Physical Sciences not elsewhere classified.

In **Part Two** of this report the term **STEM graduates** refers to the population with a higher education qualification at the bachelor degree level or higher in any of the STEM ASCED fields outlined above. The term **Non-STEM graduates** refers to people with higher education qualifications in all other fields, including mixed fields programs.

The term **graduates** does not include those with vocational education and training, or VET, qualifications—those with an advanced diploma or below.

The qualification level and field of education are self-reported by individuals in the Australian Bureau of Statistics (ABS) Census of Population and Housing. The 2006 and 2011 Census of Population and Housing captured information on respondents' highest qualification only. Therefore, it is likely that this data does not include all people with post-secondary qualifications in STEM fields, as some people will have higher qualifications in Non-STEM fields, such as a Master of Business Administration (MBA). Analysis of the 2010-11 Learning and Work report; however, indicated that approximately 90 per cent of those with STEM qualifications at the level of Certificate III and above reported it as their highest post-secondary qualification (ABS, 2014) (ABS, 2012).

DEFINING INDUSTRIES AND OCCUPATIONS

Australian industries are classified through the Australian and New Zealand Standard Industrial Classification (ANZSIC), where an individual business entity is assigned to an industry based on its predominant activity (ABS, 2006a). The ANZSIC is a hierarchical classification with four levels: Divisions (the broadest level, 1-digit), Subdivisions (2-digit), Groups (3-digit) and Classes (the finest level, 4-digit). **Appendix B** provides a summary of the specific industry levels that are referred to in this report.

Occupation data are classified according to the Australian and New Zealand Standard Classification of Occupations (ANZSCO); a skill-based classification used to classify all occupations and jobs in the Australian and New Zealand labour markets (ABS, 2013). ANZSCO has five hierarchical levels grouped on the basis of their similarities in terms of both skill level and skill specialisation. The broadest level, major group, is denoted by a 1-digit code, followed by sub-major group (2-digit), minor group (3-digit), unit group (4-digit), and the most detailed level, occupations, which are denoted by a 6-digit code. **Appendix C** provides a summary of the specific occupation levels that are referred to in this report.

Both industries and occupations are self-reported by individuals in the ABS Census of Population and Housing.

DEFINING LABOUR FORCE CHARACTERISTICS

Employed people are defined as those aged 15 years and over who worked for payment or profit, or as an unpaid helper in a family business, during the week prior to Census night, or had a job from which they were on leave or otherwise temporarily absent.

Unemployed people are those aged 15 years and over who were not employed during the week prior to Census night and had actively looked for work in the previous four weeks and were available to start work in the week prior to Census night.

Persons not in the labour force are defined as people aged 15 and over who were neither employed nor unemployed, as defined above.

The **employment to population ratio** is calculated as the number of people employed as a percentage of the total population for that particular group.

The **unemployment rate** is calculated as the number of unemployed people as a percentage of the labour force (i.e. employed and unemployed).

DATA SOURCES

The information presented in this report was collected from the following ABS reports:

- The Census of Population and Housing, 2006 and 2011 (ABS, 2006b) (ABS, 2011c)
- Learning And Work, Australia, 2010-11 (ABS, 2012)
- Australian Census Longitudinal Dataset, 2006–2011 (ABS, 2011a)

The information in this report was also compiled from several internal projects commissioned by the Office of the Chief Scientist to the ABS.

PART 1

AUSTRALIA'S STEM CAPABILITY

To prepare for a future in which STEM will be pervasive, Australia must ensure that it has a suitably qualified population from which a skilled and adaptable workforce can be drawn.

The following chapters report on the characteristics of the STEM-qualified Australian population compared to the population with qualifications in Non-STEM fields.

Chapter 2 covers broad demographic trends, including the number, age and distribution of the STEM-qualified population in Australia.

Chapter 3 reports on employment outcomes, such as employment status, the industries and occupations of employment, business ownership and salaries.

CHAPTER 2

DEMOGRAPHICS OF AUSTRALIA'S STEM-QUALIFIED POPULATION

2

DEMOGRAPHICS OF AUSTRALIA'S STEM-QUALIFIED POPULATION

KEY FACTS

1. In 2011, there were 2.3 million people with STEM qualifications in Australia, and 5.7 million people with Non-STEM qualifications.
2. Of the STEM-qualified population, approximately two thirds held Vocational Education and Training (VET) qualifications, while one third were higher education graduates with bachelor degrees or higher.
3. Of the 1 117 011 people with certificate III and IV qualifications, just over one million had Engineering qualifications.
4. The gender distribution of people with STEM qualifications was highly skewed, with males making up 84 per cent of the total.
5. Thirty-five per cent of people with STEM and 31 per cent of people with Non-STEM qualifications living in Australia were born elsewhere, but there are differences across the different STEM disciplines.
6. Between 2006 and 2011, the number of STEM-qualified individuals in Australia grew by 15 per cent, while the number of Non-STEM-qualified individuals grew by 26 per cent.
7. The age of the STEM-qualified population varied across the disciplines; for example, almost half (49 per cent) of the Information Technology qualified population was under the age of 34, compared to one third (33 per cent) of the Non-STEM, and 29 per cent of the STEM-qualified population.

HOW MANY STEM-QUALIFIED PEOPLE ARE THERE IN AUSTRALIA?

In 2011, there were approximately 8 million people in Australia aged 15 years or over with a post-secondary qualification at the certificate III level or above. Amongst those where the field of qualification was identifiable, 2.3 million qualifications (28 per cent) were in STEM fields (Table 2.1). The majority of post-secondary qualifications (5.7 million, 72 per cent) were from Non-STEM fields. 7.6 million people aged 15 years and over did not have a post-secondary qualification in 2011.

Of the 2.3 million people with STEM qualifications in Australia, 8 per cent had a postgraduate degree (doctorate or masters) as their highest level of education, 25 per cent a bachelor degree or graduate diploma, 12 per cent a diploma or advanced diploma, and 55 per cent a certificate III or IV (Table 2.1).

The number of people and level of qualification varies significantly across the different STEM fields (Table 2.1, Figure 2.1 and Figure 2.2). Two thirds of the total STEM-qualified population had a qualification in Engineering, the majority (82 per cent) of whom held vocational level qualifications.

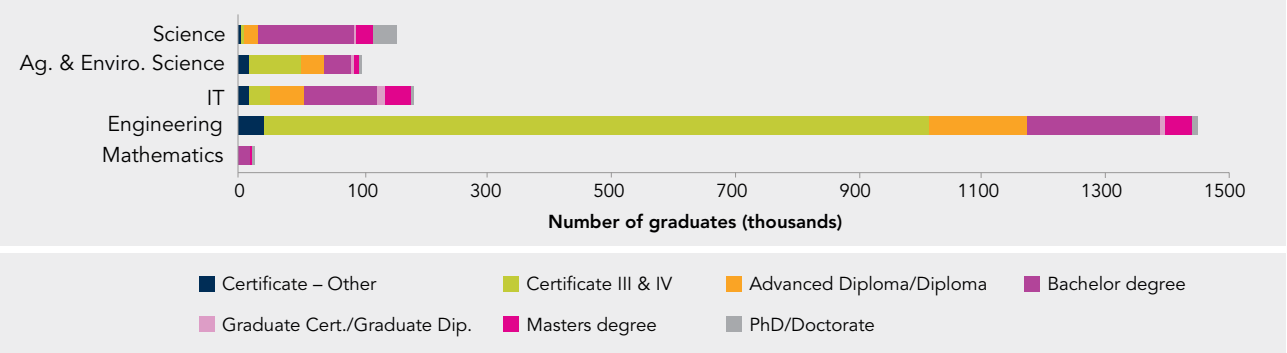
Mathematics was the STEM field with the fewest qualified people (just over 27 000). It was the field with the lowest percentage of people with VET qualifications and the highest proportion of people with qualifications at the bachelor level and above, at 95 per cent.

Table 2.1: Australian population with post-secondary qualifications, by field and level

	Science	Ag. & Enviro. Science	Information Technology	Engineering	Mathematics	Total STEM	Total Non-STEM
Doctorate	34 050	2 911	2 914	10 634	2 762	53 271	62 825
Masters degree (a)	23 997	8 444	38 662	39 686	3 873	114 662	390 200
Graduate Certificate/ Diploma	5 127	3 285	11 567	6 708	1 074	27 761	266 743
Bachelor degree	143 644	38 440	107 768	200 356	17 960	508 168	1 769 902
Higher education subtotal	**206 818**	**53 080**	**160 911**	**257 384**	**25 669**	**703 862**	**2 489 670**
Advanced Diploma/ Diploma	20 898	36 829	55 745	149 327	784	263 583	1 102 289
Certificate III & IV	6 350	77 126	27 396	1 006 009	130	1 117 011	1 409 918
Certificate–Other	5 804	20 580	20 881	41 347	195	88 807	379 011
VET subtotal	**33 052**	**134 535**	**104 022**	**1 196 683**	**1 109**	**1 469 401**	**2 891 218**
TOTAL (b)	**239 870**	**187 615**	**264 933**	**1 454 067**	**26 778**	**2 173 263**	**5 380 888**
Level inadequately described	3 942	4 044	9 602	30 130	200	47 918	188 964
Level not stated	2 000	4 587	3 389	25 743	171	35 890	133 091
TOTAL	**245 812**	**196 246**	**277 924**	**1 509 940**	**27 149**	**2 257 071**	**5 702 943**

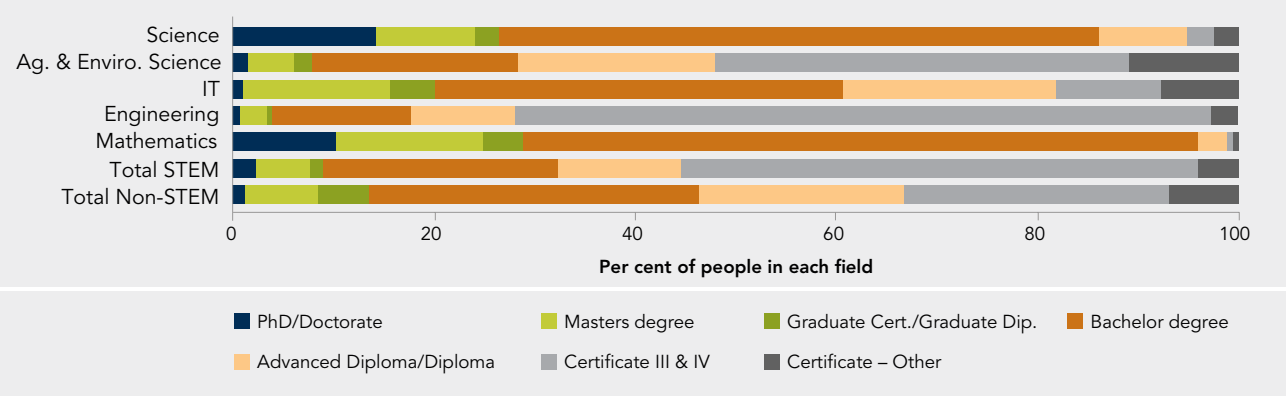
Note: (a) Includes 'Postgraduate level not further defined'. (b) This total includes only those whose level of highest post-secondary qualification was both stated and adequately described. The number of respondents whose response was inadequately described or not stated is significant, and is displayed in the following rows as well as included in the total. As there are some people with qualifications in more than one STEM field, some people will be included in more than one row.

Figure 2.1: Australian STEM-qualified population, by field and level



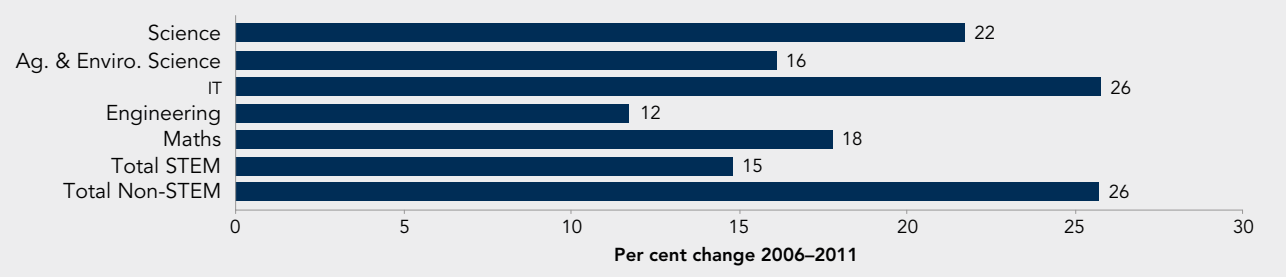
Note: The values in the above graph do not include respondents with inadequately described or not stated level of education and thus the numbers in this graph are different from those in Table 2.1. Respondents with qualifications in more than one STEM field will be included in more than one data point.

Figure 2.2: Australian population with post-secondary qualifications, by field and level as a percentage of the total in each field



Note: The numbers in this graph are different those in Table 2.1 due to inadequately described or not stated level of education. As there are some people with qualifications in more than one STEM field, some people will be included in more than one column.

Figure 2.3: Percentage change in the number of people living in Australia with post-secondary qualifications, by field, 2006 to 2011



From 2006 to 2011, the number of STEM-qualified people grew by 15 per cent, while the number of people with Non-STEM qualifications grew by 26 per cent (Figure 2.3). Among the STEM fields, the highest growth was in IT at 26 per cent, while the lowest growth was in Engineering at 12 per cent.

WHAT ARE THE PROPORTIONS OF MALE AND FEMALE STEM-QUALIFIED PEOPLE IN AUSTRALIA?

In 2011, 84 per cent of people with a STEM qualification were male. Females made up the majority of people with Non-STEM qualifications, at 61 per cent. The gender distribution varied across the different STEM fields and levels of qualification (Figure 2.4). The gender distribution in Science was approximately equal with 51 per cent males and 48 per cent females. The field with the most uneven gender distribution was Engineering, at 93 per cent males; which is reduced slightly to 88 per cent when considering only those with university level qualifications.

Between 2006 and 2011, the number of females with STEM qualifications increased by 23 per cent, which exceeded the growth for males at 14 per cent (Figure 2.5). The largest difference was in the number of females who had qualifications at the bachelor level and above (35 per cent growth for females, 29 per cent growth for males). The rate of growth at the certificate to advanced diploma level was significantly higher for Non-STEM compared to STEM qualifications for both males and females.

Notwithstanding the changes in the number of graduates, the proportion of females with VET level STEM qualifications was the same in 2006 and 2011 at 9 per cent (91 per cent males in VET). Amongst the population with university level STEM qualifications, the proportion of females increased slightly from 2006 to 2011 from 28 to 29 per cent, thus resulting in the male population decreasing from 72 to 71 per cent.

Figure 2.4: Gender distribution of post-secondary qualifications, by field and level

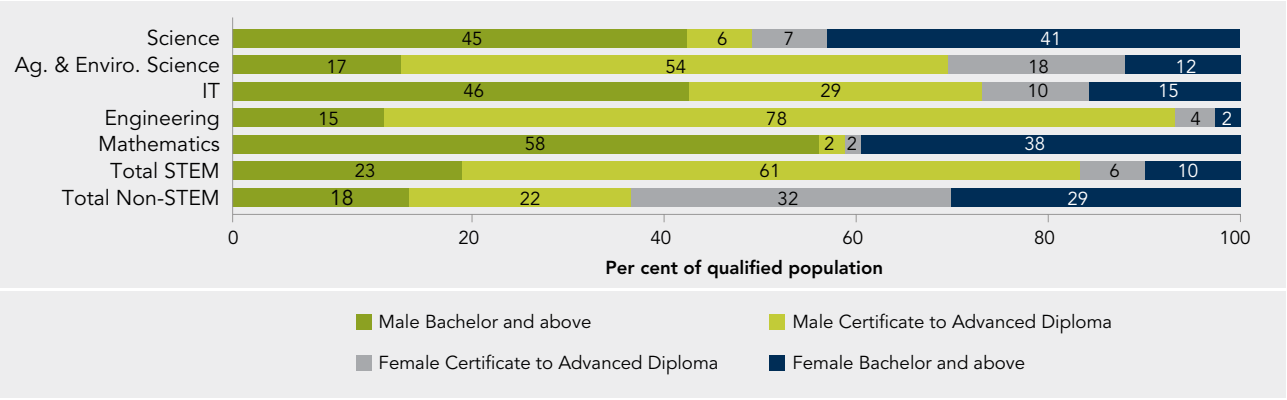


Figure 2.5: Percentage change in the number of people living in Australia with post-secondary qualifications, by gender, field and level, 2006 to 2011

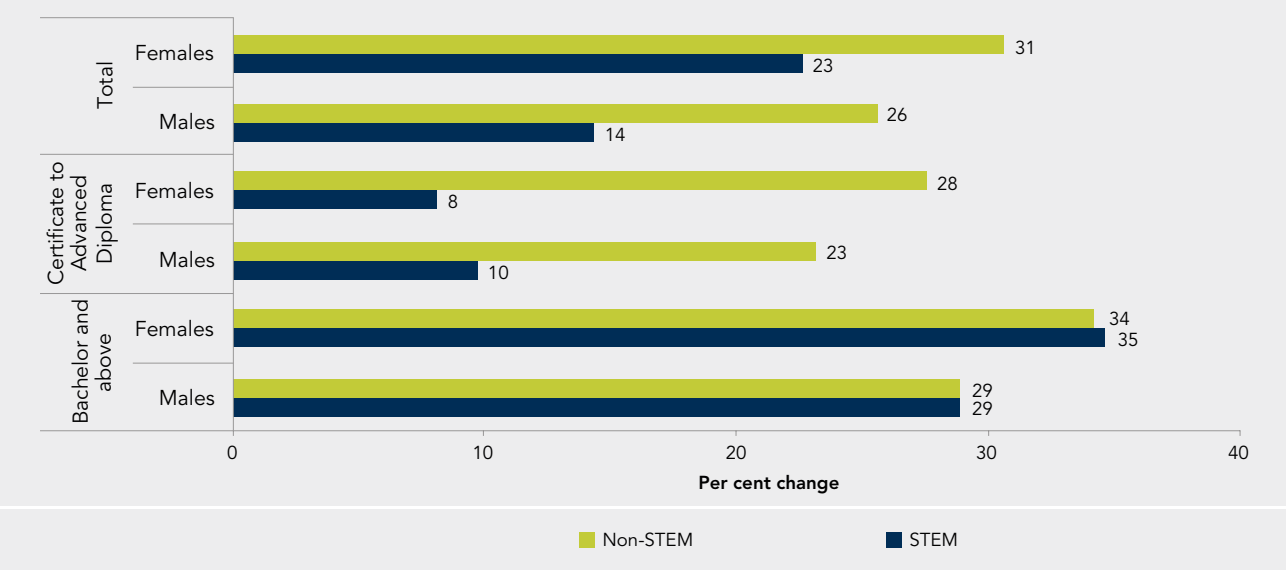
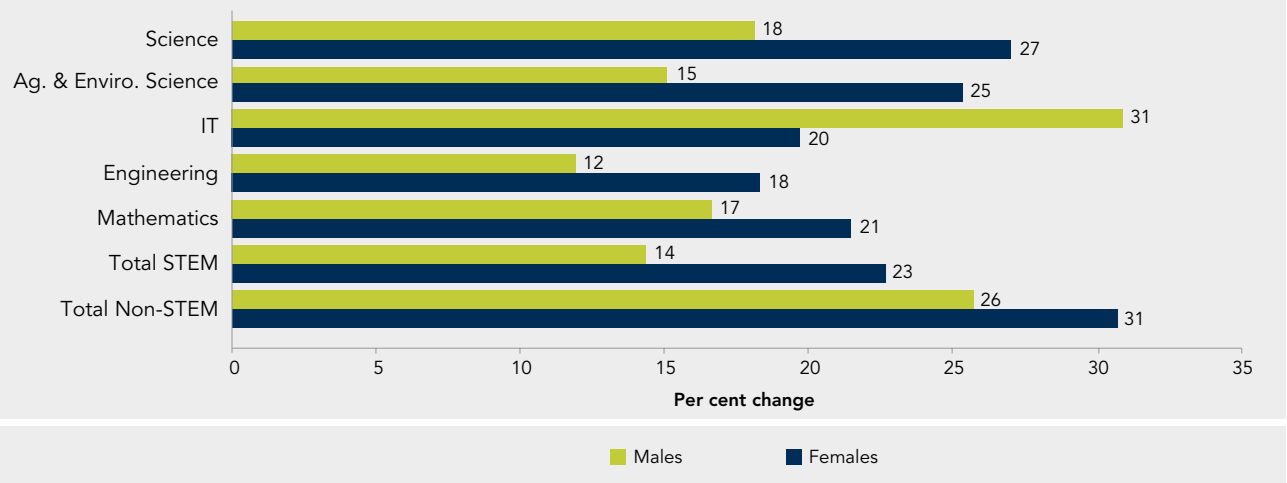


Figure 2.6: Percentage change in post-secondary qualifications, by gender and field, 2006 to 2011



The percentage growth in the number of females who had post-secondary qualifications was higher than males across all fields except IT (Figure 2.6).

WHERE DO STEM-QUALIFIED PEOPLE LIVE IN AUSTRALIA?

In 2011, ten per cent of the total population of Australia had STEM qualifications, while 27 per cent had Non-STEM qualifications. Just under one third of STEM-qualified people lived in New South Wales, a further quarter lived in Victoria and one fifth in Queensland (Figure 2.7). The distribution of STEM and Non-STEM-qualified people was similar across Australia.

The number of STEM-qualified people as a percentage of population in each state or territory varied from 12 per cent in the Australian Capital Territory and Western Australia to 9 per cent in the Northern Territory (Table 2.2). The Australian Capital Territory had the equal highest percentage of STEM-qualified people and the highest percentage of Non-STEM-qualified people; however it had the lowest ratio of STEM to Non-STEM-qualified people in Australia at 0.37.

The rate of change in the number of people with qualifications in Non-STEM fields exceeded that of STEM fields across all states and territories from 2006 to 2011 (Figure 2.8). The highest increase in STEM qualifications was in Western Australia at 25 per cent, while the lowest was in New South Wales and South Australia, both at 10 per cent.

Figure 2.7: Distribution of people with post-secondary qualifications across Australia, by field and state or territory of usual residence

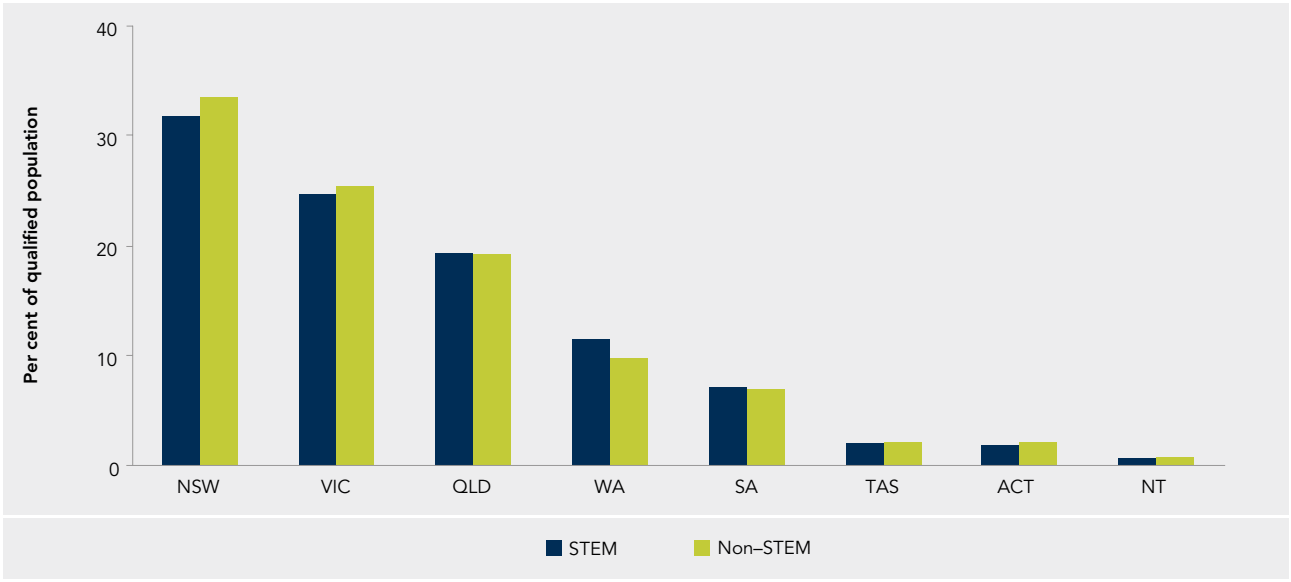
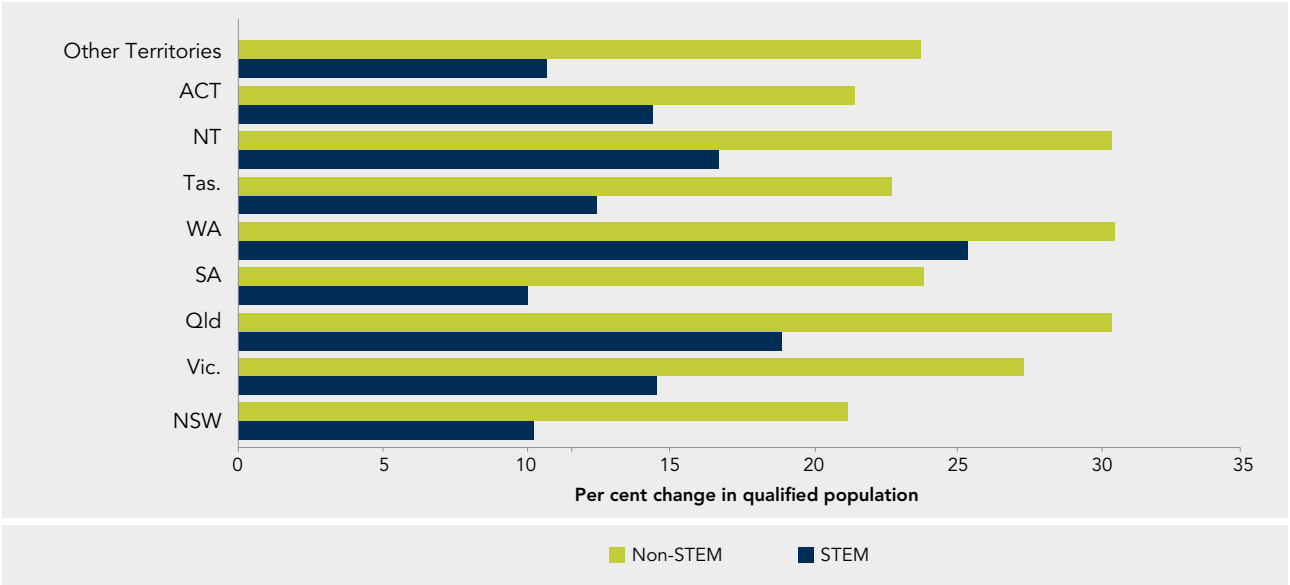


Table 2.2: Field of highest post-secondary qualification and percentage of total population, by state or territory of usual residence

	Total STEM	Total Non-STEM	Total population	Total STEM as per cent of population	Non-STEM as per cent of population	Ratio of STEM: Non-STEM
NSW	719 322	1 909 942	6 917 656	10	28	0.38
Vic.	559 126	1 453 624	5 354 040	10	27	0.38
Qld	436 819	1 090 494	4 332 737	10	25	0.40
SA	164 330	397 793	1 596 570	10	25	0.41
WA	264 755	563 503	2 239 171	12	25	0.47
Tas.	48 431	120 263	495 351	10	24	0.40
NT	19 975	46 093	211 943	9	22	0.43
ACT	44 079	120 755	357 218	12	34	0.37
Other Territories	236	473	3031	8	16	0.50
Total Australia	**2 257 073**	**5 702 940**	**21 507 717**	**10**	**27**	**0.40**

Figure 2.8: Percentage change in post-secondary qualifications, by field and state or territory of usual residence, 2006 to 2011



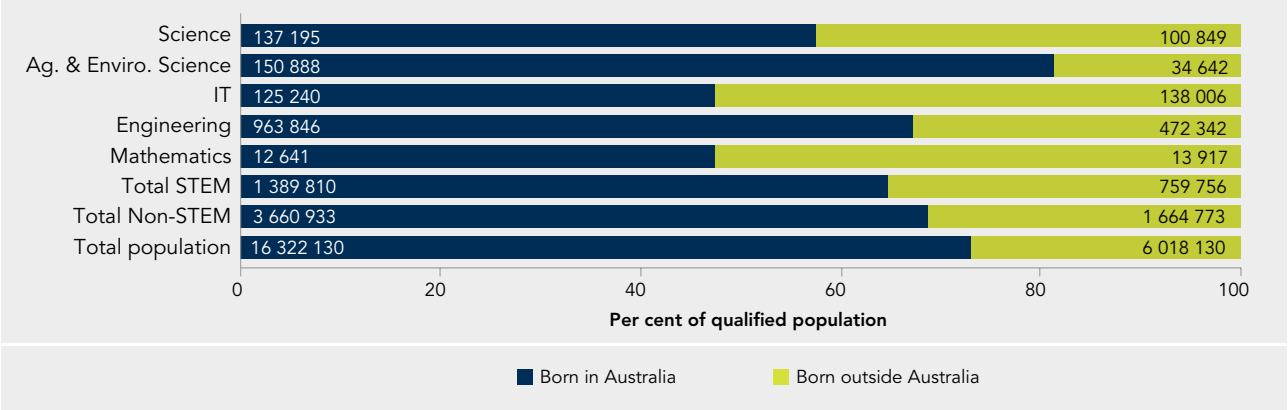
HOW MANY STEM-QUALIFIED PEOPLE LIVING IN AUSTRALIA ARE IMMIGRANTS?

The percentage of people in Australia with post-secondary qualifications who were born outside of Australia was similar for STEM and Non-STEM fields at 35 per cent and 31 per cent respectively, and slightly higher than the percentage of people in the total population of Australia born overseas, at 27 per cent (Figure 2.9) (ABS, 2015). The proportion varied across the different STEM fields: Agriculture and Environmental Science was the only field with a lower proportion of people born overseas than the total Australian population (19 per cent), while the majority of people with qualifications in IT and Mathematics were born overseas (both at 52 per cent).

HOW OLD ARE THE STEM-QUALIFIED PEOPLE IN AUSTRALIA?

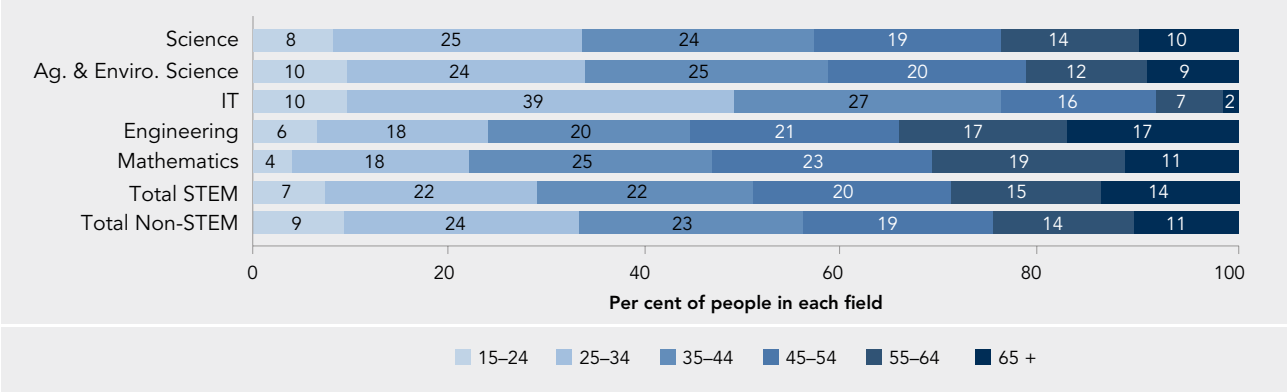
The age profile of people with STEM and Non-STEM qualifications by field is shown in Figure 2.10. Across the total STEM-qualified population, 49 per cent were aged 45 years or older. However, this varied across fields with 25 per cent of IT qualified people aged 45 years or older, while for Engineering it was 55 per cent.

Figure 2.9: Australian population with post-secondary qualifications, by field and country of birth



Note: These totals include only those where the country of birth was both stated and adequately described.

Figure 2.10: Age profile by proportion of people in each age group, by field of highest post-secondary qualification



From 2006 to 2011, there was a large increase in the percentage of STEM-qualified people aged 65 years and above, with an average increase of 52 per cent across fields (Figure 2.11 and Table 2.3). This is compared to an average increase of 14 per cent for 25-34 year olds. There was a large decline in the number of people aged 15-24 years with IT qualifications (down 30 per cent, or 11 000 from 2006 to 2011). For the same age group, there was also a decline in Mathematics (2 per cent) and Agriculture and Environmental Science (7 per cent).

It is important to note that Figure 2.11 shows the percentage change in the number of qualified people in each age group from 2006 to 2011. The absolute numbers are shown in Table 2.3, and show that while IT had the largest percentage growth in people aged 65 and above, it had the smallest absolute growth at 2288 people. Conversely, Engineering had the smallest percentage growth for this age group at 25 per cent, but the largest absolute growth, at 50 598 people.

Figure 2.11: Percentage change in STEM-qualified population, by field and age group, 2006 to 2011

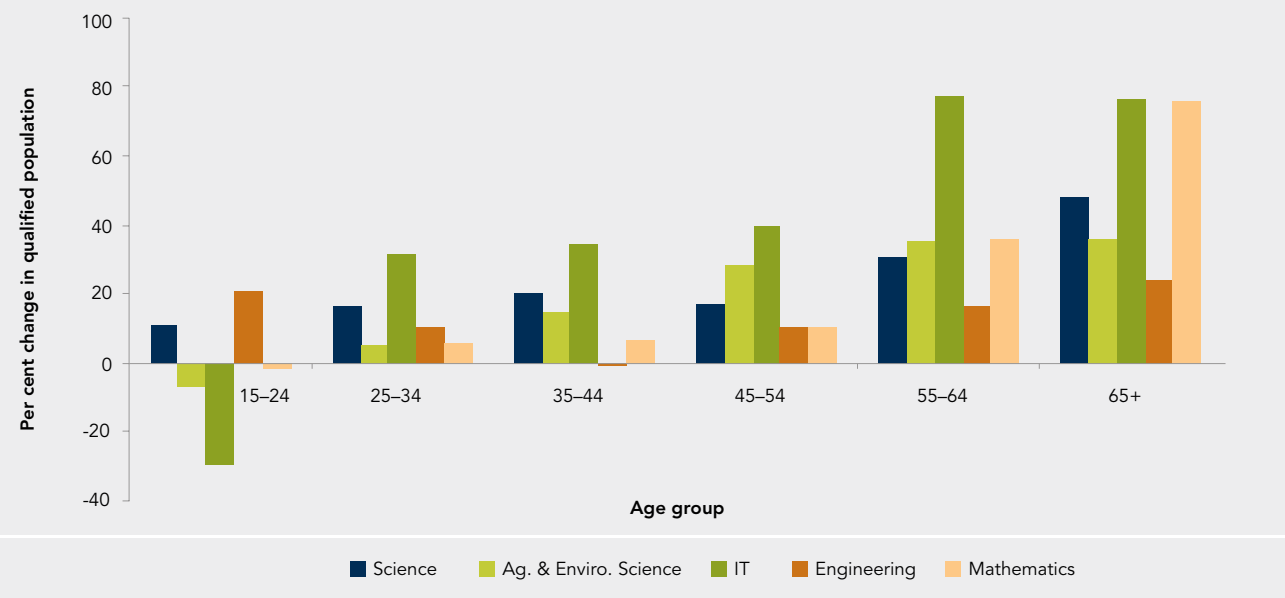


Table 2.3: Absolute change in post-secondary qualifications, by field and age group, 2006 to 2011

Age group	Science	Ag. & Enviro. Science	IT	Engineering	Mathematics	Total STEM	Total Non-STEM
15-24	1 983	-1 381	-11 267	16 372	-23	5 684	81 628
25-34	8 692	2 327	25 987	24 773	276	62 055	293 033
35-44	9 735	6 328	19 318	-338	421	35 464	251 032
45-54	6 828	8 706	12 392	30 654	582	59 162	158 966
55-64	7 983	6 280	8 226	36 761	1 399	60 649	214 365
65+	8 632	4 952	2 288	50 598	1 442	67 912	167 692
Total	**43 853**	**27 212**	**56 944**	**158 820**	**4 097**	**290 926**	**1 166 716**

CHAPTER 3

EMPLOYMENT STATUS OF AUSTRALIA'S STEM-QUALIFIED POPULATION

3

EMPLOYMENT STATUS OF AUSTRALIA'S STEM-QUALIFIED POPULATION

KEY FACTS

1 EMPLOYMENT OF STEM-QUALIFIED PEOPLE IN AUSTRALIA

- The unemployment rate for STEM-qualified people was 3.7 per cent, lower than the unemployment rate for those with Non-STEM qualifications, at 4.1 per cent.
- For males with STEM qualifications, the unemployment rate was lower than for males with Non-STEM qualifications across all age groups; the opposite was true for females, with higher rates of unemployment for STEM-qualified compared to Non-STEM- qualified females.
- The unemployment rate for females was higher than for males for both VET and university level qualifications in STEM. The unemployment rate for females with university level qualifications was 5.2 per cent compared to 3.5 per cent for males; and 6.3 per cent compared to 3.3 per cent, respectively for those holding VET level qualifications.
- For individuals with STEM qualifications who were born in Australia, the unemployment rate, at 3.1 per cent, was lower compared to those born overseas, at 4.8 per cent.

2 OCCUPATIONS OF STEM-QUALIFIED PEOPLE IN AUSTRALIA

- Across all STEM disciplines, the most common occupation was as Technician and Trades Workers (33 per cent), while one quarter worked as Professionals and 15 per cent worked as Managers.
- The most common occupations of STEM-qualified people differed depending on level of qualification:
  - For people with a university-level STEM qualification, the most common occupation for both males and females was as Professionals (56 per cent and 52 per cent, respectively).
  - For people with a VET-level STEM qualification, the most common occupation for males was as Technicians and Trades Workers (49 per cent), while for females the most common occupation was as Clerical and Administrative Workers (22 per cent).

3 INDUSTRIES OF EMPLOYMENT FOR STEM-QUALIFIED PEOPLE IN AUSTRALIA

- The most common industry of employment for STEM-qualified people was in Manufacturing, followed by Professional, Scientific and Technical Services, and Construction (17, 12 and 11 per cent, respectively).
- The most common industry of employment was different across the STEM fields:
  - Professional, Scientific and Technical Services was the most common industry for Science and IT (both at 17 per cent).
  - Those with qualifications in Mathematics were most likely to be employed in Education and Training (23 per cent).
  - Manufacturing was the top industry for Engineering qualification holders (22 per cent).
  - Individuals with Agriculture and Environmental Science qualifications were most commonly employed in the Agriculture, Forestry and Fishing industry (21 per cent).
- Eighty-five per cent of STEM-qualified people worked in the private sector compared to 77 per cent of Non-STEM-qualified people.

HOW MANY STEM-QUALIFIED PEOPLE ARE EMPLOYED IN AUSTRALIA?

Of the 2.3 million people with STEM qualifications in Australia in 2011, 1.7 million were employed—an increase of 14 per cent in the absolute number of people since 2006. The number of employed people with a Non-STEM qualification increased by 25 per cent over the same period—to a total of 4.2 million (Figure 3.1).

The largest increase in the number of employed people amongst the STEM fields was in IT, which increased by 25 per cent. The lowest increase was for Engineering and Mathematics, both at 11 per cent.

People with a STEM qualification were more likely to be working full-time than those with a Non-STEM qualification. More than four in five (84 per cent) of employed STEM-qualified people were working full-time, higher than those with Non-STEM qualifications (68 per cent). Males were more likely than females to be working full-time for both the STEM and Non-STEM-qualified workforce (88 per cent and 63 per cent, respectively (Figure 3.2).

HOW MANY UNEMPLOYED STEM-QUALIFIED PEOPLE ARE THERE IN AUSTRALIA?

There were approximately 65 500 unemployed STEM-qualified people in 2011. This group has increased approximately 25 per cent since 2006. Meanwhile, the number of unemployed people with Non-STEM qualifications increased by around 49 per cent to 183 400 over the same period. The largest increases in unemployment across the STEM fields were in Science and Mathematics (46 and 37 per cent, respectively), while Engineering had the smallest, at 22 per cent (data not shown).

Figure 3.1: Percentage change (bars) and absolute change (data labels) in employed people by field, 2006 to 2011

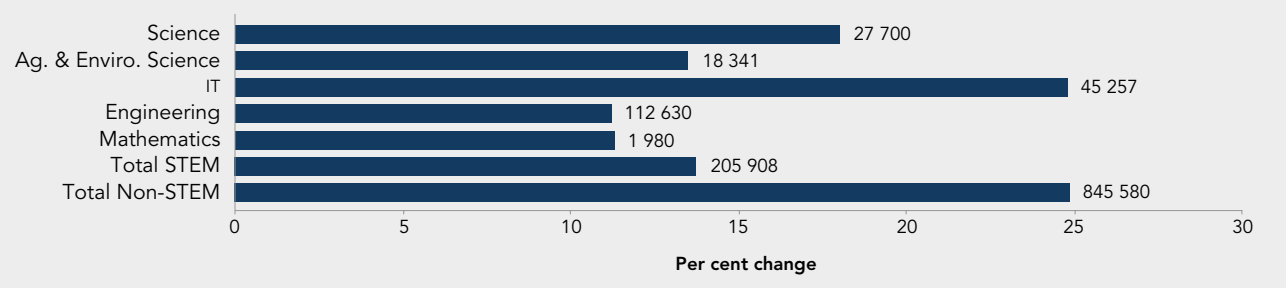
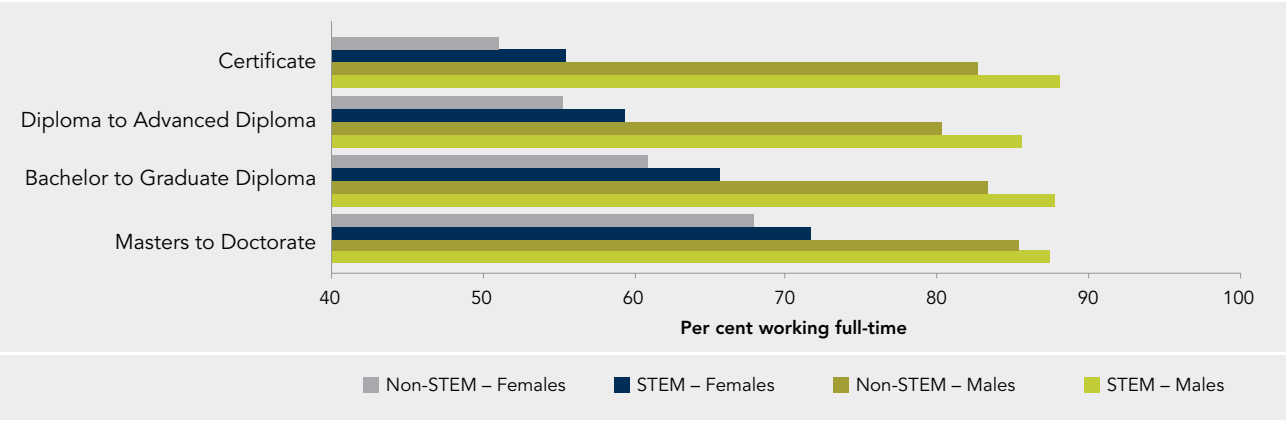


Figure 3.2: Percentage of employed people working full-time, by field, gender and level



HOW MANY STEM-QUALIFIED PEOPLE ARE NOT IN THE LABOUR FORCE IN AUSTRALIA?

In 2011, there were around 482 300 STEM-qualified people not in the labour force, 18 per cent more than in 2006. The number of Non-STEM-qualified people not in the labour force in 2011 was 1 256 100, a 27 per cent increase since 2006 (data not shown).

Within the STEM fields, the greatest increase in the number of people not in the labour force was among those with qualifications in Mathematics, IT and Science (40, 34 and 33 per cent, respectively) (data not shown).

HOW DOES THE EMPLOYMENT RATE OF STEM-QUALIFIED PEOPLE COMPARE ACROSS FIELDS?

In 2011, the unemployment rate of people with STEM qualifications was 3.7 per cent, and the unemployment rate for those with Non-STEM qualifications was 4.1 per cent. There was an increase in the unemployment rate across all fields between 2006 and 2011; however, the rate of increase was lower across the total STEM fields compared to Non-STEM fields (0.4 and 0.7 percentage points, respectively) (Figure 3.3).

Figure 3.3: Unemployment rate, by field, 2006 and 2011

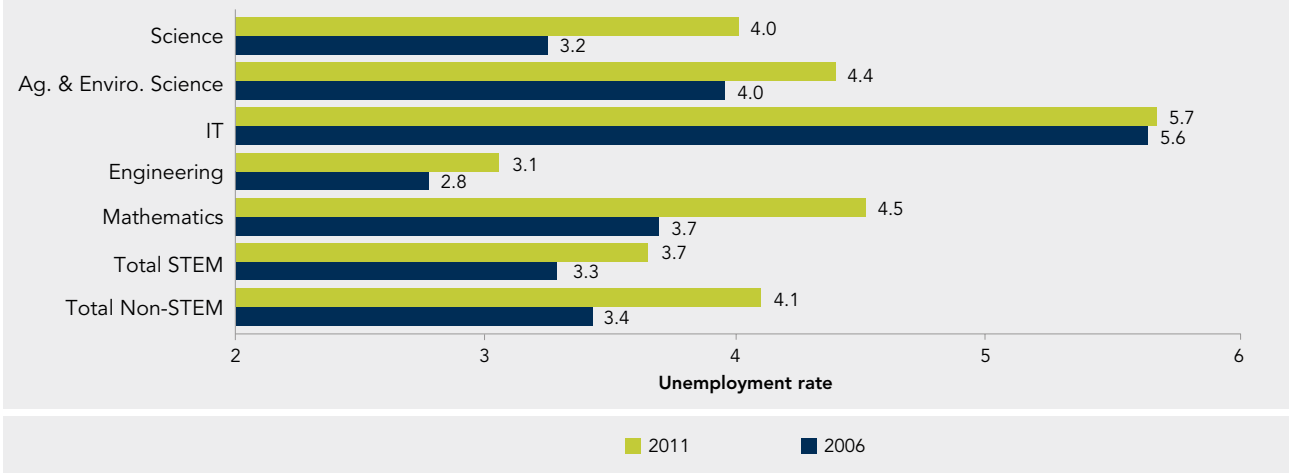


Figure 3.4: Unemployment rate, by field, level of qualification and gender

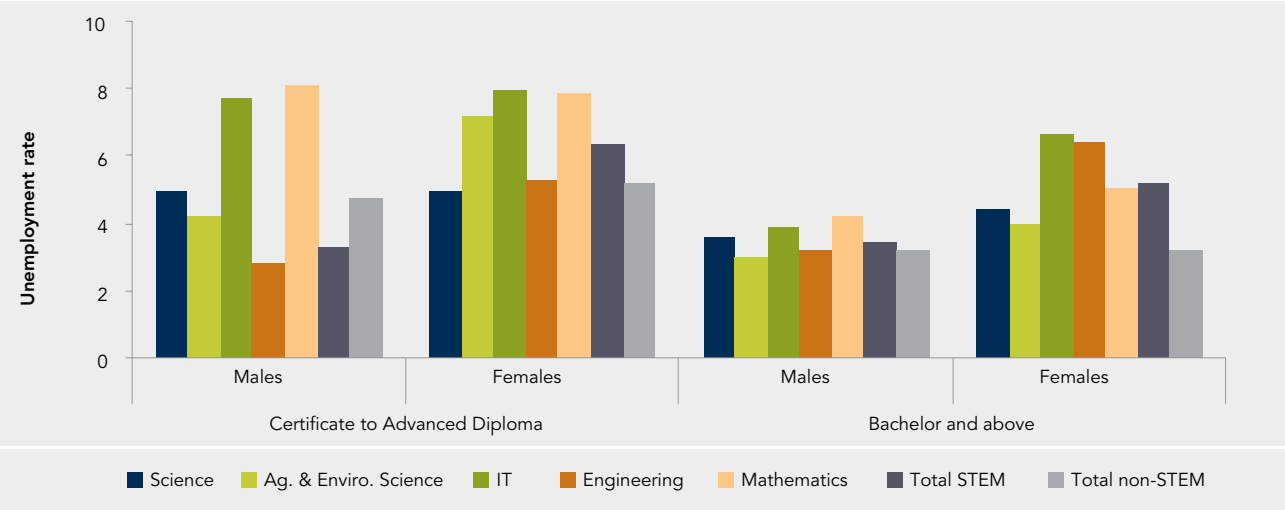
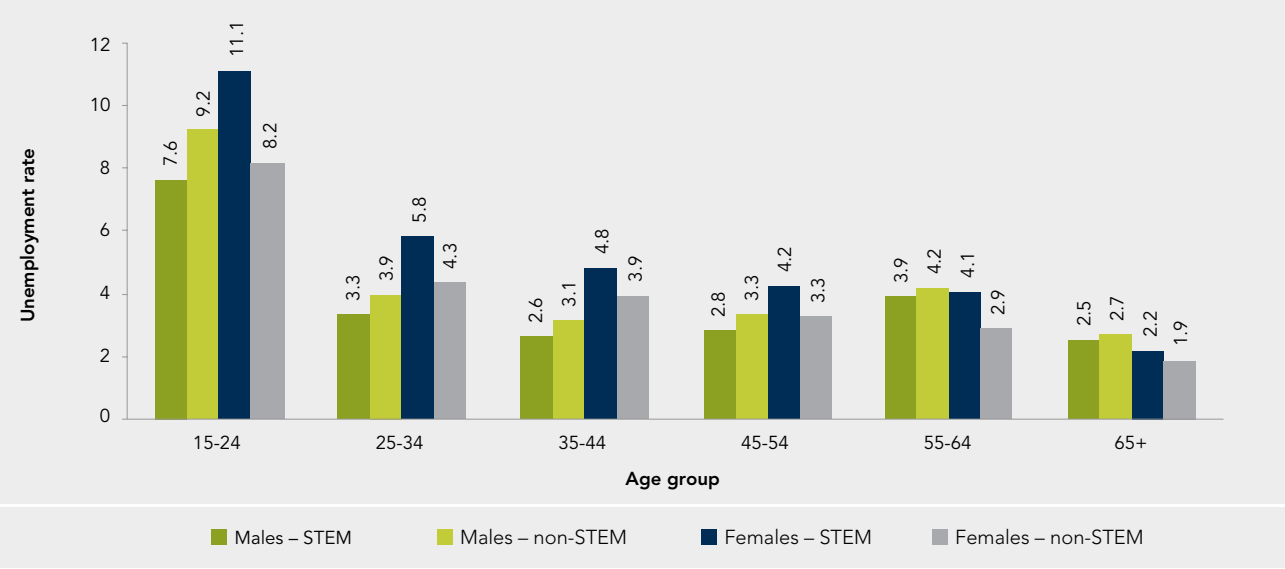


Figure 3.5: Unemployment rate, by field, age and gender



There were differences in the unemployment rate depending on gender and level of qualification (Figure 3.4). The unemployment rate for those with STEM qualifications was 5.2 per cent for females and 3.5 per cent for males with university level qualifications; and 6.3 per cent for females and 3.3 per cent for males with VET qualifications. The unemployment rate was higher among females than males across each STEM field at the university level; and all fields except Science and Mathematics at the VET level. The STEM field with the lowest unemployment at the university level was Agriculture and Environmental Sciences for both males and females (3.9 and 4.0 per cent, respectively). At the VET level, males with Engineering qualifications and females with Science qualifications had the lowest unemployment rate (at 2.9 and 5.0 per cent, respectively).

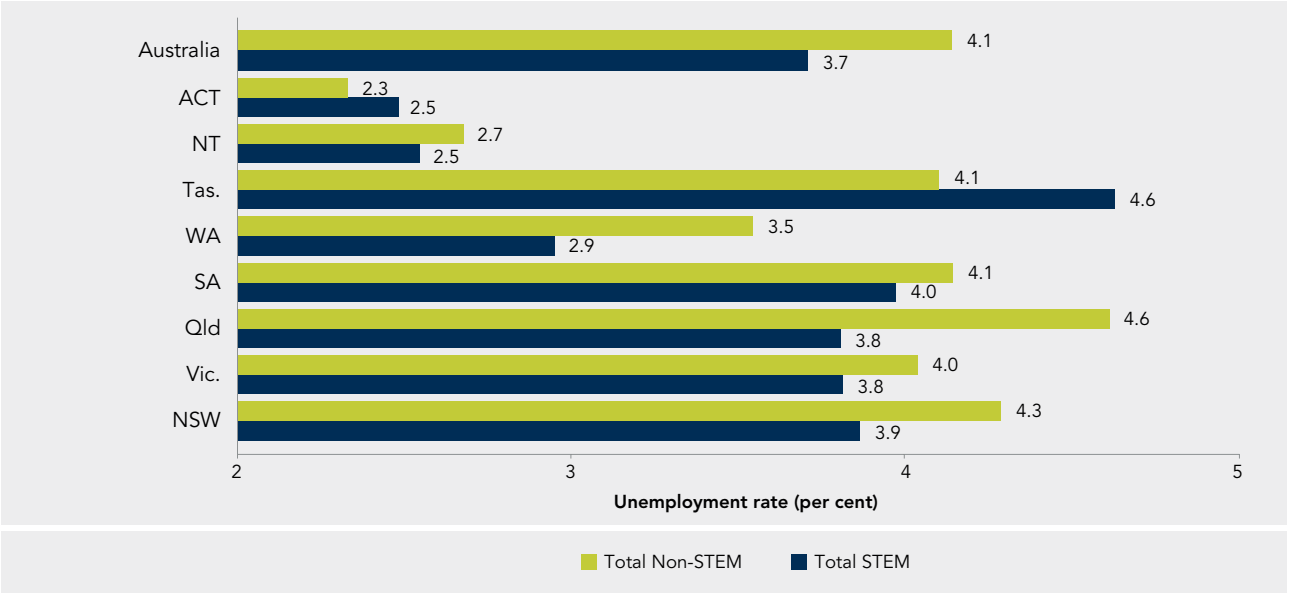
Across all age groups, the unemployment rate for males with STEM qualifications was lower than for those with Non-STEM qualifications. The opposite was true for females, with higher rates of unemployment for STEM-qualified females across all age groups (Figure 3.5).

Table 3.1: Unemployment rate, by state or territory of usual residence and field of highest post-secondary qualification (a)

	Science	Ag. & Enviro. Science	IT	Engineering	Mathematics	Total STEM	Total Non-STEM	Total population
NSW	4.3	4.3	5.8	3.2	4.4	3.9	4.3	5.2
Vic.	4.2	3.6	5.6	3.3	5.2	3.8	4.0	5.1
Qld	4.0	5.7	6.5	3.1	5.3	3.8	4.6	5.8
SA	4.4	4.7	6.4	3.4	4.0	4.0	4.1	5.8
WA	3.4	4.0	5.1	2.5	3.8	2.9	3.5	4.2
Tas.	4.2	5.4	8.9	4.0	3.9	4.6	4.1	5.2
NT	1.6	3.5	3.1	2.4	3.0	2.5	2.7	3.3
ACT	2.7	2.7	2.7	2.2	2.8	2.5	2.3	3.8
Australia (b)	4.0	4.4	5.7	3.1	4.6	3.7	4.1	5.1

Notes: (a) Of the population aged 15-64 years of those whose field of highest post-secondary qualification was both stated and adequately described.
(b) Includes 'Other territories'.

Figure 3.6: Unemployment rate, by state or territory of usual residence and field of highest post-secondary qualification



ARE EMPLOYMENT LEVELS OF STEM-QUALIFIED PEOPLE DIFFERENT ACROSS STATES AND TERRITORIES?

In 2011, the unemployment rate was lower for STEM-qualified people compared to those with Non-STEM qualifications across all states and territories, except for the ACT and Tasmania (Table 3.1 and Figure 3.6). For STEM-qualified people, the unemployment rate was lowest in the ACT and NT (2.5 per cent), and highest in Tasmania (4.6 per cent). There was some variation in employment across different STEM fields in different geographic areas; for example, Science in the Northern Territory had the lowest unemployment rate at 1.6 per cent, while IT in Tasmania had the highest unemployment rate at 8.9 per cent (Table 3.1 and Figure 3.6).

DOES THE PLACE OF BIRTH AND DATE OF ARRIVAL FOR IMMIGRANTS MAKE A DIFFERENCE TO THEIR EMPLOYMENT?

In 2011, the unemployment rate was lower for people born in Australia than for people born overseas (Figure 3.7). This was the case for both STEM and Non-STEM-qualified people across all levels and fields of qualification. The difference was largest for those with qualifications in Science, and least for people with IT qualifications.

The unemployment rate was lower among qualified people who arrived in Australia prior to 2006 compared to more recent arrivals, for all fields except for IT (Figure 3.8). Foreign-born people with an IT qualification who arrived in Australia prior to 2006 had lower unemployment rates compared to those who arrived more recently, or those born in Australia (4.5, 9.3 and 5.4 per cent, respectively). The unemployment rate for people with Engineering qualifications was the lowest across all fields and immigration comparisons.

Unfortunately, the Census does not include information on where the qualification was obtained, so no conclusions can be drawn regarding the location from where a qualification was obtained with employment outcomes.

Figure 3.7: Unemployment rate of people living in Australia with post-secondary qualifications, by field and place of birth

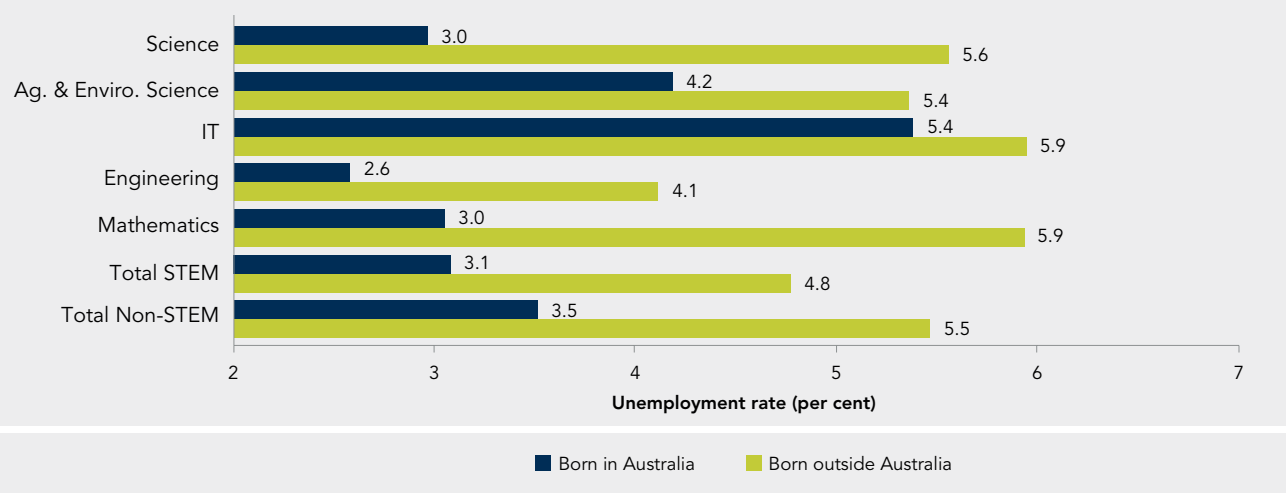
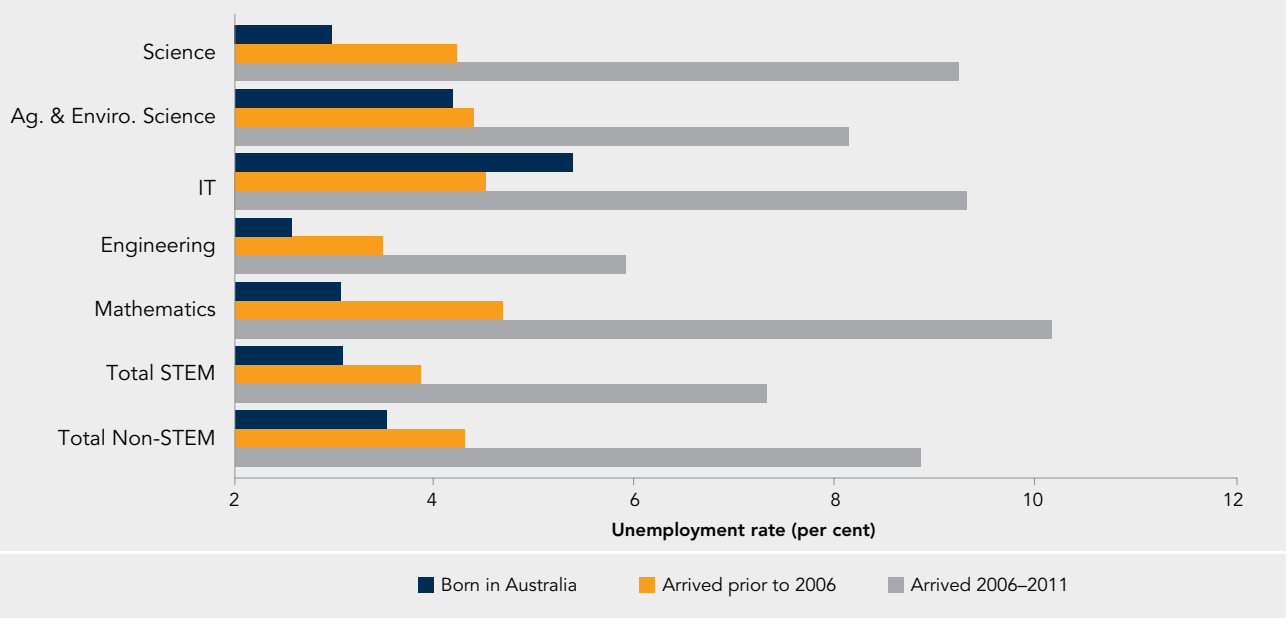


Figure 3.8: Unemployment rate of people living in Australia with post-secondary qualifications, by field, place of birth and date of arrival



WHICH INDUSTRY SECTORS EMPLOY STEM-QUALIFIED PEOPLE?

The most common industry of employment for people with STEM qualifications was Manufacturing, followed by Professional, Scientific and Technical Services, and Construction (17, 12 and 11 per cent, respectively) (Figure 3.9). For those with Non-STEM qualifications, the most common industry of employment was Health Care and Social Assistance, followed by Education and Training, and Professional, Scientific and Technical Services (20, 14 and 9 per cent, respectively).

The most common industry of employment for people with STEM qualifications was different depending on the field of qualification (data not shown):

- The Professional, Scientific and Technical Services sector was the most common sector of employment for IT and Science qualified people (28 and 17 per cent, respectively).
- Those with Mathematics qualifications were most likely to be employed in the Education and Training sector (23 per cent; with 11 per cent in Higher Education, 7 per cent in Secondary Education and 1 per cent in Primary Education).
- Manufacturing was the most common sector for Engineering qualified people (22 per cent).
- Those with Agriculture and Environmental Science qualifications were most likely to be employed in the Agriculture, Forestry and Fishing industry sector (21 per cent).

In 2011, the majority of employed STEM-qualified people worked in the private sector (85 per cent), compared to 77 per cent of people with Non-STEM qualifications (Table 3.2). Across the STEM fields, there were large differences in the sector of employment: for example 89 per cent of people with Engineering qualifications worked in the private sector, compared to 68 per cent of those with qualifications in Science.

Figure 3.9: Industry sector of employment, by field

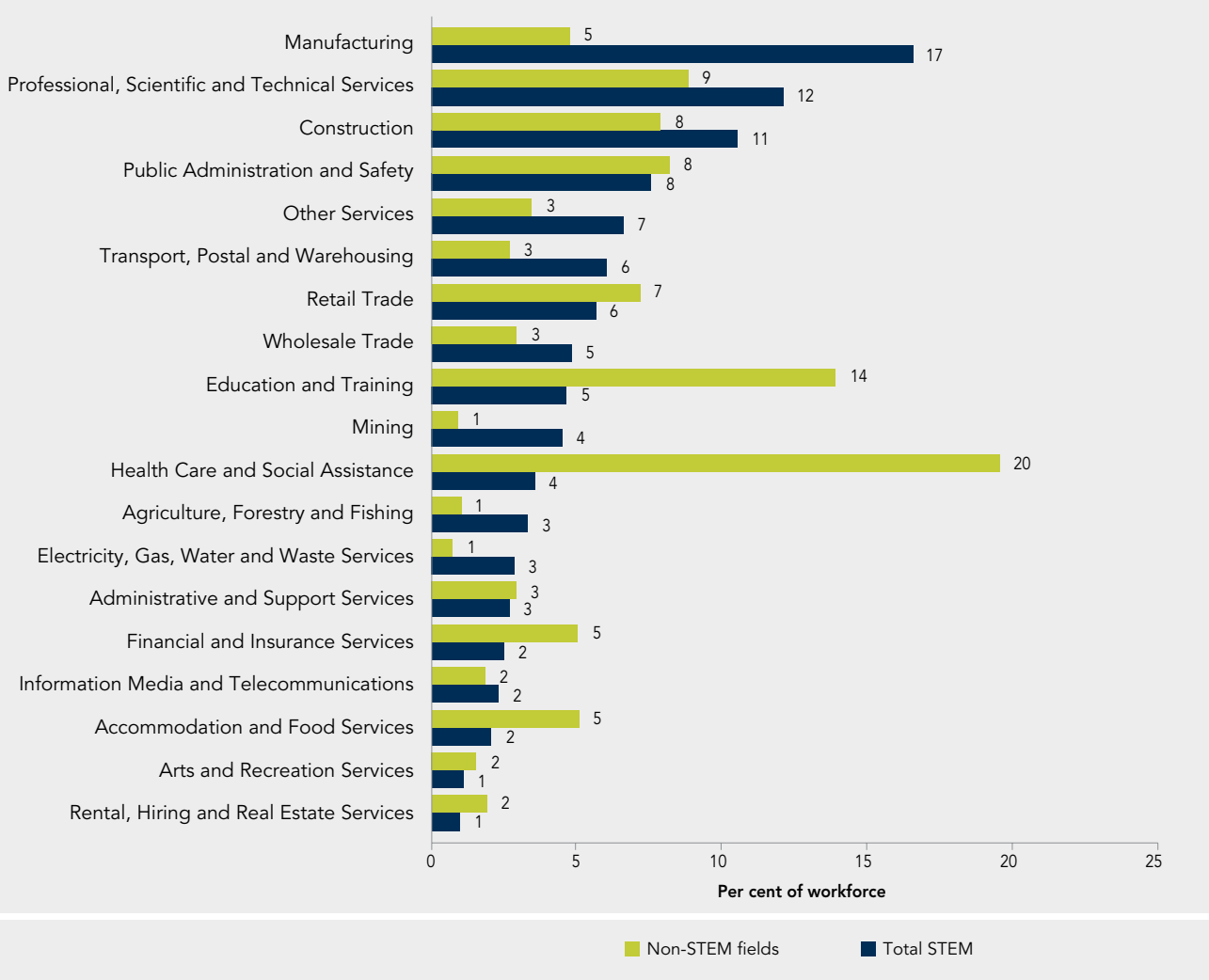


Table 3.2: Sector of employment, by field of highest post-secondary qualification

	Science	Ag. & Enviro. Science	IT	Maths	Eng.	Total STEM	Total Non-STEM
National Government	15	4	8	18	3	6	5
State/Territory Government	16	10	8	13	6	8	16
Local Government	1	6	1	1	2	2	2
Private sector	68	80	83	69	89	85	77

Figure 3.10: Occupations of people with a VET level qualification, by field

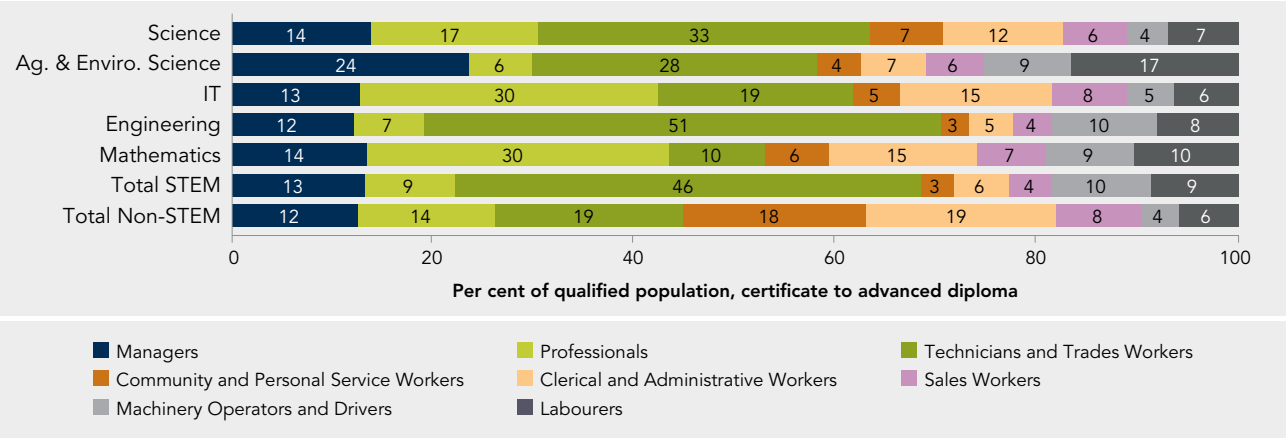
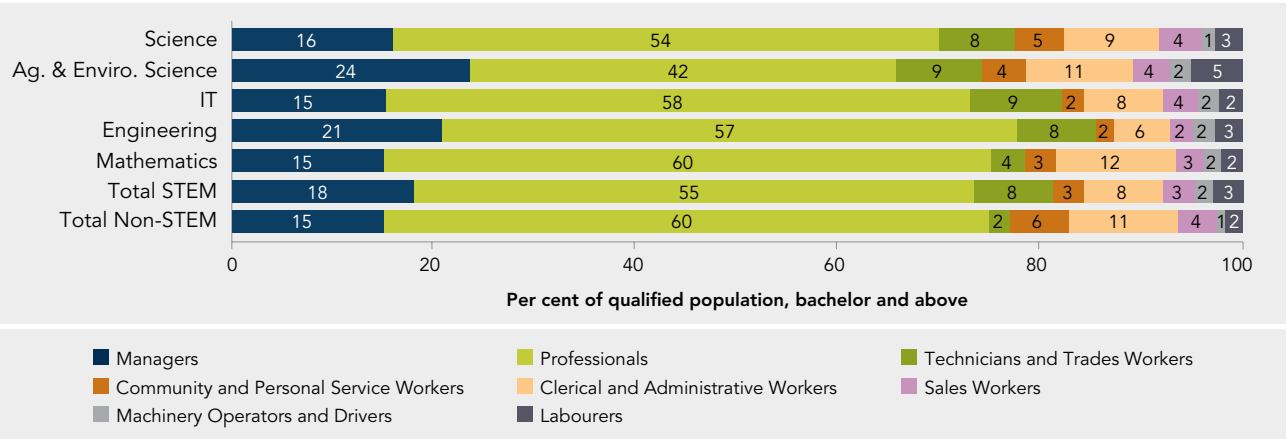


Figure 3.11: Occupations of people with a university level qualification, by field



WHAT ARE THE OCCUPATIONS OF STEM-QUALIFIED PEOPLE?

In 2011, one-third of the total STEM-qualified workforce was employed as Technicians and Trades Workers (data not shown). One quarter worked as Professionals, while 15 per cent worked as Managers. In comparison, the most common occupation for people with a Non-STEM qualification was as Professionals, followed by Clerical and Administrative Workers, and Managers (35, 15 and 14 per cent, respectively, data not shown).

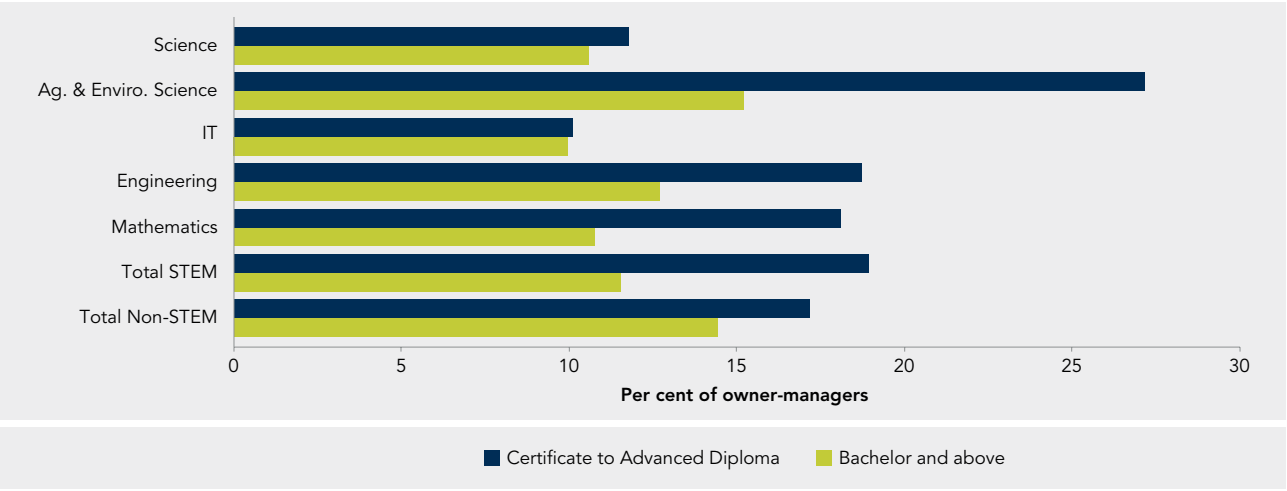
The occupations of STEM-qualified people were different depending on the level of qualification (Figure 3.10 and Figure 3.11). For those with VET level qualifications, almost one-half of all STEM graduates were employed as Technicians and Trades Workers (46 per cent), while over one half of those with university level qualifications were employed as Professionals (55 per cent). The occupations of qualified people also varied across fields at the VET level, while Professionals was the most common occupation across all fields amongst those with university level qualifications.

There were distinct differences in the occupations of STEM-qualified people by gender and qualification (Table 3.3). Among those with a bachelor degree or above, more than half of both males and females worked as Professionals (56 and 53 per cent, respectively). The highest occupation group for those with certificate to advanced diploma qualifications for males was as Technicians and Trade Workers (49 per cent), and as Clerical and Administrative Workers for females (22 per cent).

Table 3.3: Occupations of people with STEM qualifications, percentage by gender and level of highest post-secondary qualification

	Bachelor and above		Certificate to advanced diploma	
	Males	Females	Males	Females
Managers	20	13	14	11
Professionals	56	53	9	12
Technicians and Trades Workers	8	7	49	21
Community and Personal Service Workers	2	5	3	9
Clerical and Administrative Workers	5	14	4	22
Sales Workers	3	4	4	10
Machinery Operators and Drivers	2	1	10	4
Labourers	3	3	8	12

Figure 3.12: Business ownership, by field and level of qualification



HOW MANY STEM-QUALIFIED PEOPLE OWN THEIR OWN BUSINESSES?

The percentage of people who worked as owner-managers (and can be considered as owning their own businesses), was similar between the STEM and Non-STEM cohorts at the different levels—19 and 17 per cent at the VET level, and 12 and 14 per cent at the university level, respectively (Figure 3.12). People with VET level qualifications had a much higher level of business ownership compared to those with university level qualifications across all fields.

Across the different fields, business ownership was highest for those in Agriculture and Environmental Science, across all levels of qualification, at 27 per cent for those from VET and 15 per cent for those from university. Business ownership was lowest for those with IT qualifications for both the VET and university levels, at 10 per cent.

ARE THE SALARIES DIFFERENT BETWEEN STEM AND NON-STEM-QUALIFIED PEOPLE?

There are a number of differences in the personal income levels of STEM and Non-STEM-qualified people in Australia (Figure 3.13 and Figure 3.14). A higher percentage of people with STEM qualifications had an income in the highest bracket (more than $104 000), and a lower percentage had an income in the lowest bracket (less than $41 600), compared to those with Non-STEM qualifications, at both the VET and University levels.

Across all fields, a higher percentage of those with University qualifications had an income in the highest bracket compared to those with VET qualifications. The increase was larger for those with STEM qualifications than Non-STEM qualifications.

Figure 3.13: Personal income of people with VET level qualifications, by field

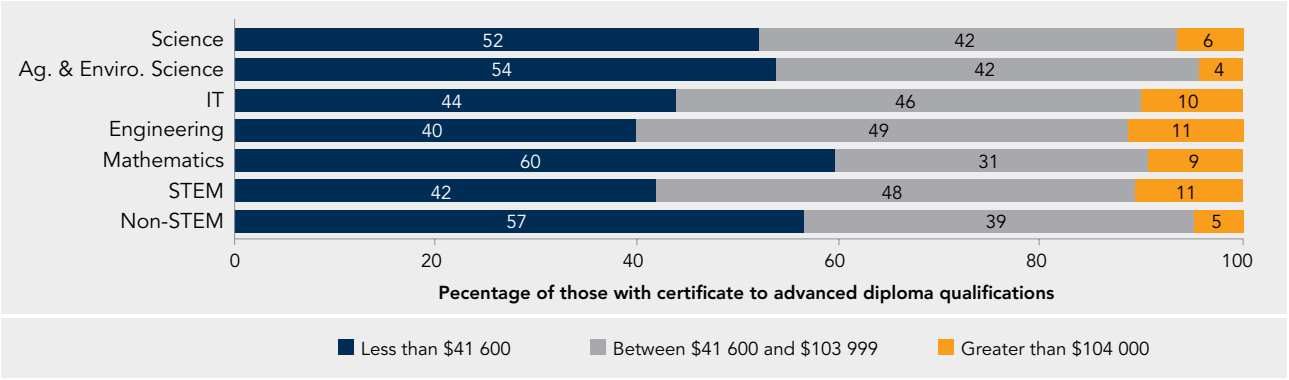
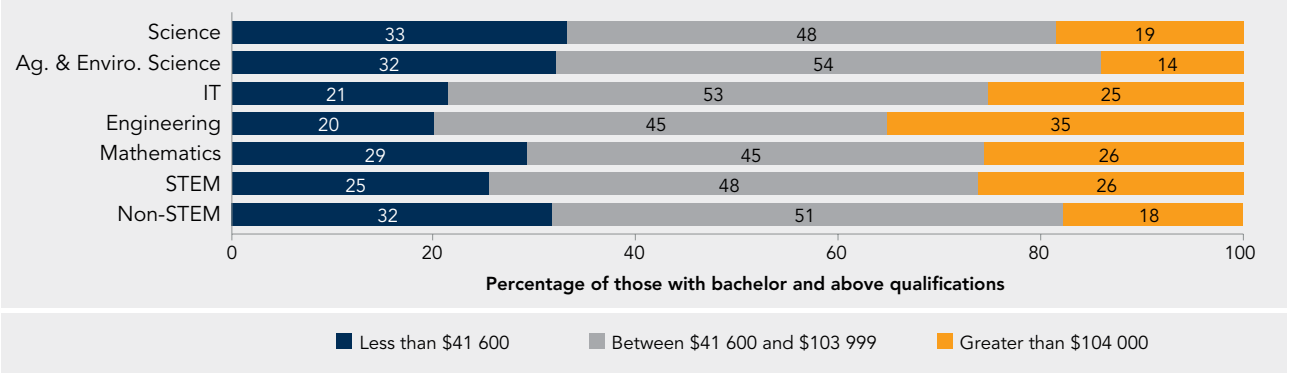


Figure 3.14: Personal income of people with university level qualifications, by field



PART 2

PATHWAYS OF UNIVERSITY STEM GRADUATES IN AUSTRALIA

With the release of the National Innovation and Science Agenda, the Australian Government has renewed its focus on innovation and science. The agenda acknowledges that the 'talent and skills of our people is the engine behind Australia's innovative capacity.' (Department of the Prime Minister and Cabinet, 2015)

Despite this recognised role, to date there has been little analysis of the destinations of people with STEM qualifications and the contribution they make to Australia's economy. Knowledge of the workforce destinations of university STEM graduates helps policy makers to better understand how they are deployed throughout the economy. It also provides information to guide both curriculum development and student subject and career choices.

Part One of this report analysed the demographic characteristics and employment outcomes of STEM-qualified people in Australia; and compared those with VET and university level qualifications.

Part Two investigates the workforce destinations and outcomes for university STEM graduates at the bachelor level and above from different fields in more detail, including their salaries, industry sectors of employment, and occupations.

Chapter 4 presents a high level overview comparing outcomes across the different STEM fields, with comparisons to the Non-STEM qualified population, where possible. Chapters 5 to 13 then present each STEM field of study in detail. The fields analysed are:

- Physics and Astronomy
- Chemical Sciences
- Earth Sciences
- Biological Sciences
- Agricultural Sciences
- Environmental Studies
- Information Technology
- Engineering and Related Technologies
- Mathematical Sciences

Each chapter is structured with the same headings and analysis of data, where possible, to allow comparison across fields and with the total STEM and Non-STEM graduate populations. This includes analysis of:

- Broad demographics
- Industry sector of employment
- Occupations
- Salaries

The term graduates in this report refers to the population with a higher education qualification at the bachelor level or above. It does not include those with vocational education and training, or VET, qualifications—those with an advanced diploma or below.

CHAPTER 4

STEM PATHWAYS: OVERVIEW

4

STEM PATHWAYS: OVERVIEW

KEY FACTS

1. Across the whole STEM graduate workforce, less than one third (27 per cent) were females.
2. The male workforce with STEM graduate qualifications was older than the female workforce across all STEM fields. Those aged 34 and below comprised 37 per cent of the male STEM graduate workforce compared to 45 per cent of females.
3. Graduates in the workforce with qualifications in the Science fields were more likely to have doctorates—with a high of 34 per cent for Physics and Astronomy—than those in the other STEM fields, including Mathematics, Agriculture, Engineering and IT (2 per cent).
4. Seventy-seven per cent of all STEM graduates worked in the private sector, compared to only 43 per cent of those with STEM doctorates.
5. The Professional, Scientific and Technical Services sector was one of the top three industry sector destinations for graduates from all STEM fields except for Fisheries Studies.
6. Other common industries of employment included Public Administration and Safety, and Education and Training.
7. Healthcare and Social Assistance employed a high percentage of female STEM graduates (60 per cent)—varying from 69 per cent of those with Science qualifications, to 35 per cent with Engineering qualifications.
8. Twelve per cent of STEM graduates were business owners—varying from 24 to 7 per cent across all fields—and of these 5.5 per cent owned businesses with more than 20 employees. For doctorate holders, 10 per cent of STEM graduates owned businesses compared to 23 per cent non-STEM.
9. Completing a doctorate level STEM qualification can be more financially rewarding than a bachelor degree across all STEM fields, as measured by the percentage of graduates in the top income bracket who earned $104 000 or above per year.
10. There was almost three times the percentage of male STEM graduates in the highest income bracket ($104 000 or above) compared to female STEM graduates. The magnitude of this disparity is not accounted for by the percentage of women with children, or by the higher proportion of females who work part-time.

STEM-QUALIFIED UNIVERSITY GRADUATES IN AUSTRALIA

In 2011, there were 703 864 STEM university graduates in Australia (Table 4.1).

The majority of STEM graduates had bachelor degrees as their highest qualification. Of all STEM graduates, approximately 72 per cent (508 168 individuals) held bachelor degrees, 16 per cent (112 945 individuals) masters degree level, and 8 per cent (53 269 individuals) doctorates as their highest qualification.

The most common field of qualification was Engineering, with 37 per cent of all STEM graduates (257 380 individuals). Almost half of the Engineering graduates (47 per cent) did not give further detail of their specific field of qualification. Of those who did, Electrical and Electronic Engineering and Technology were the most common, at 16 per cent.

Natural and Physical Sciences graduates comprised 29 per cent of the STEM graduate population with 206 819 graduates. Of these, 38 per cent did not specify their field any further. Graduates with a Biological Sciences degree (21 per cent) was the next largest cohort, while Physics and Astronomy graduates comprised less than 6 per cent of the total STEM graduate population.

There were 160 913 Information Technology graduates (23 per cent of the total number of STEM graduates), 53 085 Agriculture, Environmental and Related Studies graduates (8 per cent), and 25 667 Mathematical Sciences graduates (4 per cent).

The rate of completion of post-graduate studies varied across fields. In some STEM fields (such as Biological Sciences and Physics and Astronomy) over 30 per cent of students held a doctoral qualification. Thirteen times as many IT graduates held masters degrees than doctorates (Table 4.1), while 15 per cent of Mathematics graduates held doctorates and 11 per cent held masters degrees.

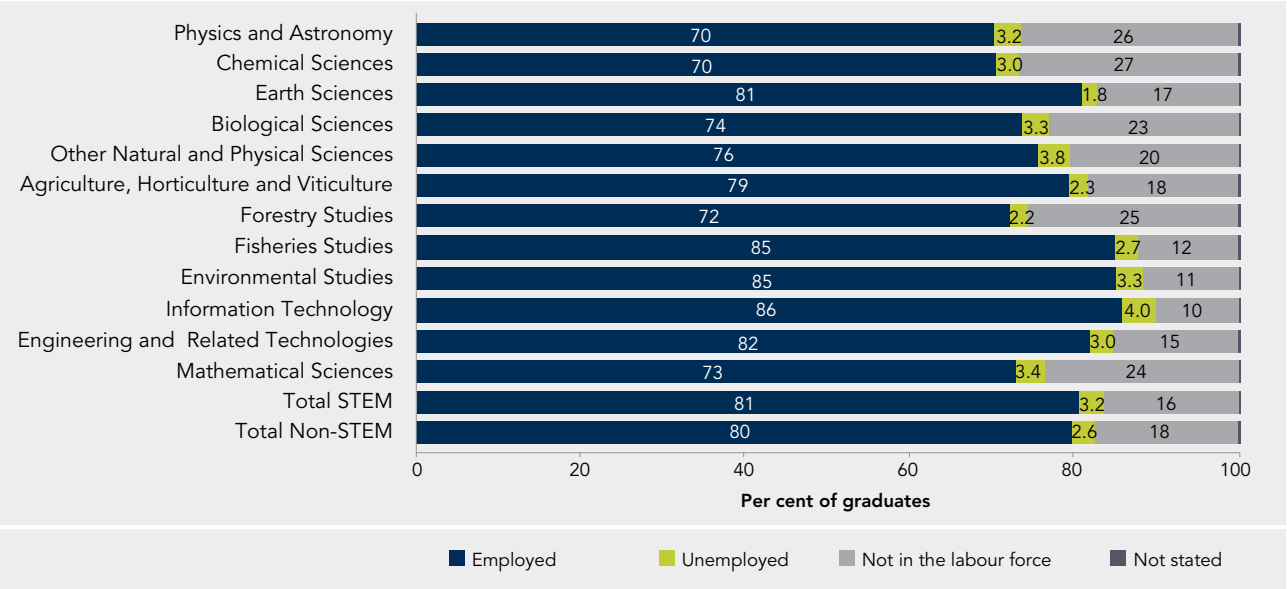
Table 4.1: Number of individuals with qualifications at the bachelor level and above, by highest level of qualification and field

	Highest level of qualification							
Post-secondary Qualification: Field of Study	Bachelor Degree	Graduate Certificate Level	Graduate Diploma Level	Graduate Diploma and Graduate Certificate Level, n.f.d	Masters Degree Level	Doctoral Degree Level	Postgraduate Degree Level, n.f.d	Total
Natural and Physical Sciences, total (excluding mathematics)	**143 644**	**651**	**3 932**	**533**	**23 468**	**34 048**	**543**	**206 819**
Physics and Astronomy	6 138	29	142	34	1 894	3 879	17	12 133
Chemical Sciences	15 006	31	307	66	2 534	5 152	51	23 147
Earth Sciences	11 190	17	504	56	3 510	3 007	111	18 395
Biological Sciences	25 055	95	676	65	5 653	12 501	118	44 163
Other Natural and Physical Sciences	21 365	217	839	65	3 858	3 808	79	30 231
Natural and Physical Sciences, n.f.d	64 890	262	1 464	247	6 019	5 701	167	78 750
Agriculture, Environmental and Related Studies, total	**38 441**	**632**	**2 508**	**150**	**8 312**	**2 917**	**125**	**53 085**
Agriculture	16 126	125	613	53	2 055	1 560	27	20 559
Horticulture and Viticulture	3 130	36	200	0	340	135	13	3 854
Forestry Studies	1 875	13	36	0	268	145	5	2 342
Fisheries Studies	862	17	104	0	230	72	0	1 285
Environmental Studies	16 342	441	1 547	97	5 385	991	80	24 883
Other Agriculture, Environmental and Related Studies	21	0	0	0	11	5	0	37
Agriculture, Environmental and Related Studies, n.f.d	85	0	8	0	23	9	0	125
Information Technology, total	**107 764**	**1 019**	**9 077**	**1 474**	**38 151**	**2 913**	**515**	**160 913**

Post-secondary Qualification: Field of Study	Highest level of qualification							
	Bachelor Degree	Graduate Certificate Level	Graduate Diploma Level	Graduate Diploma and Graduate Certificate Level, n.f.d	Masters Degree Level	Doctoral Degree Level	Postgraduate Degree Level, n.f.d	Total
Computer Science	34 338	140	1 735	182	8 648	1 707	142	46 892
Information Systems	5 410	55	751	103	3 329	253	39	9 940
Other Information Technology	3	34	0	0	0	0	0	37
Information Technology, n.f.d	68 013	790	6 591	1 189	26 174	953	334	104 044
Engineering, total	**200 360**	**1 016**	**5 040**	**661**	**39 201**	**10 627**	**475**	**257 380**
Manufacturing Engineering and Technology	2 607	10	140	0	644	99	16	3 516
Process and Resources Engineering	15 311	32	584	0	3 142	2 112	48	21 229
Automotive Engineering and Technology	138	0	0	0	0	0	0	138
Mechanical and Industrial Engineering and Technology	16 411	124	367	50	2 673	594	17	20 236
Civil Engineering	22 759	60	561	64	4 448	878	65	28 835
Geomatic Engineering	7 156	87	516	15	673	179	15	8 641
Electrical and Electronic Engineering and Technology	32 817	77	777	121	6 729	1 434	90	42 045
Aerospace Engineering and Technology	4 662	82	140	0	735	147	6	5 772
Maritime Engineering and Technology	1 719	0	0	0	49	13	0	1 781
Other Engineering and Related Technologies	1 984	139	189	0	1 497	413	23	4 245
Engineering and Related Technologies, n.f.d	94 796	405	1 766	411	18 611	4 758	195	120 942
Mathematical Sciences	**17 959**	**166**	**785**	**122**	**3 813**	**2 764**	**58**	**25 667**
STEM total	**508 168**	**3 484**	**21 342**	**2 940**	**112 945**	**53 269**	**1 716**	**703 864**
Non-STEM total	**1 769 903**	**37 511**	**208 911**	**20 324**	**377 157**	**62 824**	**13 040**	**2 489 670**

Note: n.f.d is 'not further defined'.

Figure 4.1: Employment status of STEM graduates, by field



WHAT IS THE EMPLOYMENT STATUS OF STEM GRADUATES?

In 2011, of the total population of graduates with STEM qualifications 81 per cent were employed, 16 per cent were not in the labour force and 3.2 per cent were unemployed (Figure 4.1). There is some variation in the proportion of graduates who were not in the labour force across the different fields.

HOW OLD IS THE STEM GRADUATE WORKFORCE?

The age distributions of males and females in the STEM workforce is shown in Figure 4.2 and Figure 4.3. The patterns are further analysed for the dominance of younger or older graduate population, by analysing the skewness of the distribution (Figure 4.4 and Figure 4.5). Skewness indicates the degree of asymmetry of a distribution around its mean. In this data a positively skewed distribution indicates a higher proportion of younger graduates in the population, while a negatively skewed distribution reflects a higher proportion of older graduates in the population. The scale of the skewness shows the extent to which a younger (positive skewness) or an older (negative skewness) age group dominates the population distribution.

The age distribution of the male STEM graduate population indicates that most of the workforce was predominantly older, with the exception of those qualified in Information Technology, Other Natural and Physical Sciences (which includes Medical Science and Food Science and Biotechnology), and Environmental Sciences (Figure 4.2 and Figure 4.4). Such distributions potentially reflect the recent emergence of these fields in the economy.

A strong contrast was observed when the patterns of female STEM graduate population were considered (Figure 4.3 and Figure 4.5). With the exception of Chemical Sciences and Mathematical Sciences, all other fields showed a positive skewness in their female graduate population distribution. This indicated that the female population in the workforce was much younger compared to the male population.

Figure 4.2: Age distribution of employed male graduates, by field

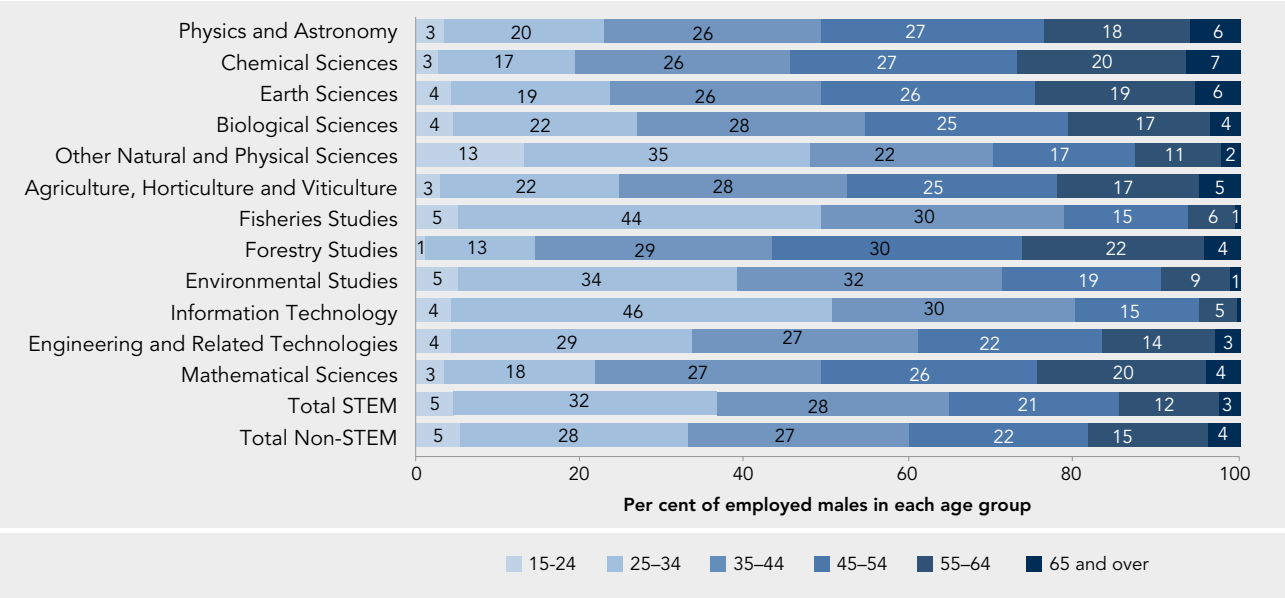


Figure 4.3: Age distribution of employed female graduates, by field

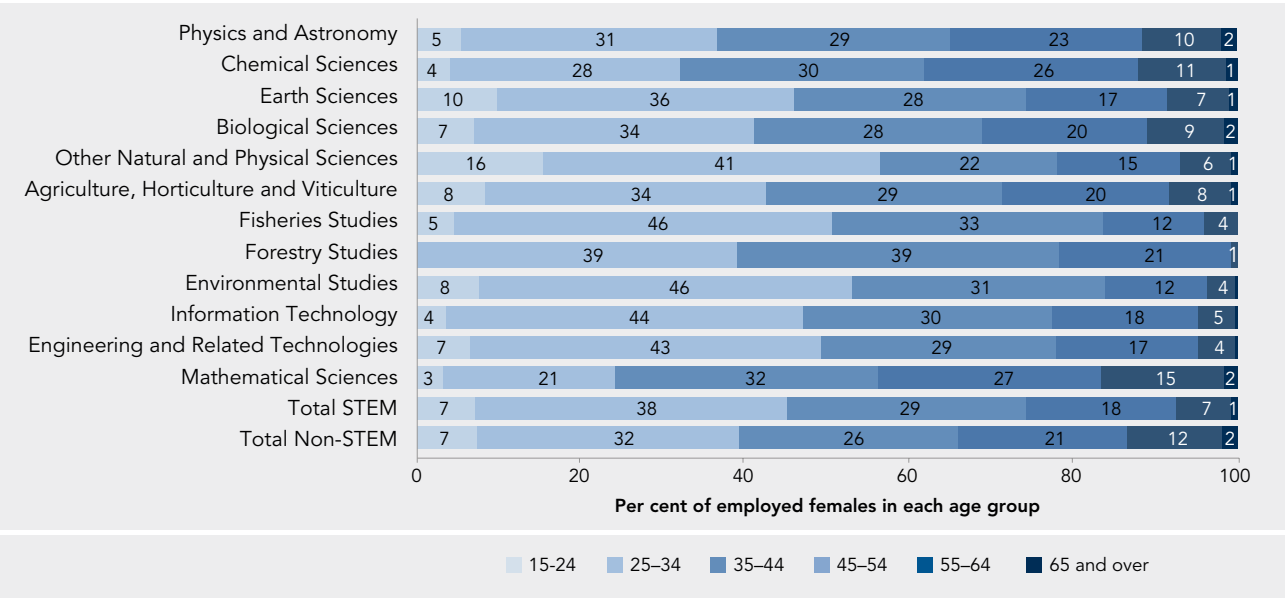


Figure 4.4: Skewness of the age distribution pattern of male STEM graduates, by field

Positive values indicate a higher proportion of younger graduates and negative values indicate a higher proportion of older graduates in the population distribution

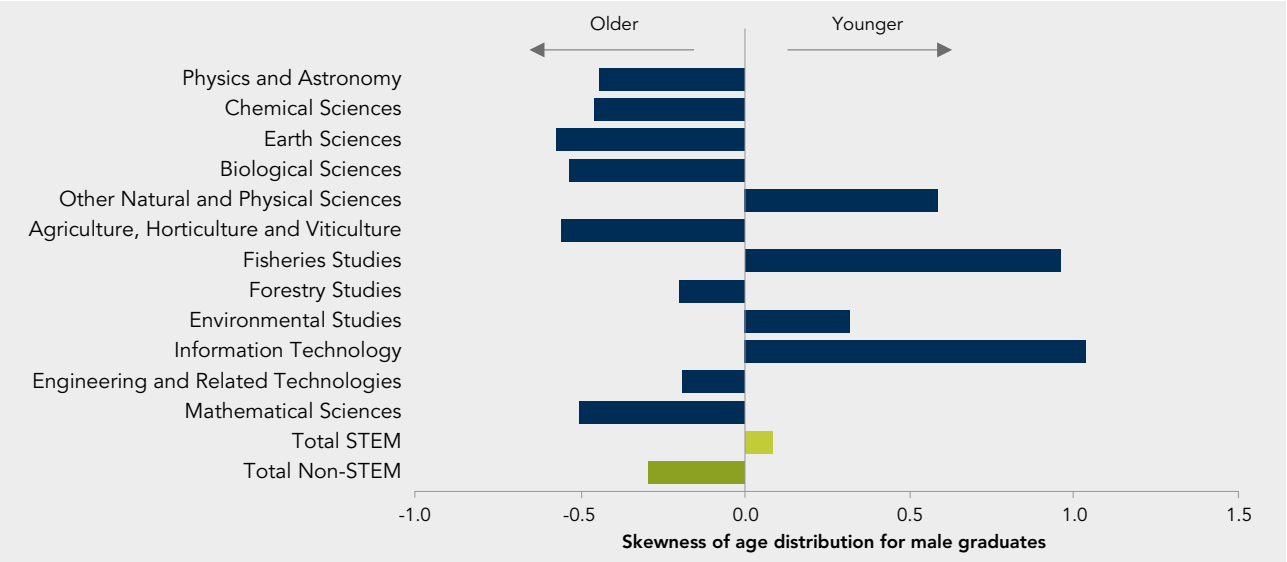
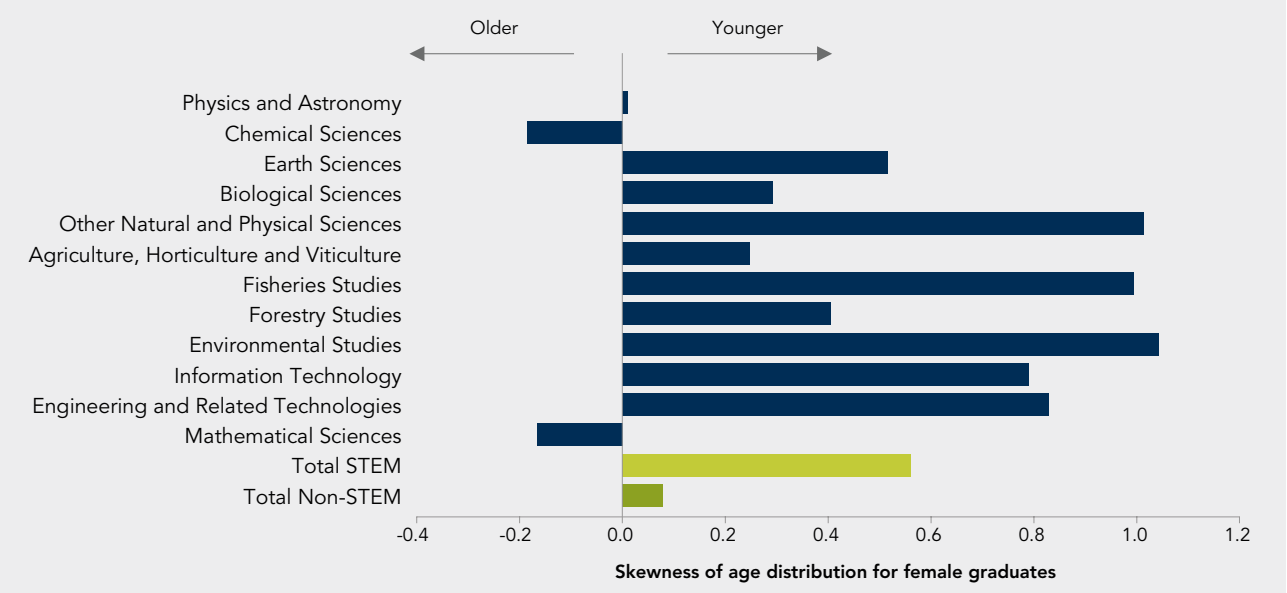


Figure 4.5: Skewness of the age distribution pattern of female STEM graduates, by field

Positive values indicate a higher proportion of younger graduates and negative values indicate a higher proportion of older graduates in the population distribution



HOW COMMON ARE DOCTORATE DEGREES IN THE STEM GRADUATE WORKFORCE?

When the workforce is analysed by field of qualification, some STEM fields had a much higher percentage of graduates with doctorate degrees compared to others (Figure 4.6).

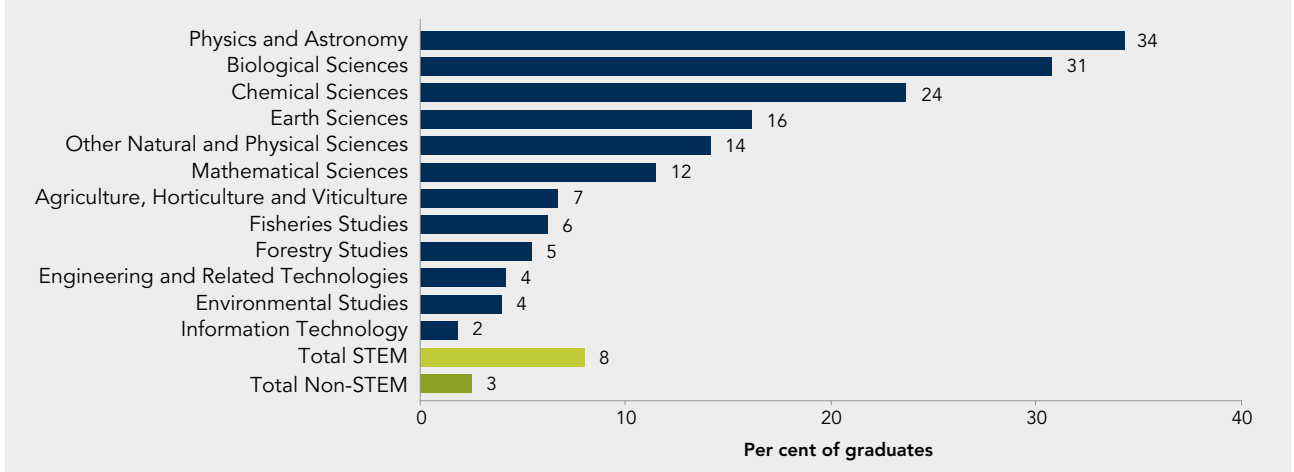
Generally, graduates in the workforce with qualifications in the Sciences fields were more likely to have doctorates than those in the other STEM fields; particularly in Physics and Astronomy, Biological Sciences and Chemical Sciences graduates (34, 31 and 24 per cent, respectively). In contrast, only 2 per cent of graduates in the workforce with qualifications from Information Technology had doctorates.

WHERE DO STEM GRADUATES WORK?

WHAT PROPORTIONS OF THE STEM GRADUATE WORKFORCE WERE EMPLOYED IN THE PRIVATE SECTOR?

The use of STEM skills is strongly associated with the likelihood of innovation. A STEM qualification fosters skills in areas such as creativity and critical thinking; and those businesses that make use of STEM skills are almost 60 per cent more likely to be innovative. What percentage of STEM graduates work in the private sector, helping to contribute to innovative businesses and an innovative workforce and country?

Figure 4.6: Percentage of graduates in the workforce with doctorates, by field



The top three industry divisions of employment across STEM were Professional, Scientific and Technical Services (25 per cent); Manufacturing (10 per cent) and Public Administration and Safety (10 per cent). On average, 77 per cent of STEM graduates worked in the private sector, compared to 69 per cent of Non-STEM graduates (Figure 4.7). This varied across STEM fields. While over 80 per cent of Engineering and IT graduates worked in the private sector, the percentages for Physics and Astronomy, Biological Sciences, Environmental Studies, and Forestry Studies graduates were lower, between 50-60 per cent.

When the graduates with doctorates are considered separately, the private sector employed a much lower proportion of doctorate holders across all fields (Figure 4.8). For instance, 82 per cent of all IT graduates but only 44 per cent of IT doctorates worked in the private sector.

WHICH INDUSTRIES EMPLOY STEM GRADUATES?

Depending upon the field of qualification, the top three industry divisions of employment for STEM graduates varied; however, there were some similarities (Figure 4.9). The Professional, Scientific and Technical Services sector was one of the top three destinations for graduates from all STEM fields except for Fisheries. This sector employed over 20 per cent of graduates in the fields of IT, Engineering, Earth Sciences, Physics and Astronomy, Environmental Studies, and Mathematical Sciences.

Figure 4.7: Percentage of graduates employed in the private sector, by field

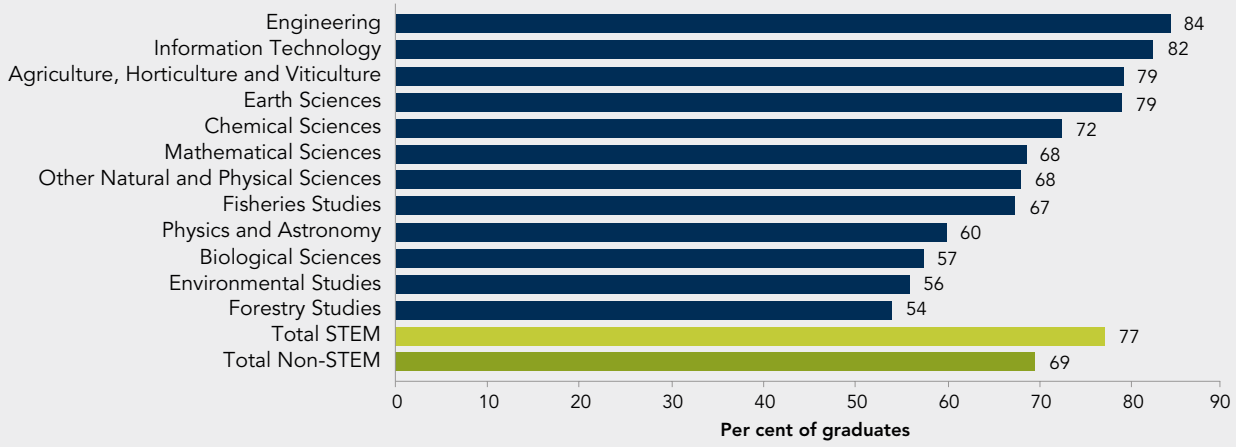


Figure 4.8: Percentage of doctorates employed in the private sector, by field

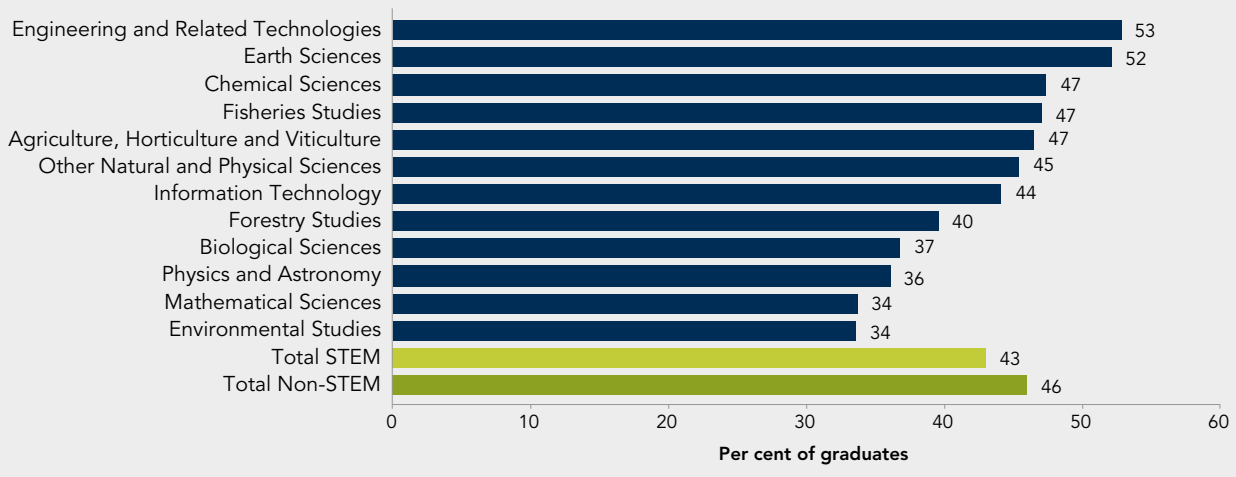
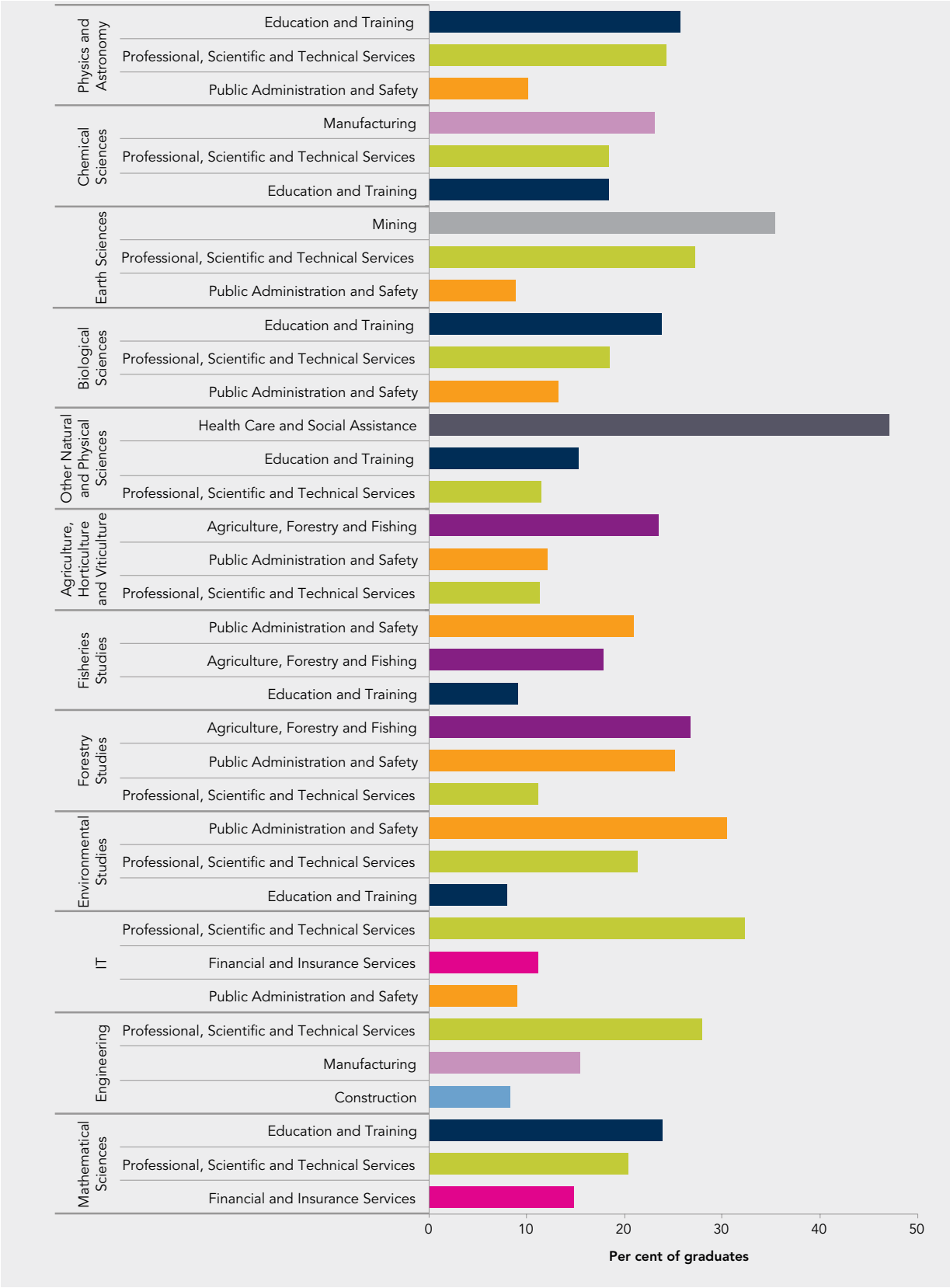


Figure 4.9: Top three industry divisions for graduate employment, by field



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.

The Public Administration and Safety division employed a significant percentage of STEM graduates from fields which have a strong public sector focus—including Environmental Studies (30 per cent), Forestry Studies (25 per cent), and Fisheries Studies (21 per cent). Around one quarter of STEM graduates from Physics and Astronomy, Biological Sciences, and Mathematical Sciences were employed in the Education and Training sector. Graduates from particular fields were employed by specific industries which require those disciplinary skills, including:

- 35 per cent of Earth Science graduates in Mining
- 23 per cent and 27 per cent respectively of the Agriculture, Horticulture and Viticulture and Forestry Studies graduates in Agriculture, Forestry and Fishing
- 23 per cent of Chemical Sciences graduates in Manufacturing
- 47 per cent of Other Natural and Physical Sciences (56 per cent of which had qualifications in the Medical Sciences field) in Health Care and Social Assistance.

WHAT IS THE GENDER DISTRIBUTION OF STEM GRADUATES ACROSS INDUSTRY DIVISIONS OF THE WORKFORCE?

The STEM workforce was strongly dominated by males, as shown in Chapter 2.2, where 84 per cent of people with a STEM qualification were male. In the graduate workforce with STEM qualifications, 27 per cent were female (Figure 4.10). This imbalance was reflected across the STEM fields variably: the comparatively high percentage of females in Sciences, at 46 per cent, compared to low percentages in Engineering and Information Technology (13 and 22 per cent, respectively).

Compared to Non-STEM graduates, the male to female ratio in the Science population was high (Figure 4.11). For example, the Non-STEM workforce was 60 per cent female, but conversely only 17 per cent of the Physics and Astronomy and 25 per cent of the Earth Sciences graduate workforce was female. Biological Sciences and Other Natural and Physical Sciences (the majority of which were graduates with qualifications in Medical Science and Food Science and Biotechnology) were the only Science fields where there were more females than males in the graduate workforce, at 53 and 61 per cent respectively.

Which industry divisions had a high proportion of female STEM graduates?

Across the whole workforce, 27 per cent of STEM graduates were female (Figure 4.10). Yet, some industries of the workforce employed a higher percentage of female STEM graduates than others.

In the Healthcare and Social Assistance division, females comprised the majority of employees with STEM qualifications overall (60 per cent)—varying from 68 per cent of those with Science qualifications, to 35 per cent with Engineering qualifications (comparing favourably to only 13 per cent of Engineering graduates being female across the total workforce) (Figure 4.10).

Education and Training was another industry division which employed a relatively large percentage of females, where 41 per cent of employed graduates with STEM qualifications were female. In this industry, the majority of graduates from the Sciences and Agriculture, Environmental and Related Studies fields were female.

In which industry divisions were females scarce?

Most industry divisions did not employ a significant percentage of female STEM graduates compared to males. For example, only 12 per cent of those employed in Construction were female—among the Engineering graduates in this industry, only 8 per cent were females. Female STEM graduates comprised 15 per cent of the STEM graduate workforce in the Transport, Postal and Warehousing industry. Among those employed in this industry with an Engineering qualification, only 9 per cent were female, while a higher percentage of the Science graduates employed in this sector were females (28 per cent) (Figure 4.10).

In some industries while there was a low proportion overall of female STEM graduates, the percentage from different fields varied widely. Female STEM graduates comprised only 25 per cent of the Agriculture, Forestry and Fishing industry sector, and only 23 per cent of Agriculture, Environmental and Related Studies graduates in this sector were female. Yet female Agriculture, Environmental and Related Studies

Figure 4.10: Percentage of females in each industry division, by field of qualification

100 per cent female — 0 per cent female

Industry division	Science	Agriculture, Environmental and Related Studies	Information Technology	Engineering and Related Technologies	Mathematical Sciences	Total STEM	Total Non-STEM
Agriculture, Forestry and Fishing	38	23	27	10	37	25	57
Mining	24	38	21	11	29	17	43
Manufacturing	39	29	19	11	29	20	43
Electricity, Gas, Water and Waste Services	35	41	24	12	34	19	44
Construction	30	26	18	8	39	12	36
Wholesale Trade	42	27	19	12	36	23	47
Retail Trade	53	47	22	19	43	33	58
Accommodation and Food Services	52	48	24	21	38	34	56
Transport, Postal and Warehousing	28	25	15	9	26	15	39
Information Media and Telecommunications	38	48	19	12	34	19	54
Financial and Insurance Services	42	36	27	18	37	29	44
Rental, Hiring and Real Estate Services	47	34	25	12	38	27	46
Professional, Scientific and Technical Services	40	43	18	12	31	21	47
Administrative and Support Services	45	34	24	18	40	29	60
Public Administration and Safety	45	46	24	14	35	31	58
Education and Training	50	52	29	19	41	41	71
Health Care and Social Assistance	68	62	39	35	59	60	74
Arts and Recreation Services	52	46	20	17	29	38	55
Other Services	49	51	23	11	41	29	55
All sectors	**46**	**40**	**22**	**13**	**37**	**27**	**60**

Figure 4.11: Percentage of females with Science qualifications in each industry division, by field

100 per cent female — 0 per cent female

Industry division	Physics and Astronomy	Chemical sciences	Earth sciences	Biological sciences	Other Natural and Physical Sciences	Total Non-STEM
Agriculture, Forestry and Fishing	15	24	20	40	42	57
Mining	10	24	22	45	40	43
Manufacturing	12	31	19	47	46	43
Electricity, Gas, Water and Waste Services	12	29	27	45	50	44
Construction	9	21	13	39	52	36
Wholesale Trade	13	29	20	47	58	47
Retail Trade	22	42	28	58	60	58
Accommodation and Food Services	17	45	35	57	59	56
Transport, Postal and Warehousing	12	20	15	38	42	39
Information Media and Telecommunications	17	34	26	52	52	54
Financial and Insurance Services	17	38	18	52	61	44
Rental, Hiring and Real Estate Services	22	41	18	54	63	46
Professional, Scientific and Technical Services	12	34	23	49	62	47
Administrative and Support Services	18	37	29	48	56	60
Public Administration and Safety	19	34	31	50	59	58
Education and Training	20	42	31	54	61	71
Health Care and Social Assistance	36	58	51	69	68	74
Arts and Recreation Services	24	40	38	56	59	55
Other Services	15	38	32	57	63	55
All sectors	**17**	**36**	**25**	**53**	**61**	**60**

graduates were prominent in the STEM workforce of other industries (Figure 4.10). This variation persisted for those with doctorate degrees, where 10 per cent of STEM doctorate holders owned businesses compared to 23 per cent of non-STEM doctorate holders (not shown in chart).

IS THERE A DIFFERENCE IN BUSINESS OWNERSHIP ACROSS STEM-QUALIFIED GRADUATES?

If Australia is to reap the economic benefit of its investment in STEM we must not only produce STEM graduates, but also ensure they are willing to become entrepreneurs. High impact entrepreneurship drives economic growth and employment rates (Spike Innovation, 2015). The total number of technology-based start-ups in Australian cities is low in a global context. So what percentage of STEM graduates in Australia owned businesses? And did they own businesses that were growing?

On average, 12 per cent of STEM graduates were business owners in 2011, compared to 14 per cent of Non-STEM graduates (Figure 4.12). There was a large variation across the STEM fields—varying from a high of 24 per cent of Agriculture, Horticulture and Viticulture to 8 per cent of Environmental Sciences graduates.

This variation persisted for those with doctorate degrees, where 10 per cent of STEM doctorate holders owned businesses compared to 23 per cent of non-STEM doctorate holders (not shown in chart).

Amongst the business owners, what per cent employ more than 20 employees?

Larger businesses, employing more than 20 individuals were less prevalent for STEM-qualified graduates (Figure 4.13). Five and a half per cent of STEM graduates who owned a business, owned a large business. In comparison, 7.2 per cent

Figure 4.12: Business ownership amongst employed graduates with qualifications at the bachelor level or above, by field

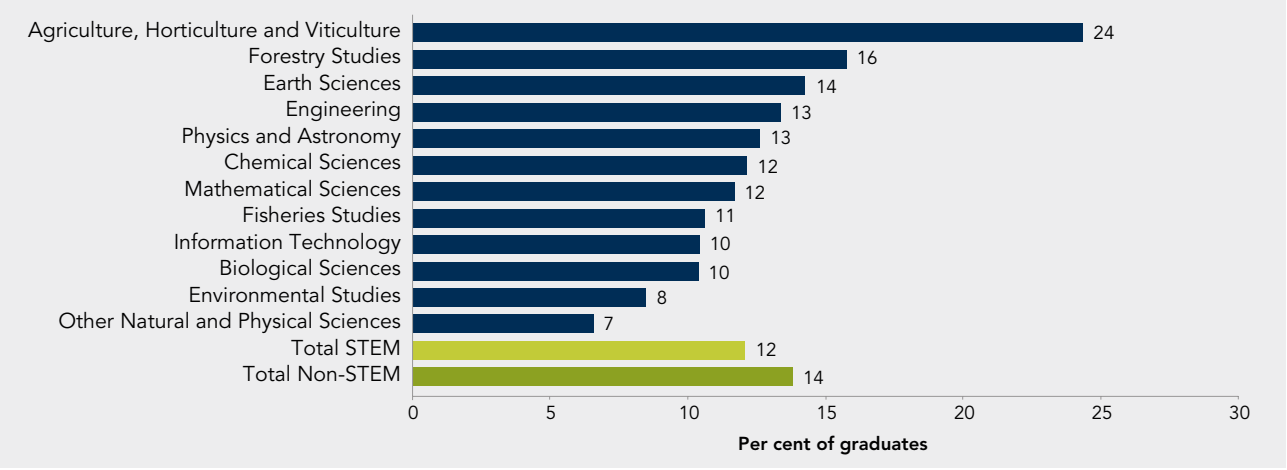


Figure 4.13: Percentage of graduates who were business owners employing more than 20 individuals, by field

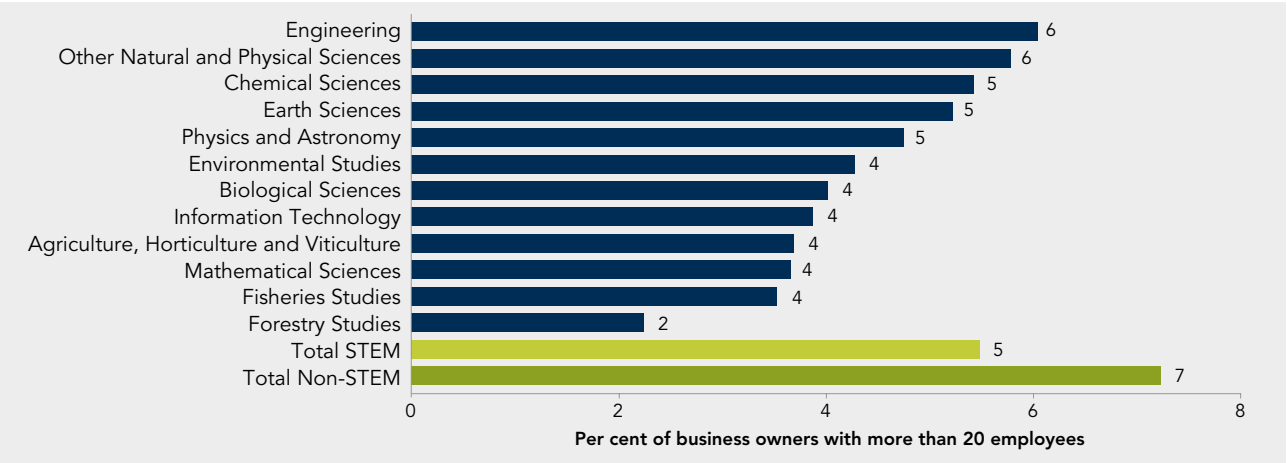


Figure 4.14: Top three unit group level occupations, by field

STEM field	1st		2nd		3rd	
Physics and Astronomy	Other Natural and Physical Science Professionals	10%	University Lecturers and Tutors	8%	Software and Applications Programmers	6%
Chemical Sciences	Chemists, and Food and Wine Scientists	13%	Other Specialist Managers	5%	University Lecturers and Tutors	5%
Earth Sciences	Geologists and Geophysicists	45%	Environmental Scientists	3%	Other Specialist Managers	3%
Biological Sciences	Medical Laboratory Scientists	8%	Life Scientists	8%	University Lecturers and Tutors	6%
Other Natural and Physical Sciences	Medical Laboratory Scientists	24%	Chemists, and Food and Wine Scientists	5%	Medical Technicians	4%
Agriculture, Horticulture and Viticulture	Agricultural and Forestry Scientists	11%	Livestock Farmers	6%	Crop Farmers	5%
Fisheries Studies	Aquaculture Farmers	10%	Agricultural Technicians	6%	Environmental Scientists	5%
Forestry Studies	Agricultural and Forestry Scientists	24%	Environmental Scientists	6%	Other Specialist Managers	4%
Environmental Studies	Environmental Scientists	27%	Other Specialist Managers	6%	Contract, Program and Project Administrators	5%
Information Technology	Software and Applications Programmers	21%	ICT Managers	8%	ICT Support Technicians	6%
Engineering	Civil Engineering Professionals	11%	Engineering Professionals n.f.d	6%	Industrial, Mechanical and Production Engineers	6%
Mathematical Sciences	Software and Applications Programmers	8%	Secondary School Teachers	8%	University Lecturers and Tutors	6%

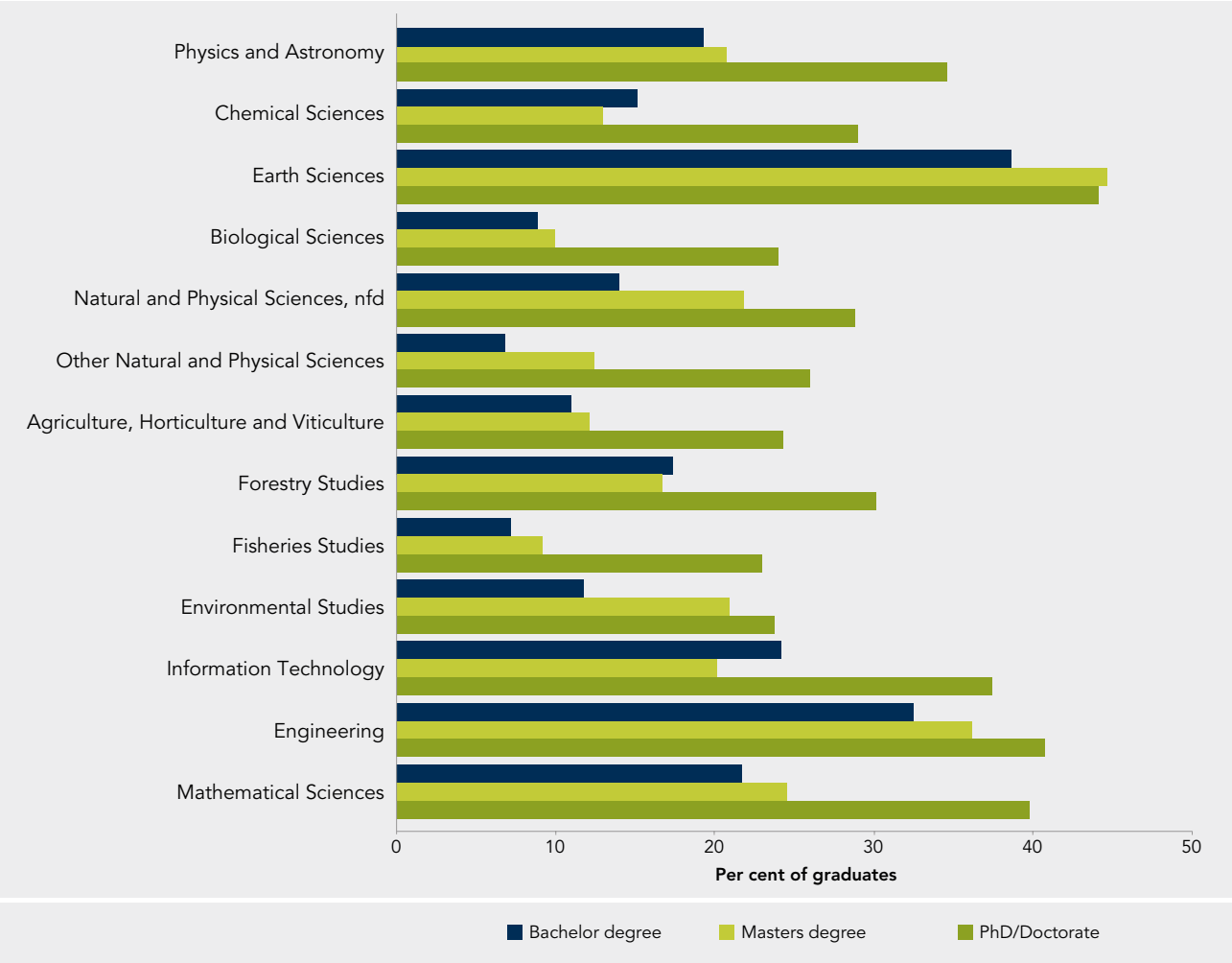
of Non-STEM graduates who owned a business, owned a large business. Only Engineering and Other Natural and Physical Sciences exceeded the average, at 6.0 and 5.8 per cent, respectively.

Less than 4 per cent of business owners who were qualified in Information Technology, Agriculture, Mathematics, Fisheries and Forestry owned large businesses employing more than 20 individuals.

WHAT ARE THE OCCUPATIONS OF STEM GRADUATES?

While there were some similarities amongst the top industry sectors of employment, the top occupations of STEM graduates were more diverse (Figure 4.14). In particular, 45 per cent of Earth Science graduates were Geologists and Geophysicists; 24 per cent of those with qualifications in Forestry Studies were Agricultural and Forestry Scientists; 27 per cent of graduates from Environmental Studies were Environmental Scientists; 21 per cent of graduates from IT were Software and Applications Programmers; and 23 per cent of Engineering graduates were Engineers or Engineering Professionals.

Figure 4.15: Percentage of STEM graduates earning above $104 000, by level and field



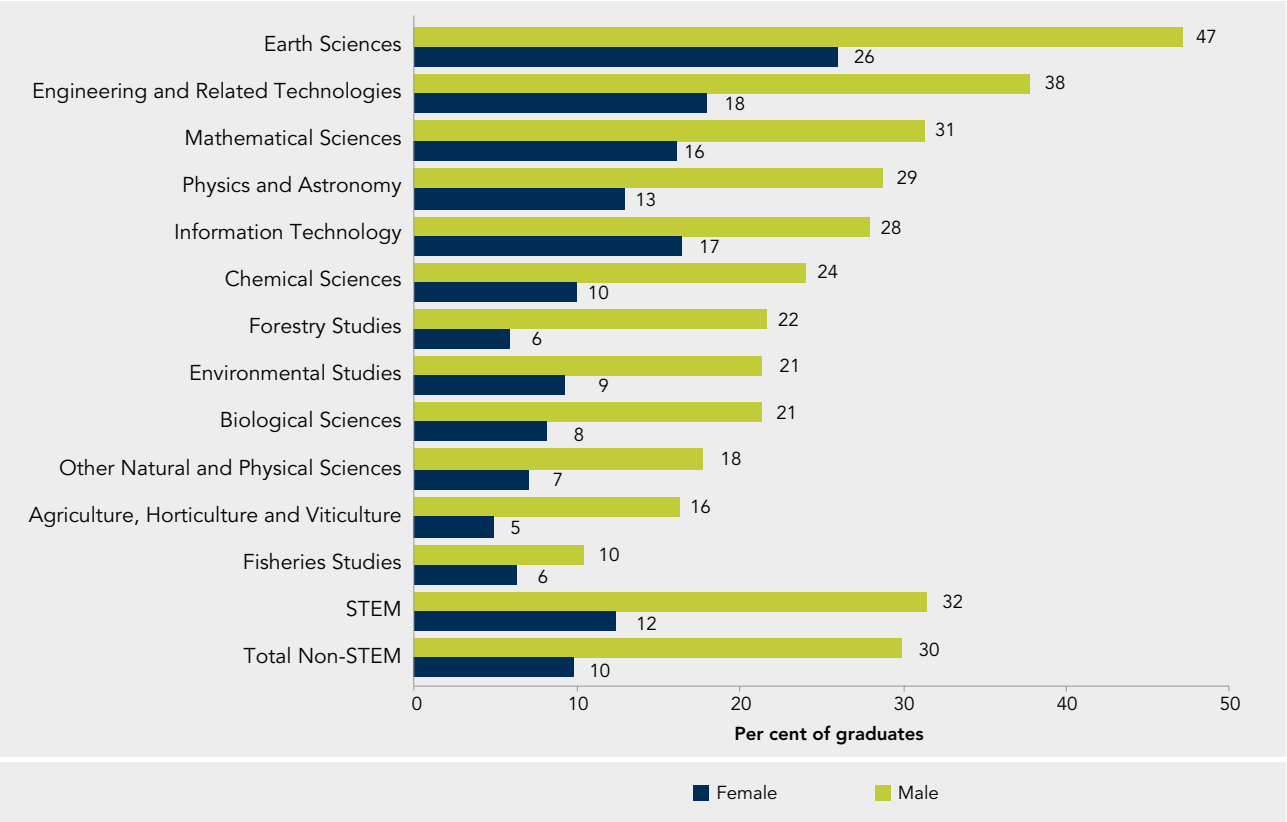
Occupations are classified in five levels (ABS, 2013):

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

See Appendix C for a detailed list.

Other graduates had more varied occupations. For instance, 8 per cent of graduates from Biological Sciences were Medical Laboratory Scientists, 8 per cent were Life Scientists, and 6 per cent were University Lecturers and Tutors; 8 per cent of graduates from Mathematical Sciences were Software and Applications Programmers, 8 per cent were Secondary School Teachers, and 6 per cent were University Lecturers and Tutors.

Figure 4.16: Percentage of graduates with a personal income above $104 000, by gender and field



ARE STEM GRADUATES HIGH EARNERS?

Figure 3.14 showed that a higher proportion of STEM graduates are in the highest income brackets as compared to non-STEM graduates.

Post-graduate studies and gender impact further upon earnings.

FINANCIAL ADVANTAGE OF COMPLETING POST-GRADUATE STUDIES

The rate of completion of post-graduate studies varied across fields, as shown in Figure 4.6. This section explores the extent to which post-graduate qualifications impact upon earnings.

The top bracket for annual personal income recorded in the ABS Census is over $104 000. The proportion of graduates earning above $104 000 annually can be used as a measure of the financial advantage of completing higher level qualifications.

This measure shows that completing a doctorate can confer substantial financial advantage compared to a bachelor level degree for most fields (Figure 4.15). For every STEM field, completion of a doctorate was associated with a higher proportion of graduates in the top income bracket relative to graduates holding a bachelor degree. The largest increases were for Other Natural and Physical Sciences (which includes Medical Science and Food Science and Biotechnology), Fisheries Studies, and the Biological Sciences (276, 218 and 171 per cent, respectively). The lowest increases were in Earth Sciences and Engineering (14 and 25 per cent, respectively).

There was much less financial value in completing a masters compared to a doctorate or bachelor in all fields except Earth Sciences. For IT, Chemical Sciences and Forestry Studies, a lower proportion of masters than bachelor graduates had a personal income in the highest bracket.

ARE FEMALE STEM GRADUATES PAID AS HIGHLY AS THEIR MALE EQUIVALENTS?

Across all STEM fields as a total, 20 per cent of graduates reported an annual personal income in the highest bracket: 32 per cent of males and 12 percent of females. However, the percentage of STEM graduates with incomes in the top bracket varied widely across fields and by gender (Figure 4.16).

For fields such as Earth Sciences and Engineering, above average numbers of both male and female graduates reached the highest income bracket; however, in all cases the proportion of females was less than the proportion of males. For example 38 per cent of males compared to 18 per cent of females in Engineering; and 29 per cent of males compared to 13 per cent of females in Physics and Astronomy had an income in the top bracket.

In some fields with lower percentages of high earners, the difference between males and females was greater. For instance, in Forestry Studies, 22 per cent of males compared to 6 per cent of females; and in Agriculture, Horticulture and Viticulture, 16 per cent of males compared to 5 per cent of females had an income in the top bracket.

Do females earn less because more women work part-time?

While more females than males worked part-time across most STEM fields (see Chapters 5 to 13), this does not fully explain the differences in income. If the reason for the income disparity between males and females was due to part-time work, then this disparity should disappear in the full-time cohort i.e. an equal proportion of males and females should be observed in the top income bracket. In fact, there was a substantially greater proportion of males than females in the top income bracket in each category of both full-time and part-time work. When considering those graduates who worked full-time only, a higher proportion of male than female STEM graduates at both the bachelor and doctorate levels had an income in the highest bracket across most age groups above 24 years of age (Figure 4.17 and Figure 4.18). The only exception to this was female doctorate holders aged 65 or over. At the bachelor level, double the percentage of full-time males compared to females earned over $104 000 in all age groups above the age of 40. The gap was lowest for the 35 to 39 age cohort where there were 1.7 times more males compared to females in the top income bracket.

For graduates that worked part-time, the pay disparity between males and females was high for both bachelor and doctorate graduates (Figure 4.19 and Figure 4.20). Whilst the Census does not collect information on the number of hours worked, the ABS labour force survey does. A longitudinal survey of the average hours worked by employment status and sex shows that both males and females working part-time worked almost the same number of hours per week since 1990 across the economy (ABS, 2010). This provides a basis for comparison of part-time earnings between the sexes.

For part-time bachelor degree holders, there was over three times the proportion of males compared to females in the top income bracket in the 30 and above age category (with the exception of the 50 to 54 and 65 and over age groups that had 2.9 and 2.2 times the percentage males to females). The lowest disparity was for those aged 25 to 29 at 2.1 times the percentage of males to females. For doctorate holders, the difference was lower but still above the full-time cohort.

Figure 4.17: Percentage of bachelor level STEM graduates working full-time who earned greater than $104 000 annually, by age group and gender

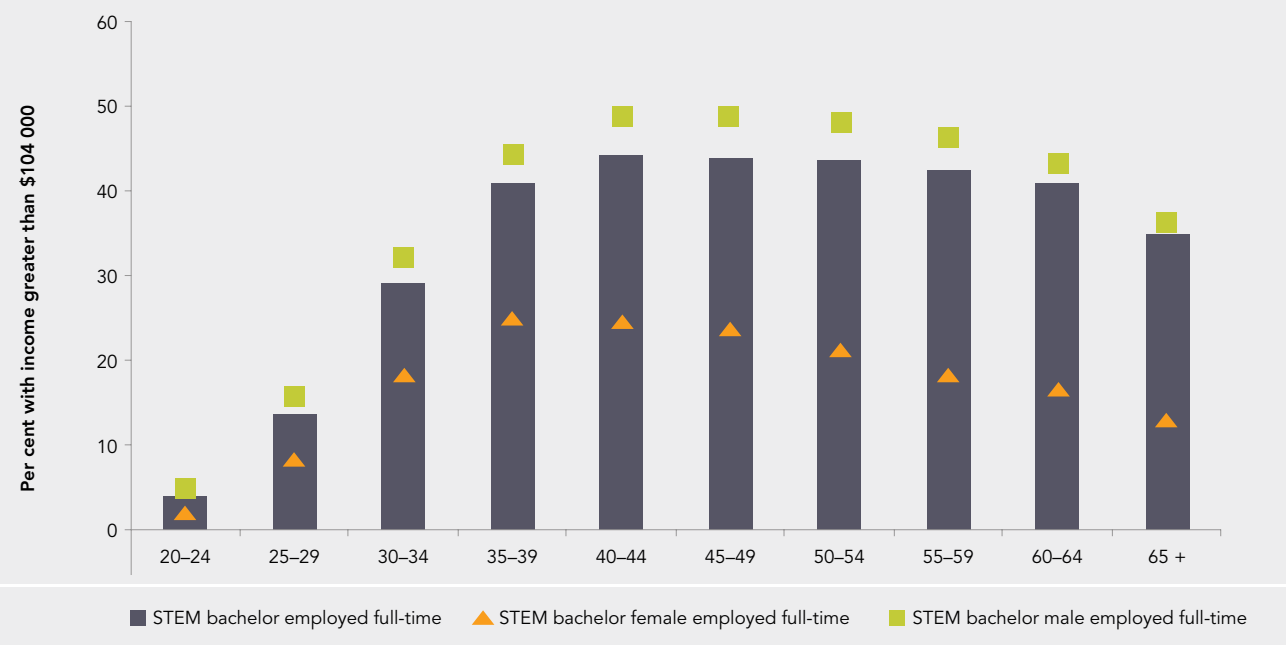


Figure 4.18: Percentage of doctorate level STEM graduates working full-time who earned greater than $104 000 annually, by age group and gender

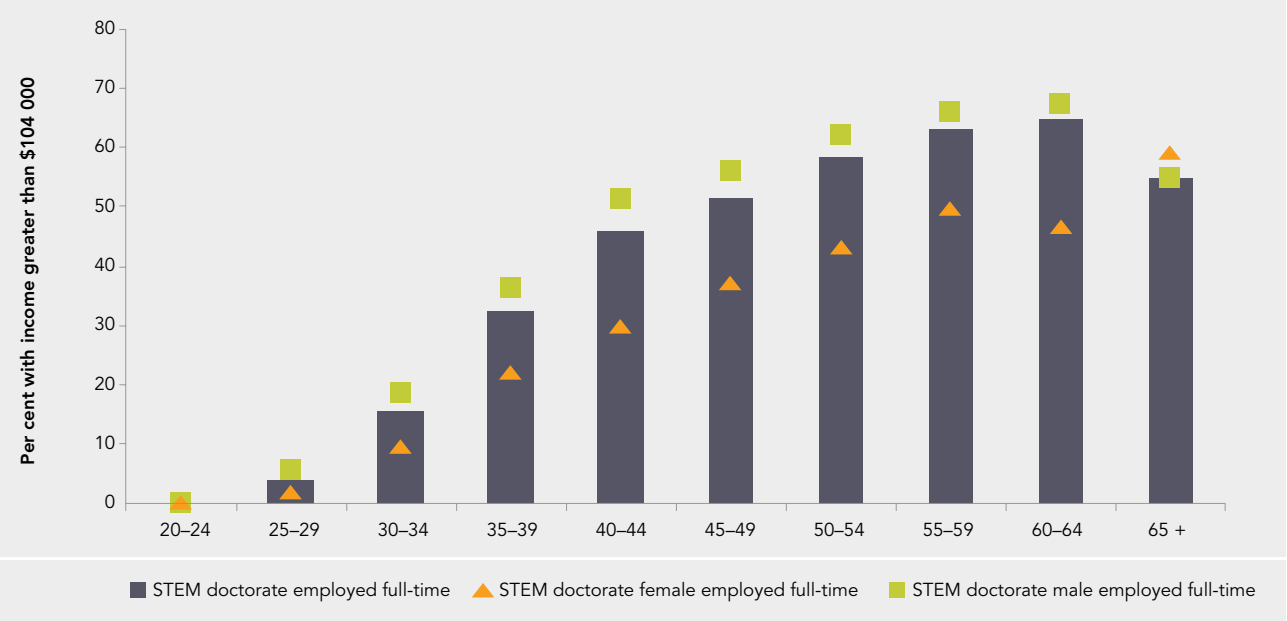


Figure 4.19: Percentage of bachelor level STEM graduates working part-time who earned greater than $104 000 annually, by age group and gender

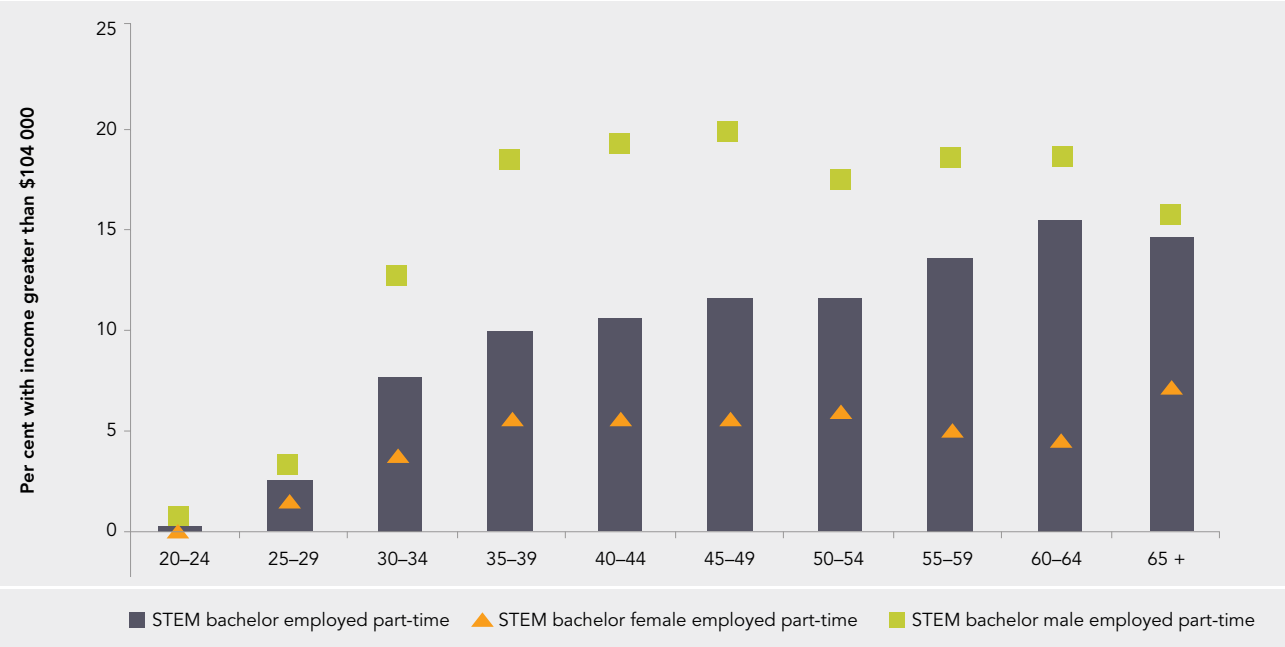
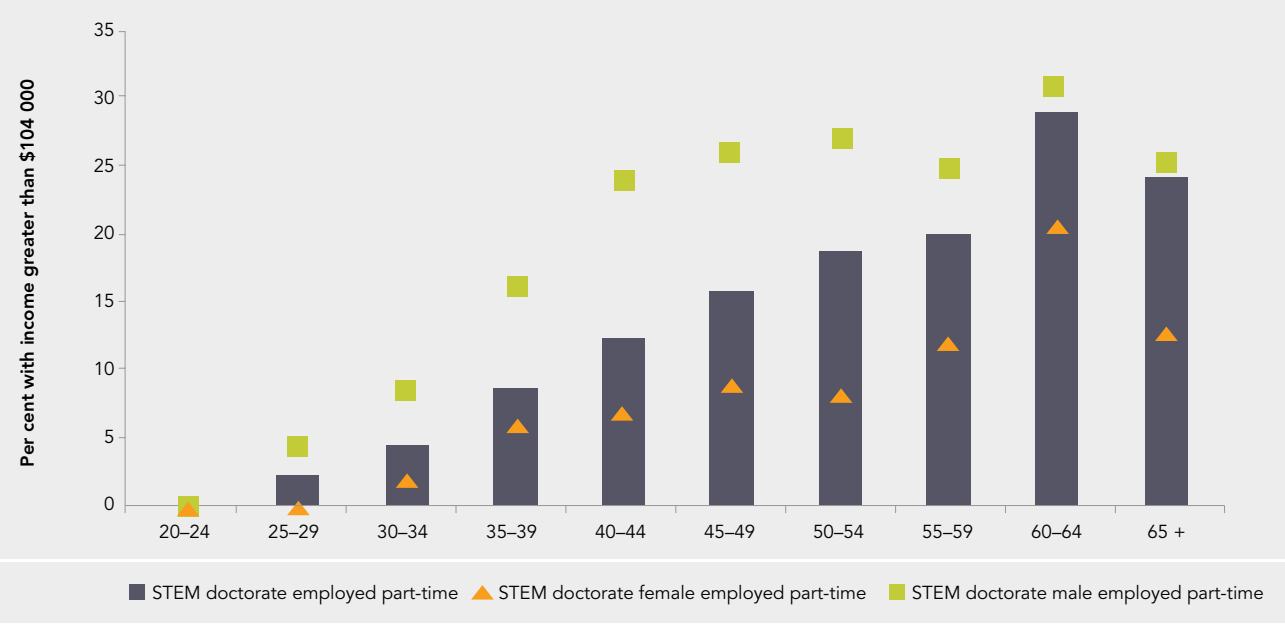


Figure 4.20: Percentage of doctorate level STEM graduates working part-time who earned greater than $104 000 annually, by age group and gender



Does having children affect the incomes of female STEM graduates?

As shown in Figure 4.16, the proportion of female graduates with incomes in the top bracket was less than the proportion of male graduates in all fields.

Figure 4.21 and Figure 4.22 show the percentage of graduates with an income in the top bracket across age groups for male graduates, female graduates, and the subset of female graduates with no children. The percentages of STEM and non-STEM graduates with incomes in the top bracket are also shown for comparison.

The disparity between males and females in the percentage of graduates in the top income bracket is evident across all age groups at both the bachelor and doctorate levels (Figure 4.21 and Figure 4.22).

Data note:

The Census collects data on the number of children ever born (live births) to each female, and these data were analysed along with the field of qualification and age group to investigate income differences. This data does not include adopted, step- or fostered children, and does not indicate if those children are currently living.

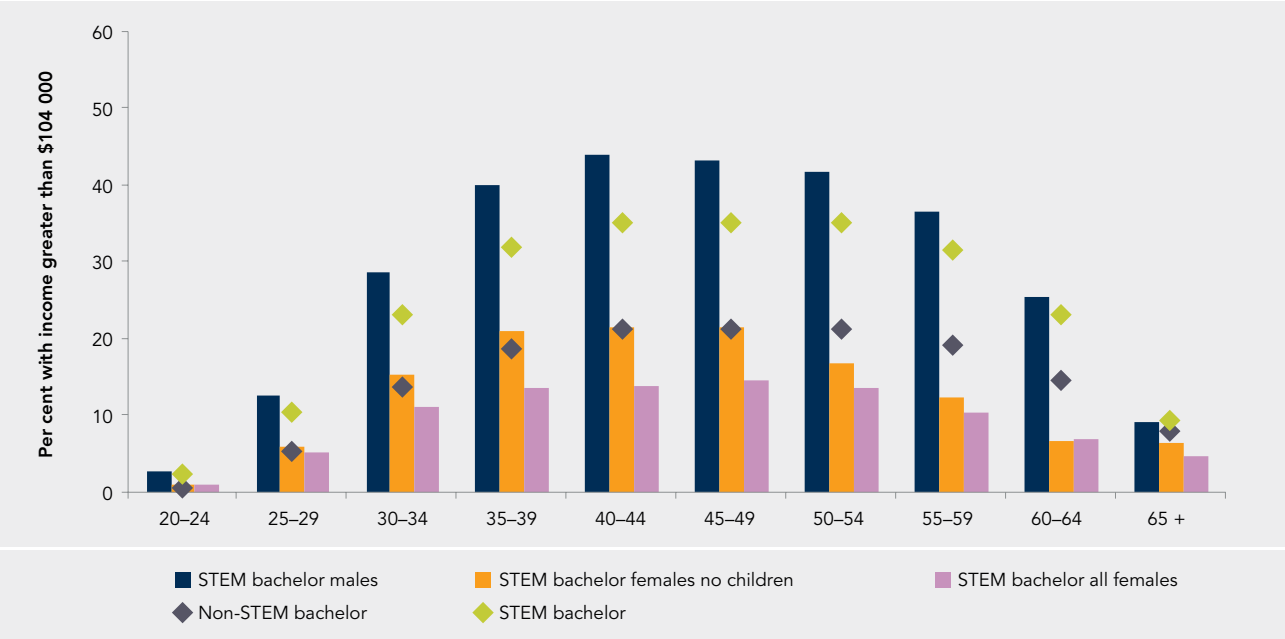
Data was not available to compare the incomes of male graduates with and without children. For the ease of discussion in this report, females who have never given birth to a live child are termed 'females with no children'

At the bachelor level, the percentage of male graduates in the top income bracket was at least twice that of both cohorts of females with and without children across all age groups, except above 65, and the difference was largest between the ages of 60 to 64 (Figure 4.21). Amongst those females with no children the percentage in the highest income bracket was slightly higher than the total female graduate population across all age groups, but was still less than half that of males, except above the age of 65.

At the doctorate level, the differences between male and female graduates was less compared to the bachelor cohort; however, the proportion of males earning top incomes was still twice that of females up to the age of 49 (Figure 4.22). Amongst female graduates with no children, the percentage in the top income bracket was slightly higher than for females as a whole, with the exception of the 60 to 64 age group, but was still much lower than for males.

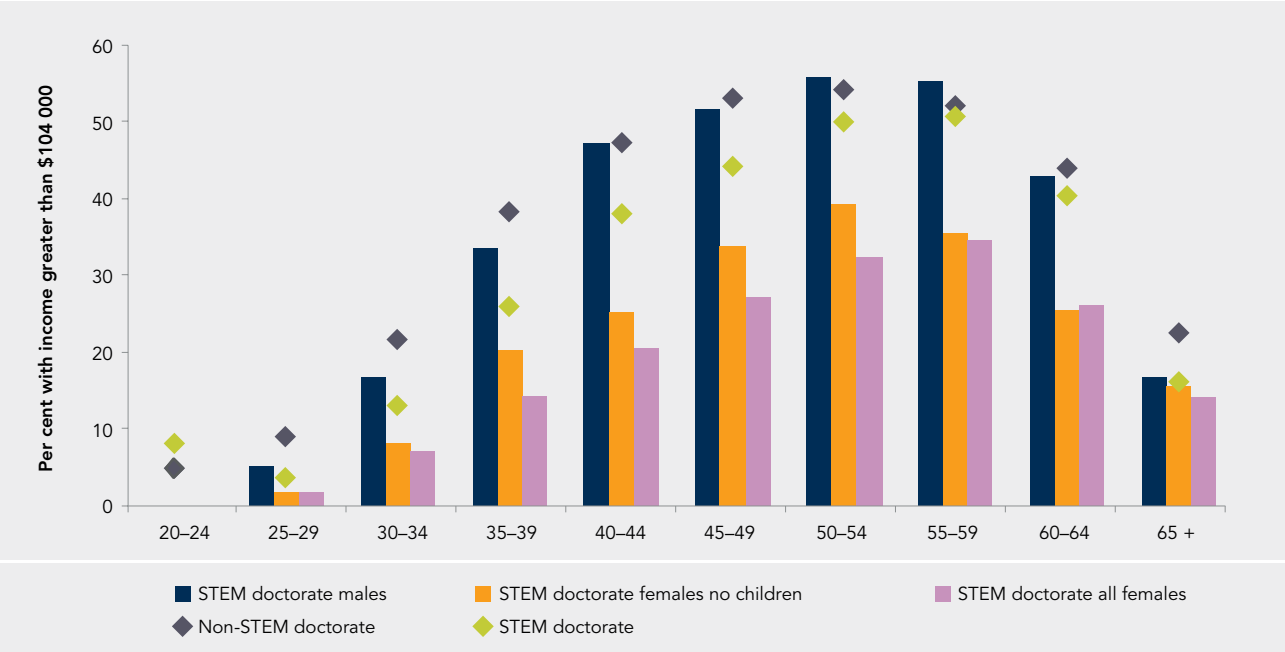
Amongst female graduates with no children, the percentage in the top income bracket was slightly higher than for females as a whole (with the exception of the 60 to 64 age group) but still much lower than for males.

Figure 4.21: Percentage of bachelor graduates earning above $104 000, by age group, field, gender and number of children



Note: The category 'STEM bachelor females no children' is used to describe those females with STEM qualifications at the bachelor qualifications who have never given birth to a live child, and may include females with adopted, step- or fostered children.

Figure 4.22: Percentage of doctorate graduates earning above $104 000, by age group, field, gender and number of children



Note: The category 'STEM doctorate females no children' is used to describe those females with STEM qualifications at the doctorate level who have never given birth to a live child, and may include females with adopted, step- or fostered children.

CHAPTER 5

STEM PATHWAYS: PHYSICS AND ASTRONOMY

WHAT IS PHYSICS AND ASTRONOMY?

The main purpose of studying and working in Physics and Astronomy is to understand and apply knowledge of the fundamental properties of the universe and the laws which govern its behaviour, and to assess and validate physical phenomena (ABS, 2001).

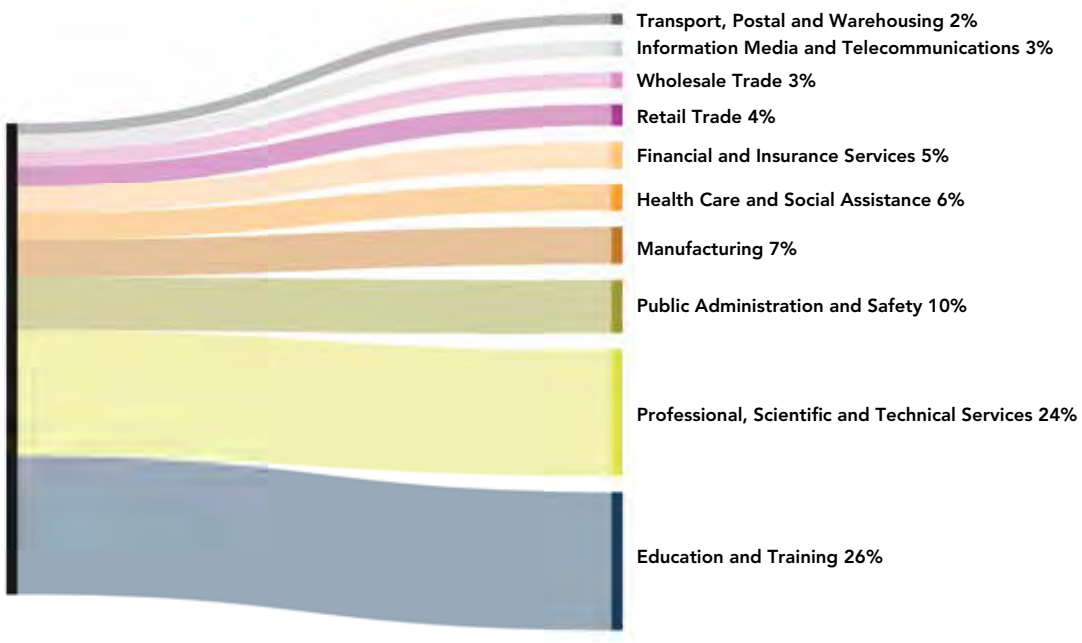
5

STEM PATHWAYS: PHYSICS AND ASTRONOMY

KEY FACTS

1. In 2011, there were 12 130 Physics and Astronomy graduates, and the majority (82 per cent) were male.
2. The female workforce was younger than the male workforce, where the largest age cohort for females was aged 25–34, and for males was aged 45–54 (30 and 21 per cent of each gender, respectively).
3. Sixty per cent of all graduates worked in the private sector—varying from 73 per cent of bachelors to 36 per cent of doctorates.
4. Half of all graduates worked in two industry divisions: Education and Training (26 per cent), and Professional, Scientific and Technical Services (24 per cent).
5. Of the doctorate holders, 39 per cent worked in Higher Education, and 13 per cent in Scientific Research Services.
6. The most common occupations were as professionals in Design, Engineering, Science and Transport (23 per cent), Education (14 per cent) and Information and Communication Technology (13 per cent).
7. Those with higher level qualifications earned more—over 1.5 times as many doctorates compared to bachelors had an annual personal income in the highest bracket (35 and 21 per cent, respectively, earned $104 000 or above).

Top ten industry sectors of employment for Physics and Astronomy graduates



HOW MANY PHYSICS AND ASTRONOMY GRADUATES ARE THERE IN AUSTRALIA?

In 2011, there were 12 130 graduates in the field of Physics and Astronomy. Ninety four per cent were Physics graduates, and 6 per cent were Astronomy graduates.

Thirty per cent of graduates (3606) were either not in the labour force or were unemployed (27 and 3 per cent, respectively).

Of those graduates in the workforce, just over one third had a doctorate degree (34 per cent), compared to eight per cent of STEM graduates and just three per cent of Non-STEM graduates. Males made up 82 per cent of all graduates, and 86 per cent of doctoral graduates.

HOW OLD IS THE PHYSICS AND ASTRONOMY GRADUATE WORKFORCE?

The Physics and Astronomy workforce is distinctive in its age distribution by gender—65 per cent of females were aged 44 or under, compared with only 49 per cent of males (Figure 5.1).

WHERE DO PHYSICS AND ASTRONOMY GRADUATES WORK?

The private sector employed 60 per cent of all Physics and Astronomy graduates; however, this percentage varied with level of qualification:

- Bachelor level: 73 per cent
- Postgraduate level: 47 per cent
  - Masters: 71 per cent
  - Doctorate: 36 per cent

INDUSTRY SECTORS OF EMPLOYMENT

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.

Figure 5.1: Age distribution of employed graduates with qualifications at bachelor level and above, by field and gender

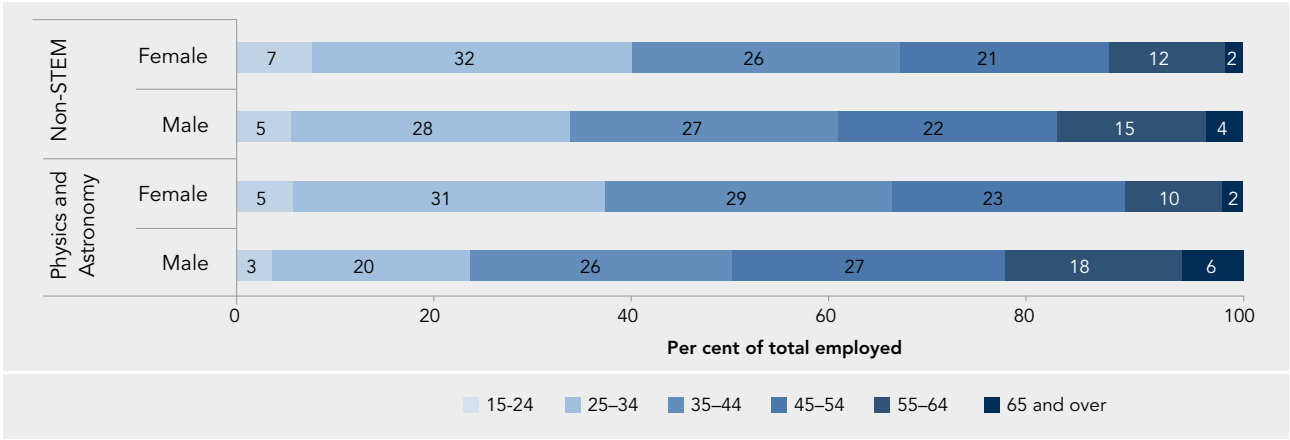


Figure 5.2: Top ten industry divisions of employment for Physics and Astronomy graduates with qualifications at bachelor level and above, by gender

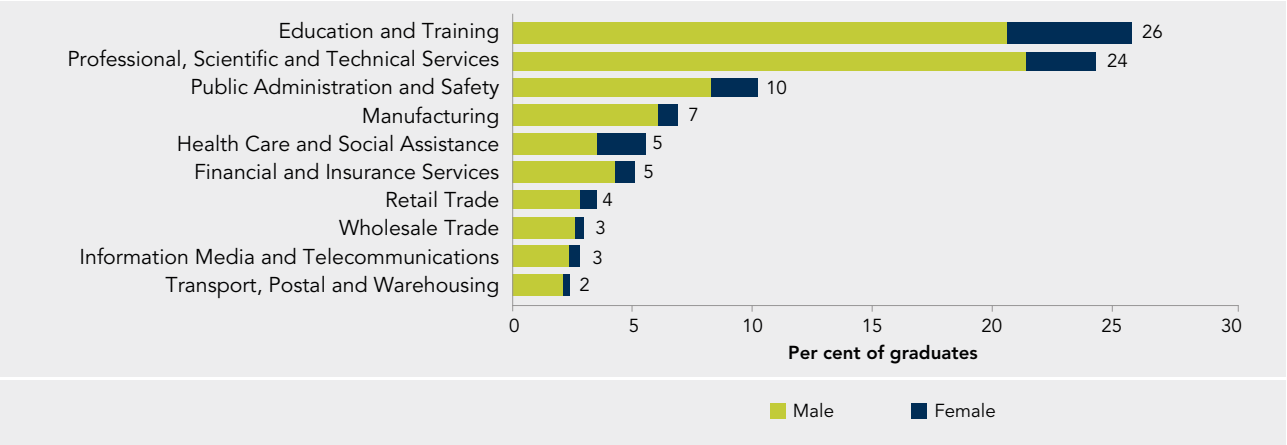
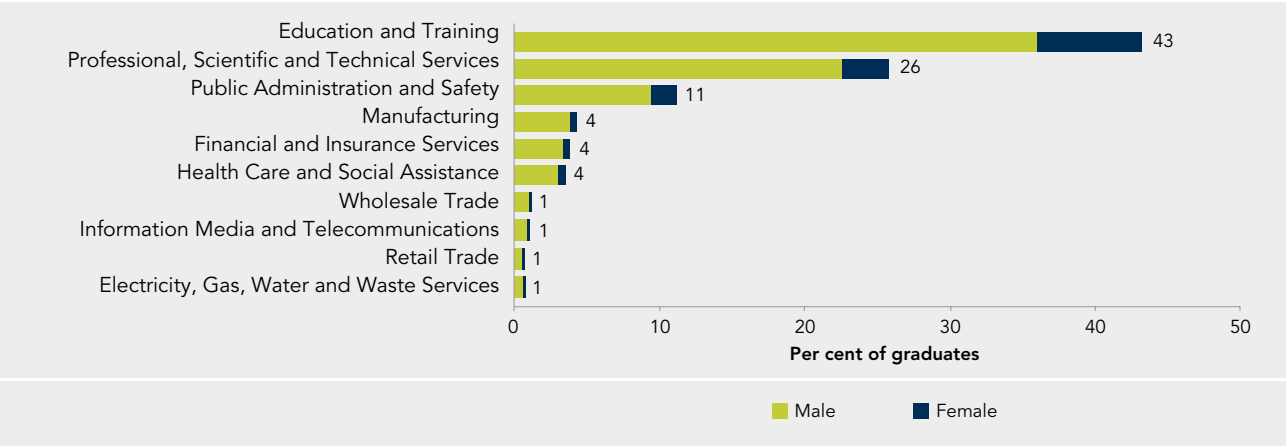


Figure 5.3: Top ten industry divisions of employment for Physics and Astronomy doctoral graduates, by gender



Half of the Physics and Astronomy graduates in Australia were employed in two industry divisions: Education and Training and Professional, Scientific and Technical Services, with 26 and 24 per cent of graduates, respectively (Figure 5.2). The other 50 per cent of graduates were spread across the remaining 17 industry divisions. At the doctorate level, 43 per cent were employed in Education and Training, and one quarter (26 per cent) in Professional, Scientific and Technical Services (Figure 5.3).

Male and female graduates were employed in different proportions across industries. For example, one quarter of males worked in each of Professional, Scientific and Technical Services, and Education and Training (26 and 25 per cent, respectively), while almost one third of females worked in Education and Training (30 per cent), and only 17 per cent in Professional, Scientific and Technical Services. The industry class of Computer System Design and Related Services employed 12 males for every female (Figure 5.4). Within the Education and Training industry, 19 per cent of graduates were employed in Higher Education, and a further 3 per cent in Secondary Education.

Doctorate graduates were more concentrated in the Higher Education and Scientific Research Services (39 and 13 per cent, respectively) sectors compared to Physics and Astronomy graduates as a whole (Figure 5.5).

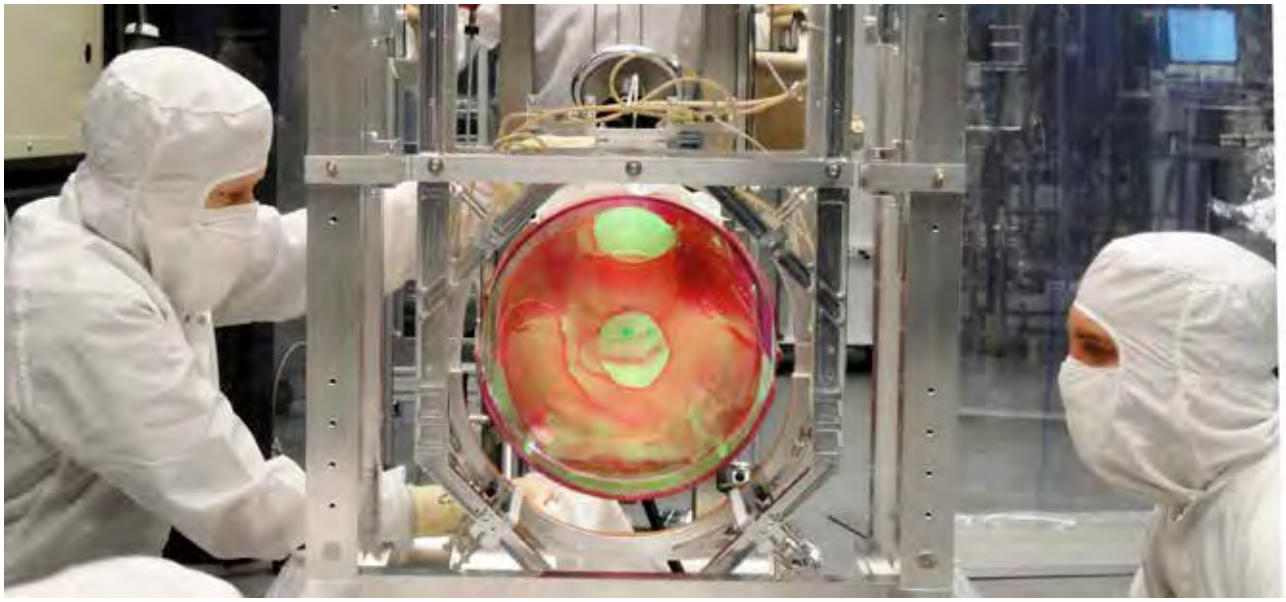


Figure 5.4: Top ten industry classes of employment of Physics and Astronomy graduates with qualifications at bachelor level and above, by gender

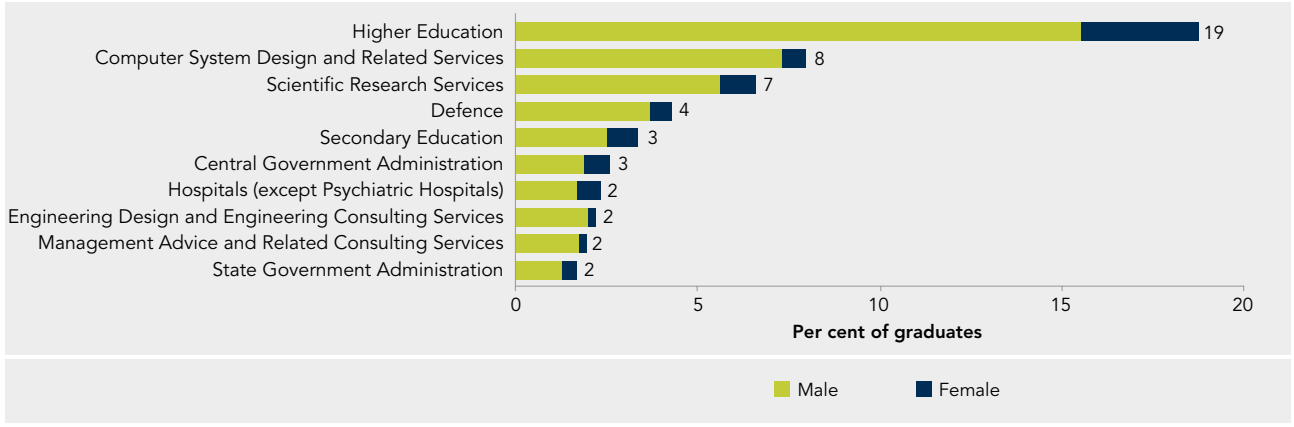


Figure 5.5: Top ten industry classes of employment of Physics and Astronomy doctoral graduates, by gender

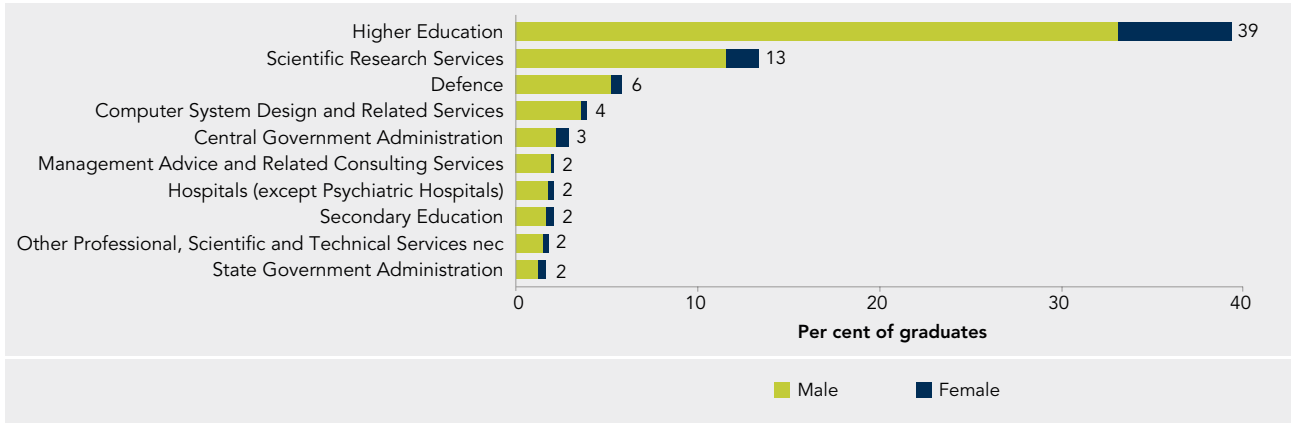


Figure 5.6: Top ten sub-major group level of occupations of Physics and Astronomy graduates with qualifications at bachelor level and above, by gender

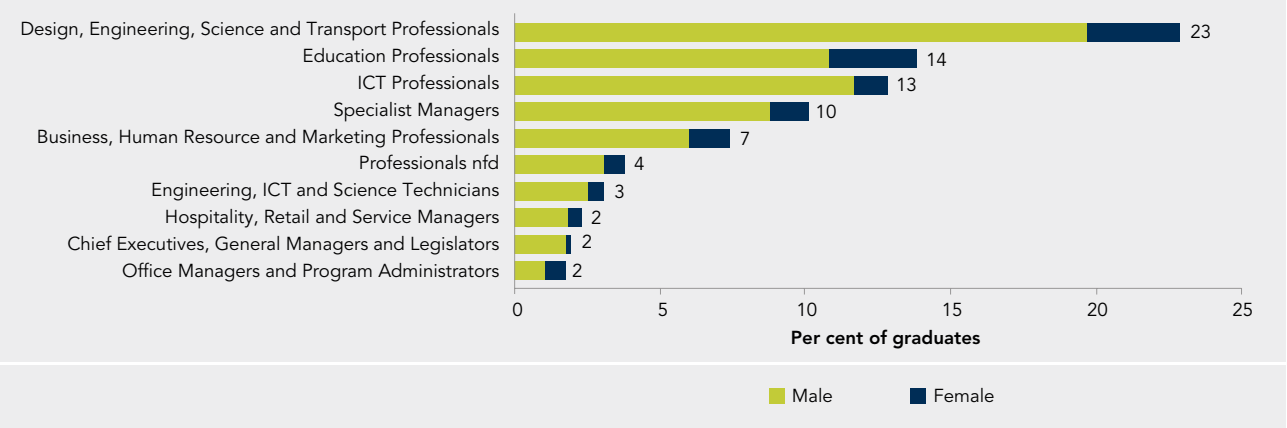
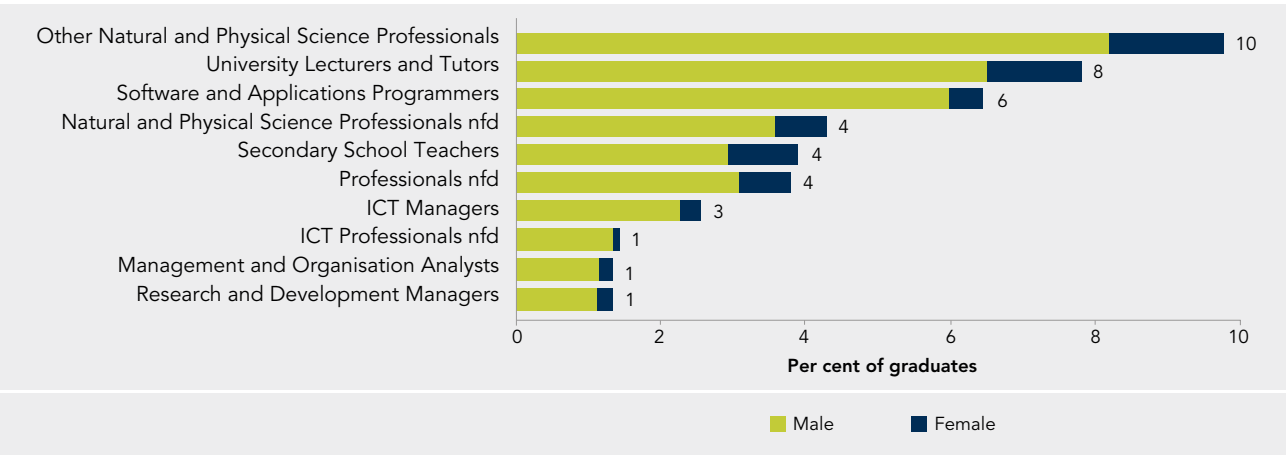


Figure 5.7: Top ten unit group level occupations of Physics and Astronomy graduates with qualifications at bachelor level and above, by gender



WHAT ARE THE OCCUPATIONS OF PHYSICS AND ASTRONOMY GRADUATES?

Almost two thirds of all Physics and Astronomy graduates were employed in the major occupational group of Professionals (64 per cent), while 15 per cent worked as Managers (data not shown).

The most common sub-major occupations were (Figure 5.6):

- Design, Engineering, Science and Transport Professionals (23 per cent)
- Education Professionals (14 per cent)
- ICT Professionals (13 per cent).

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.

More males worked as ICT Professionals (14 per cent) than Education Professionals (13 per cent), while more females were employed as Specialist Managers or Business, Human Resource and Marketing Professionals (both 8 per cent) than ICT Professionals (6 per cent).

Figure 5.8: Top ten unit group level occupations of Physics and Astronomy doctoral graduates, by gender

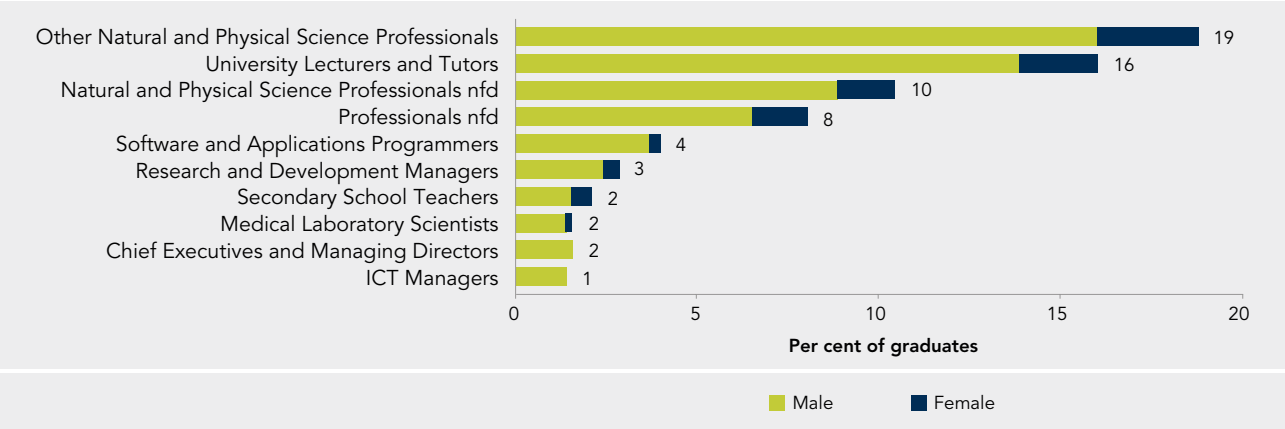
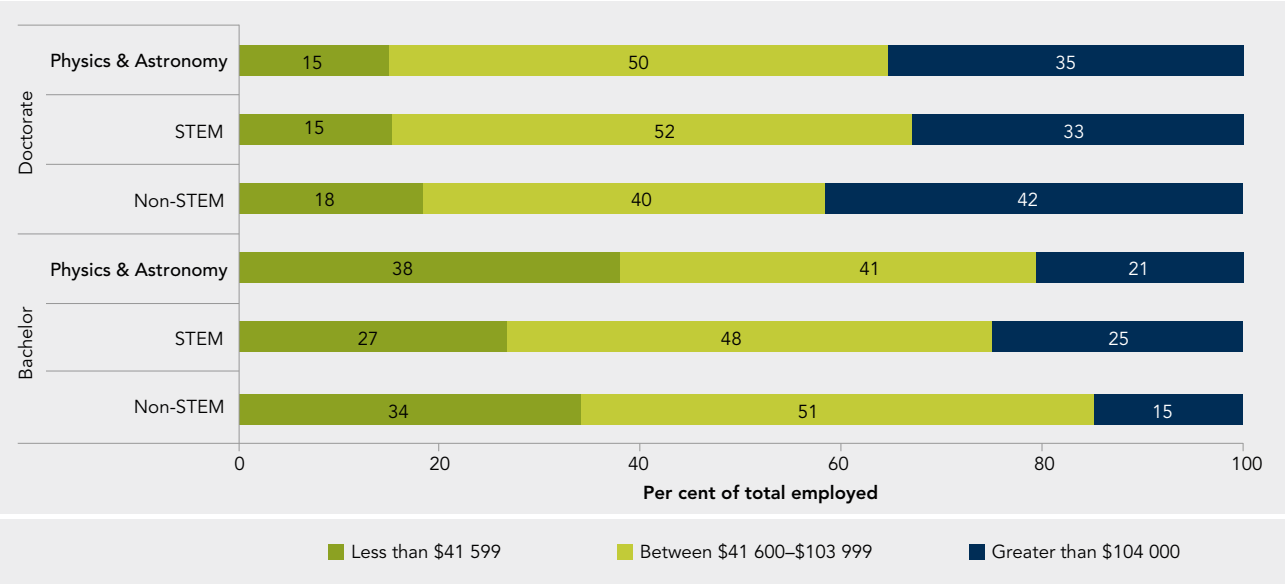


Figure 5.9: Personal annual income of graduates, by field and level of qualification



At the unit level, the most common occupations were Other Natural and Physical Science Professionals (10 per cent), and University Lecturers and Tutors (8 per cent) (Figure 5.7).

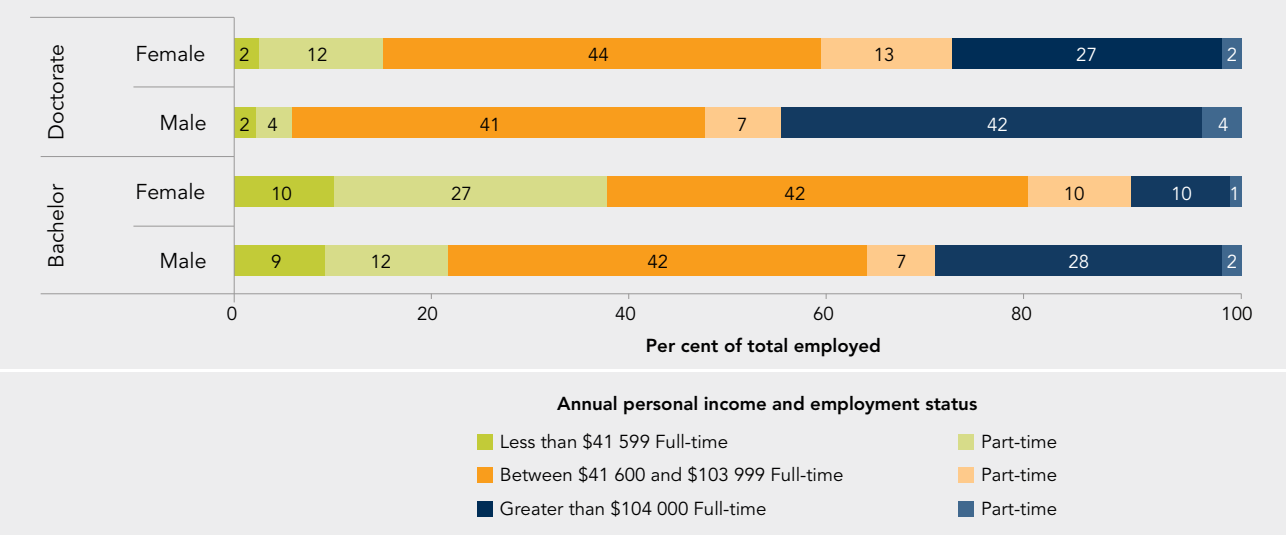
Of those who worked as Education Professionals, over half were University Lecturers and Tutors (56 per cent). ICT Professionals most commonly worked as Software and Application Programmers (50 per cent). Comparative female representation among Software and Application Programmers was the lowest of the top ten occupation unit groups (12 males for every female).

ARE THE DESTINATIONS FOR PHYSICS AND ASTRONOMY DOCTORATE HOLDERS DIFFERENT FROM THE COHORT AS A WHOLE?

The top two occupations for doctoral graduates were the same as those at bachelor level or above—37 per cent were Design, Engineering, Science and Transport Professionals, and 19 per cent were Education Professionals.

At the more detailed unit group level, doctorate holders most commonly worked as Other Natural and Physical Science Professionals (19 per cent) and University Lecturers and Tutors (16 per cent) (Figure 5.8).

Figure 5.10: Personal annual income of Physics and Astronomy graduates working full-time and part-time, by field, gender and level of qualification



ARE PHYSICS AND ASTRONOMY GRADUATES HIGH EARNERS?

At the bachelor level, a higher proportion of Physics and Astronomy graduates received an income in the highest bracket (more than $104 000 per year) compared to Non-STEM graduates (21 and 15 per cent, respectively); however, both were lower than the percentage for the total STEM bachelor cohort, at 25 per cent (Figure 5.9).

Completing a doctorate in Physics and Astronomy can be financially rewarding: over 1.5 times as many doctorate degree holders had an income in the highest bracket, compared to bachelor degree holders in the same field (35 and 21 per cent, respectively).

A higher percentage of Non-STEM doctoral graduates had an income in the higher brackets than those from Physics and Astronomy and the total STEM cohort (42, 35 and 33 per cent, respectively); however, only 15 per cent from Physics and Astronomy were in the lowest bracket (earnings less than $41 599), compared to 18 per cent of Non-STEM.

The incomes of graduates were closely related to their full-time or part-time employment status and gender; with more females and more part-time workers in the lower income brackets (Figure 5.10). At the bachelor level, 30 per cent of all male graduates earned over $104 000, while only 11 per cent of female graduates did. Almost half (46 per cent) of male graduates with a doctorate degree were in this highest income bracket.

Age and gender are important factors in the income levels of graduates—as they are for the whole population. At the bachelor level, there was a higher proportion of male Physics and Astronomy graduates in the highest income bracket compared to Non-STEM across all age groups (Figure 5.11). The proportion of male Physics and Astronomy graduates in the highest bracket was generally comparable to that of the STEM average between the ages of 30 to 50 for bachelor graduates and higher than the STEM average for doctoral graduates between the ages of 35 to 60 (Figure 5.12).

A lower proportion of female bachelor graduates were in the highest income bracket compared to males across all age groups—the difference was at least double for all age groups, and was greatest between ages 45 to 49. At the doctoral level of qualification, the difference between males and females is less pronounced, and is reversed at the ages of 65 and above.

Figure 5.11: Percentage of bachelor level graduates earning greater than $104 000 annually, by field, age group and gender

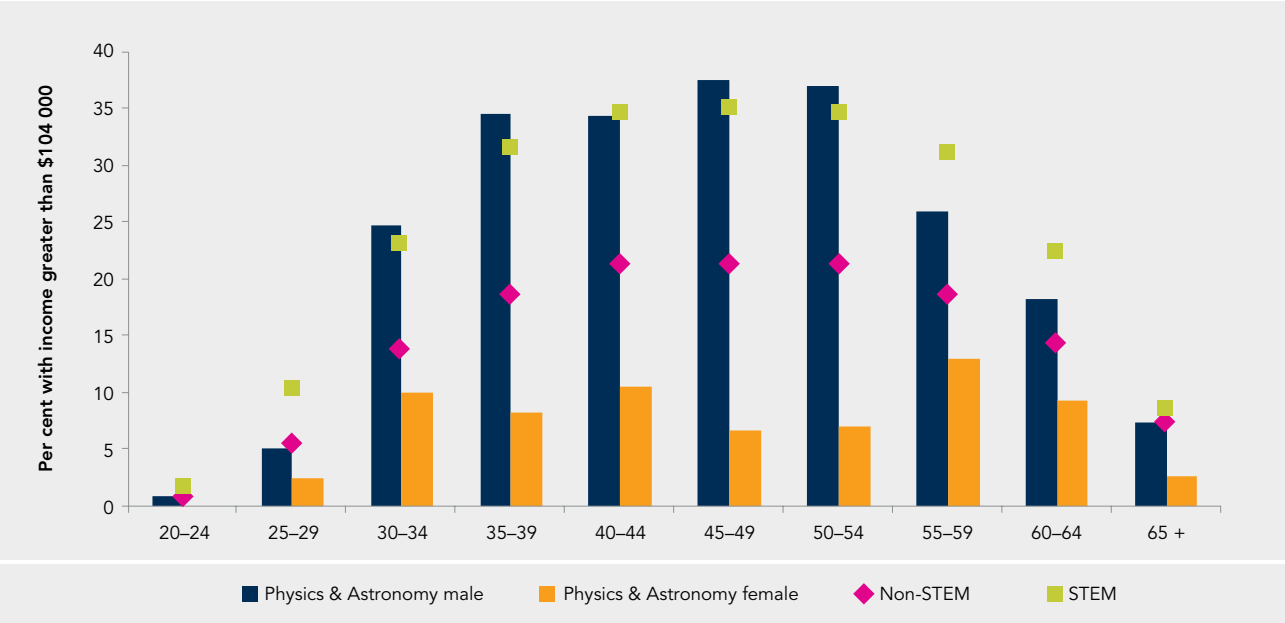
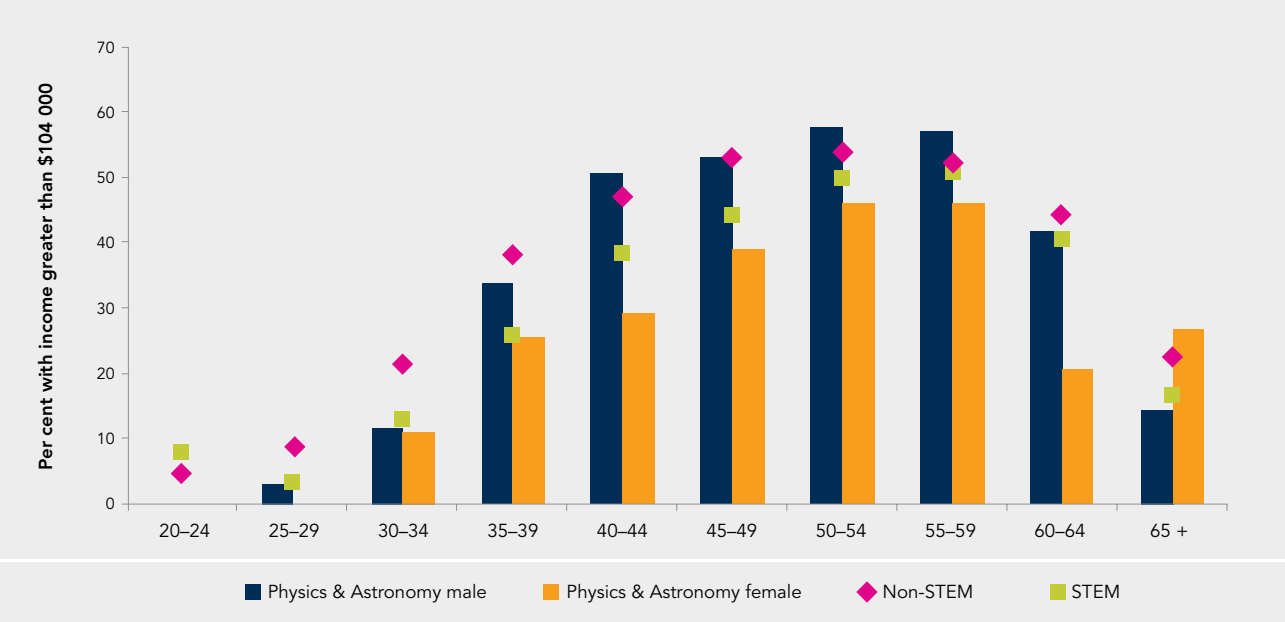
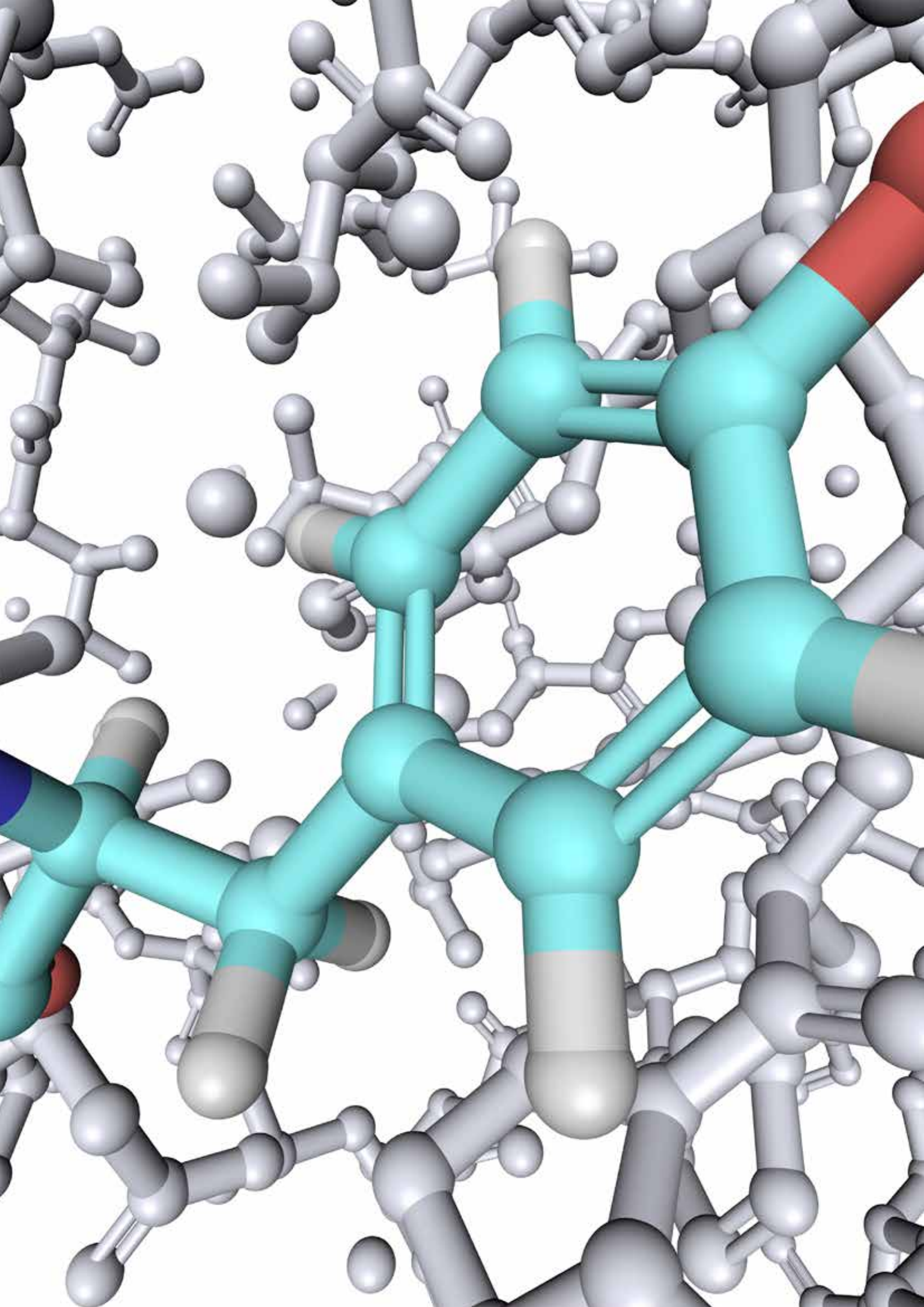


Figure 5.12: Percentage of doctoral level graduates earning greater than $104 000 annually, by field, age group and gender





CHAPTER 6

STEM PATHWAYS: CHEMICAL SCIENCES

WHAT ARE CHEMICAL SCIENCES?

The main purpose of studying and working in Chemical Sciences is to understand and apply knowledge of the fundamental properties of the elements, compounds and materials, and their reactions and transformations. Chemical Sciences is composed of: Organic Chemistry, Inorganic Chemistry and Chemical Science n.e.c. (not elsewhere classified). (ABS, 2001)

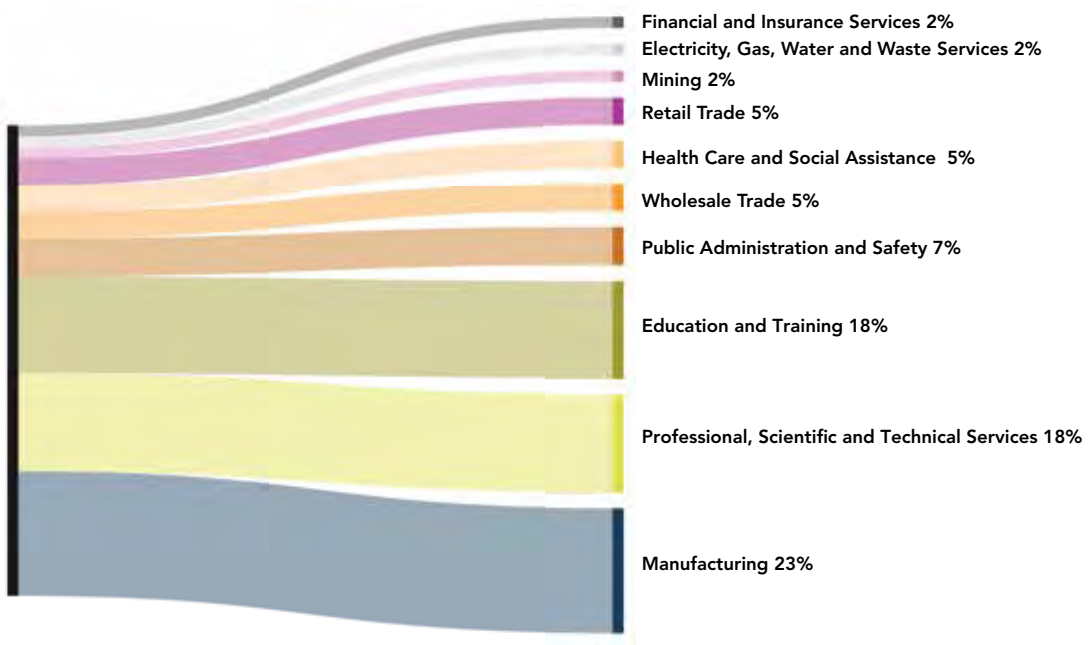
6

STEM PATHWAYS: CHEMICAL SCIENCES

KEY FACTS

1. In 2011, there were 23 147 Chemical Sciences graduates.
2. The majority of graduates in the workforce were male (64 per cent).
3. The private sector employed 72 per cent of all Chemical Science graduates—varying from 81 per cent of bachelors to 47 per cent of doctorates.
4. Almost 60 per cent worked in three industry divisions: Manufacturing (23 per cent), Professional, Scientific and Technical Services (18 per cent), and Education and Training (18 per cent).
5. Most graduates worked as Professionals or Managers (49 and 22 per cent, respectively).
6. At a more detailed level, the most common occupation was as Chemists, and Food and Wine Scientists (13 per cent).
7. Of those with doctorates, almost 87 per cent worked as Professionals, and the most common occupation was as University Lecturers and Tutors (34 per cent).
8. The proportion of graduates earning over $104 000 per year increased from 22 per cent to 40 per cent from bachelor to doctorate level of qualification.

Top ten industry sectors of employment for Chemical Sciences graduates



HOW MANY CHEMICAL SCIENCES GRADUATES ARE THERE IN AUSTRALIA?

In 2011, there were 23 147 Chemical Sciences graduates in Australia. Thirty per cent of graduates (6836) were either not in the labour force or were unemployed (27 and 3 per cent, respectively).

Approximately 24 per cent of graduates in the workforce held a doctorate degree, compared to eight per cent of STEM graduates and three per cent of graduates from Non-STEM fields.

The majority (64 per cent) of graduates were males. At the doctoral level, this disparity was higher, with males making up 73 per cent of Chemical Science doctorate holders.

HOW OLD IS THE CHEMICAL SCIENCES GRADUATE WORKFORCE?

The age distribution of graduates in the workforce was comparatively different from Non-STEM-qualified graduates in the workforce (Figure 6.1).

Compared to the male Non-STEM-qualified workforce, the male Chemical Sciences workforce is ageing, with only one fifth aged under 34, compared to one third of Non-STEM graduates. The difference is much less pronounced for females.

WHERE DO CHEMICAL SCIENCES GRADUATES WORK?

The private sector employed 72 per cent of all Chemical Sciences graduates; however the proportion varied depending on level of qualification as follows:

- Bachelor level: 81 per cent
- Postgraduate level: 56 per cent
  - Masters: 76 per cent
  - Doctorate: 47 per cent

Figure 6.1: Age distribution of employed graduates with qualifications at bachelor level and above, by field and gender

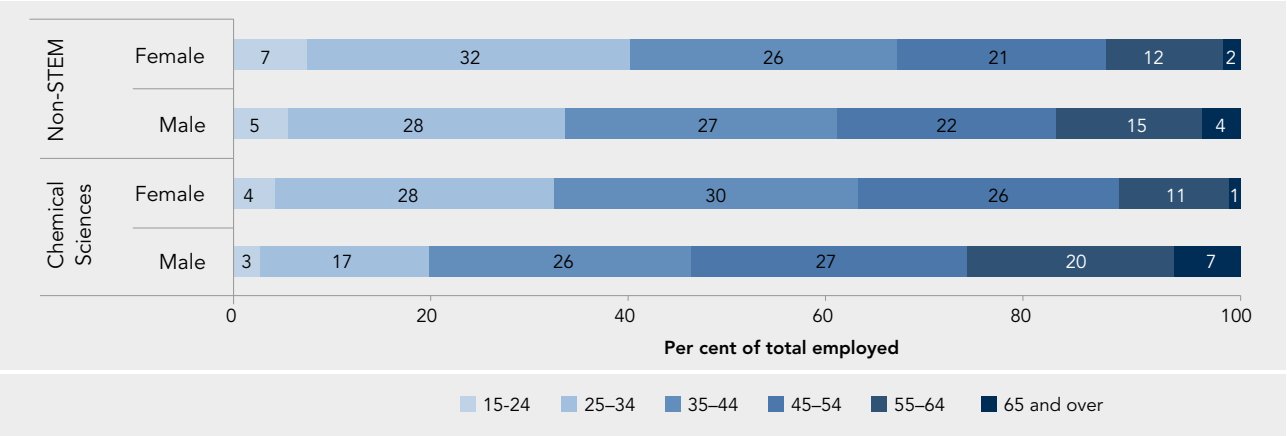


Figure 6.2: Top ten industry divisions of employment for Chemical Sciences graduates with qualifications at bachelor level and above, by gender

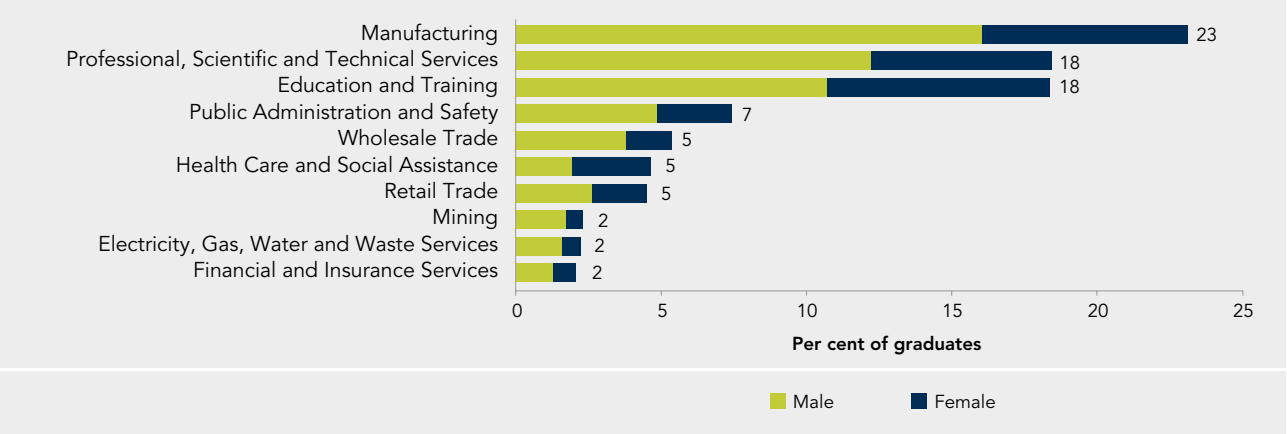
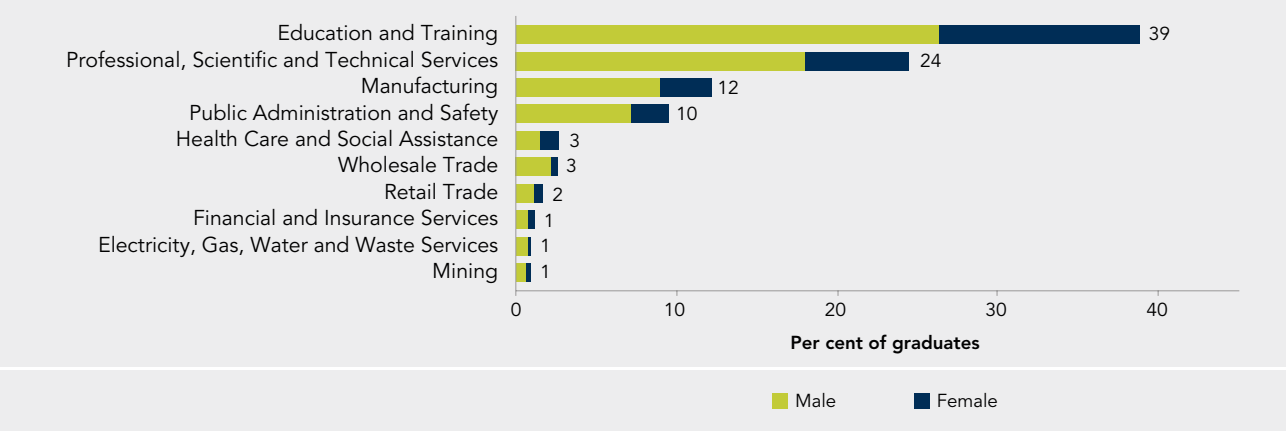


Figure 6.3: Top ten industry divisions of employment for Chemical Sciences doctoral graduates, by gender



INDUSTRY SECTORS OF EMPLOYMENT

The top three industry divisions of employment for Chemical Sciences graduates were Manufacturing; Professional, Scientific and Technical Services; and Education and Training (23, 18 and 18 per cent of graduates, respectively) (Figure 6.2). There were more males compared to females employed in all of the top ten industries, except for Health Care and Social Assistance.

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.

For individuals with a doctorate degree, the top industries of employment were Education and Training, and Professional, Scientific and Technical Services (39 and 24 per cent of graduates, respectively) (Figure 6.3). There were higher proportions of males compared to females in all of the top ten industry sectors of employment.

At the industry class level, Higher Education employed 23 per cent of all graduates and 33 per cent of doctorate degree holders. For all graduates, the second highest industry class for employment was Scientific Research Services (5 per cent of bachelor and above and 12 per cent of doctorates) (Figure 6.4 and Figure 6.5).

Figure 6.4: Top ten industry classes of employment for Chemical Sciences graduates with qualifications at bachelor level and above, by gender

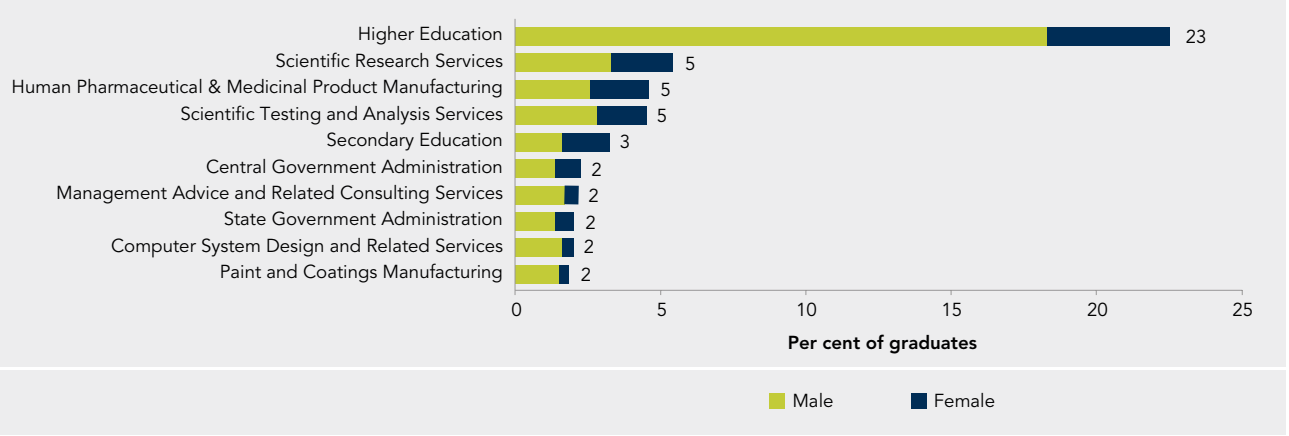


Figure 6.5: Top ten industry classes of employment for Chemical Sciences doctoral graduates, by gender

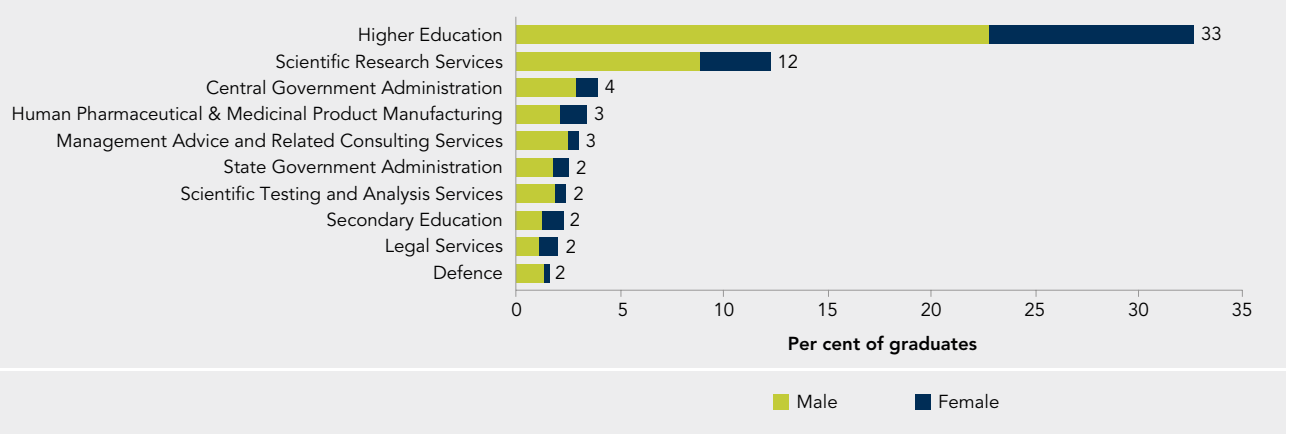


Figure 6.6: Top ten unit group level occupations of Chemical Sciences graduates with qualifications at bachelor level and above, by gender

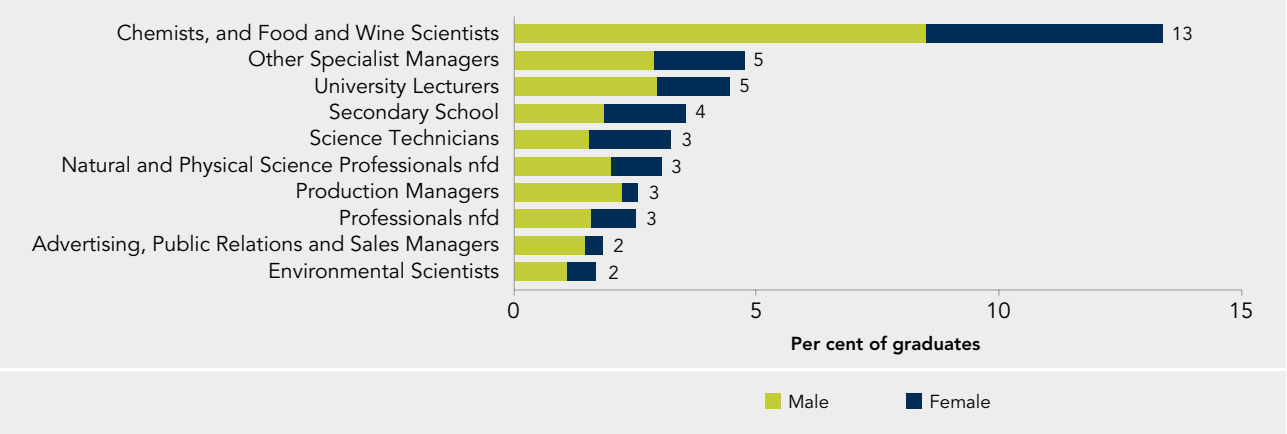
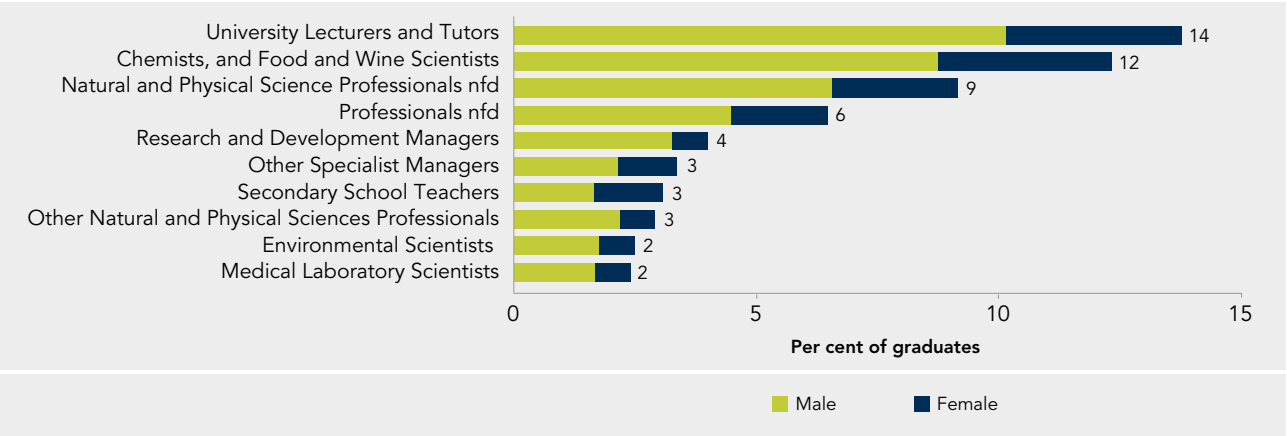


Figure 6.7: Top ten unit group level occupations of Chemical Sciences doctoral graduates, by gender



WHAT ARE THE OCCUPATIONS OF CHEMICAL SCIENCES GRADUATES?

The majority of graduates in the Chemical Sciences field were engaged as Professionals and Managers (49 and 22 per cent, respectively). Amongst the graduates employed as Professionals, the most common occupation sub-major groups were:

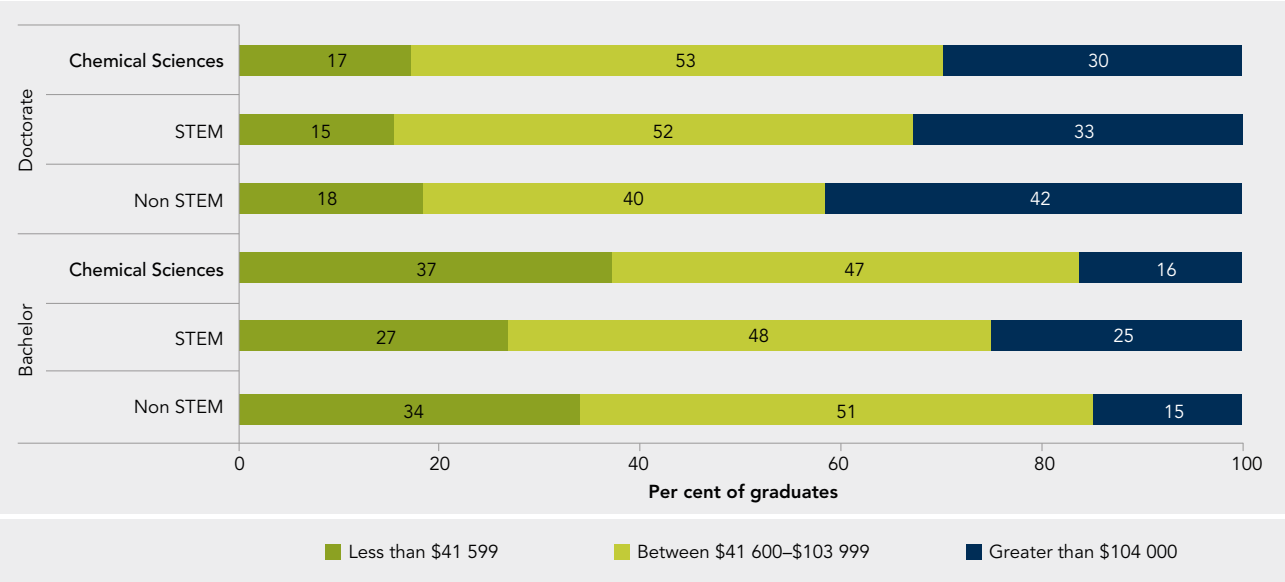
- Design, Engineering, Science and Transport Professionals (48 per cent)
- Education Professionals (20 per cent)
- Business, Human Resource and Marketing Professionals (14 per cent).

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



At the finer, unit group level of detail, the most common occupations were as Chemists, and Food and Wine Scientists; Other Specialist Managers; and University Lecturers and Tutors (13, 5 and 5 per cent of graduates, respectively) (Figure 6.6).

The gender distribution in Chemical Sciences graduates was highly skewed where more males were in the majority for most occupations. In the top ten unit group occupations, only Science Technician roles were filled by a higher proportion of females compared to males (Figure 6.6).

ARE THE DESTINATIONS FOR CHEMICAL SCIENCES DOCTORATE HOLDERS DIFFERENT FROM BACHELOR DEGREE HOLDERS?

Almost 87 per cent of doctorate holders were employed as Professionals and 8 per cent were employed as Managers. Of the Professionals, 29 per cent were employed in the private sector.

The most common unit group occupations for doctorate holders were as University Lecturers and Tutors; Chemists, and Food and Wine Scientists; and Natural and Physical Sciences Professionals, n.f.d. (not further defined) (14, 12 and 9 per cent, respectively) (Figure 6.7).

ARE CHEMICAL SCIENCES GRADUATES HIGH EARNERS?

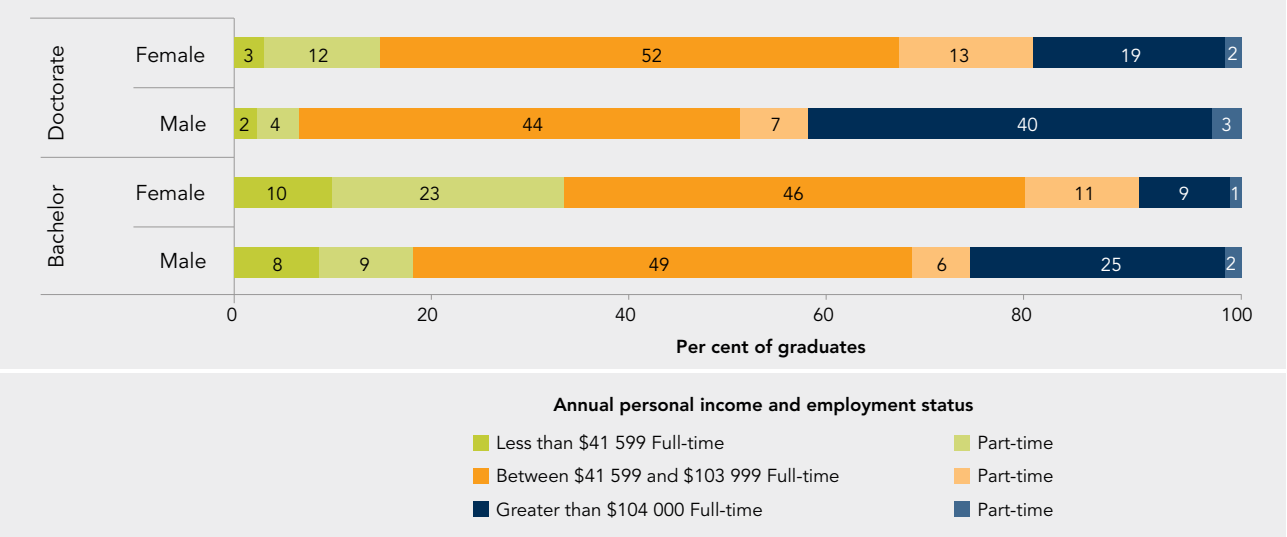
The personal income of graduates can be analysed using comparisons between income brackets and different fields of qualification, as illustrated in Figure 6.8.

At the bachelor degree level, 16 per cent of Chemical Sciences graduates earned a personal income in the highest income bracket (more than $104 000), which is similar to the percentage of Non-STEM graduates.

Completing a doctorate in Chemical Sciences can be financially rewarding, with a higher percentage of doctorate holders in the highest income bracket; however at 29 per cent, this is less than doctorate holders from all STEM fields (33 per cent) and Non-STEM fields (42 per cent).

The proportion of Chemical Sciences graduates earning less than $41 599 was 17 and 37 per cent at the doctorate and bachelor levels, respectively, which is higher than both the STEM and Non-STEM graduate cohorts.

Figure 6.9: Personal annual income of Chemical Sciences graduates working full-time and part-time, gender and level of qualification



Graduate income levels were dependent on both gender and full-time or part-time employment, with fewer females and fewer part-time workers in the higher income brackets (Figure 6.9). The largest income disparity is in the proportion of doctorate holders in the highest income bracket, which is 43 per cent for males, and less than half that for females at 21 per cent.

Over one-third (35 per cent) of females with a bachelor qualification in Chemical Sciences worked part-time, and the majority of these females had earnings in the lowest income bracket. In comparison, 17 per cent of males with a bachelor level qualification were employed part-time. At the doctorate level, 27 per cent of females and 14 per cent of males were employed on a part-time basis.

Compared to the STEM graduate cohort, lower proportions of both male and female Chemical Sciences bachelor graduates had a personal income in the highest bracket (Figure 6.10). The proportion of male bachelor graduates in the highest bracket was at least double that of female graduates for all age groups older than 29, reaching a maximum difference between the ages of 50 to 54.

At the doctorate level, higher proportions of male Chemical Sciences graduates between the ages of 35 to 54 were in the top income bracket compared to the STEM cohort (Figure 6.11). The difference between males and females was not as marked at the doctorate level compared to bachelor; however the difference was more than double between the ages of 40 to 44 and 50 to 64.

Figure 6.10: Percentage of bachelor level graduates earning greater than $104 000 annually, by field, gender and age group

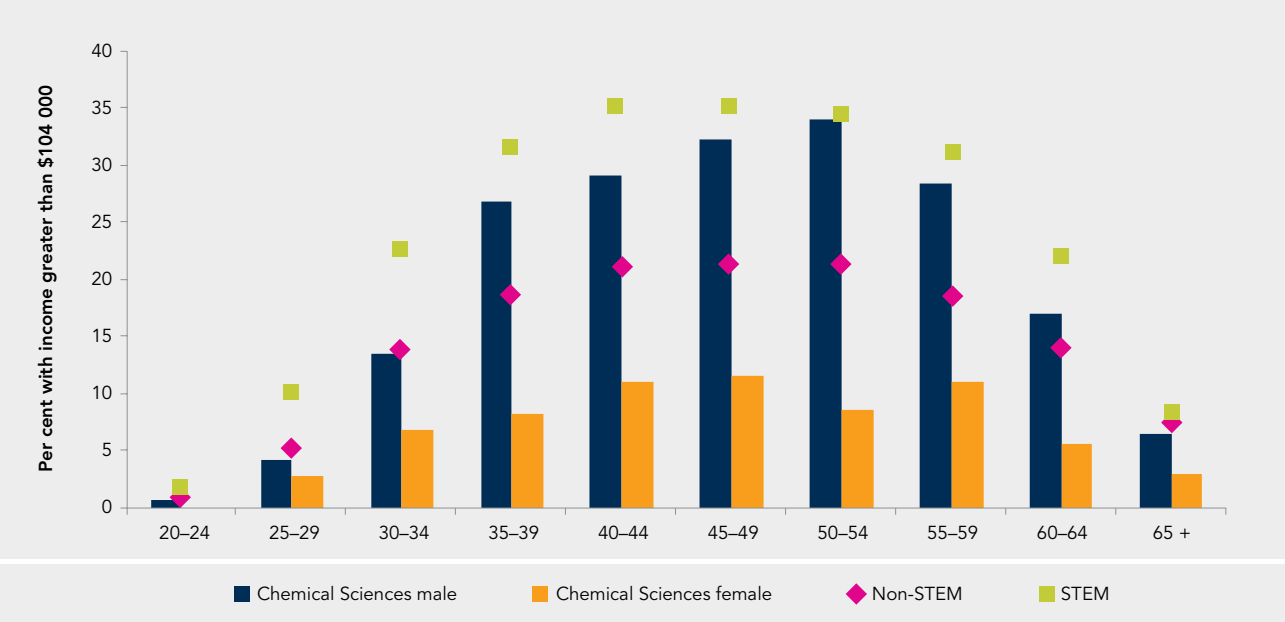
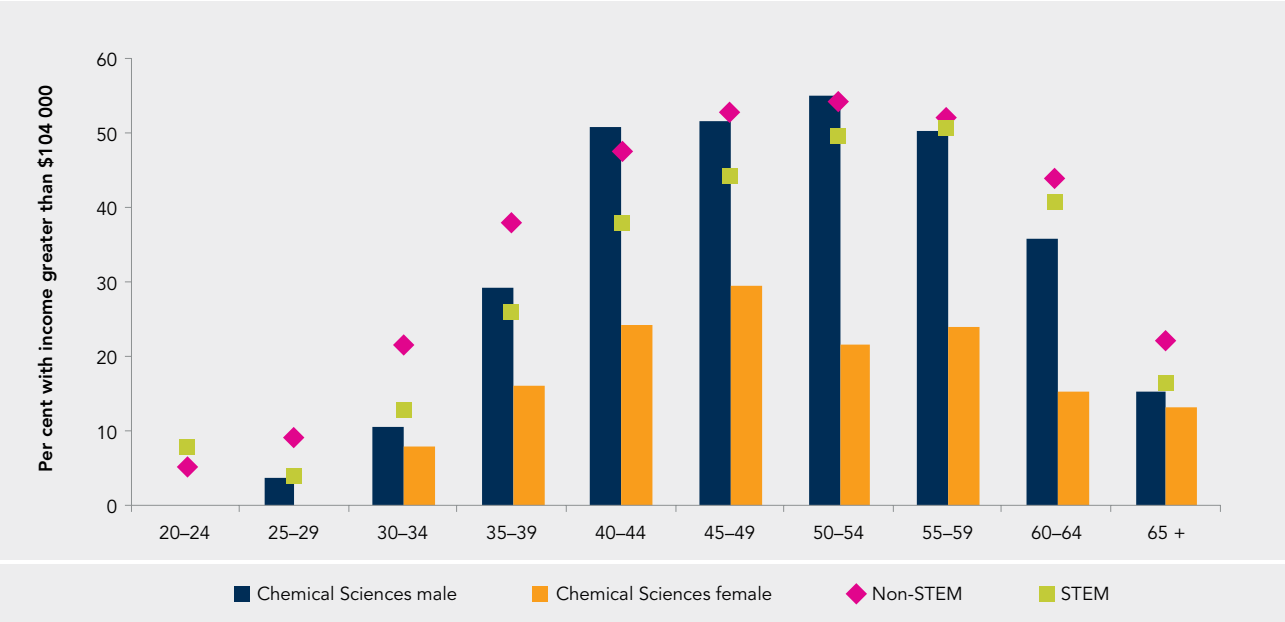


Figure 6.11: Percentage of doctoral level graduates earning greater than $104 000 annually, by field, gender and age group



CHAPTER 7

STEM PATHWAYS: EARTH SCIENCES

WHAT ARE EARTH SCIENCES?

The main purpose of studying and working in Earth Sciences is to understand and apply knowledge of the physical properties of the Earth's crust and the characteristics of its soil, landforms, climate, hydrosphere and atmosphere. Earth Sciences are composed of: Atmospheric Sciences, Geology, Geophysics, Geochemistry, Soil Science, Hydrology, Oceanography and Earth Sciences n.e.c. (not elsewhere classified) (ABS, 2001).

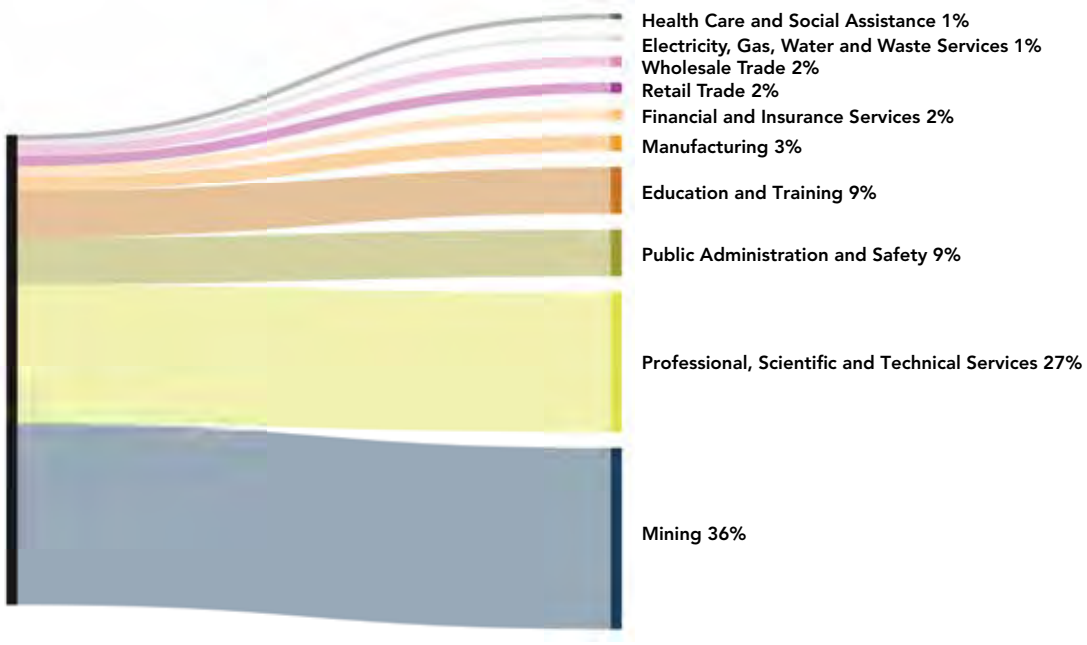
7

STEM PATHWAYS: EARTH SCIENCES

KEY FACTS

1. In 2011, there were 18 396 Earth Sciences graduates.
2. The majority of graduates in the workforce were male (76 per cent).
3. The female workforce was younger than the male workforce: one quarter of females were aged 45 or over (25 per cent), compared to half of males (51 per cent).
4. 79 per cent were employed in the private sector, with the proportions varying from 85 per cent of bachelors to 52 per cent of doctorates.
5. Just over one-third worked in the Mining industry (35 per cent), and just over one quarter in the Professional, Scientific and Technical Services industry (27 per cent).
6. Doctorate holders were more commonly employed in the Professional, Scientific and Technical Services (33 per cent) and Education and Training (27 per cent) than Mining (20 per cent) industries.
7. The majority worked as Professionals (72 per cent), and the most common occupation was as Design, Engineering, Science and Transport Professionals (57 per cent).
8. A higher proportion of Earth Sciences graduates with a bachelor degree had a personal income more than $104 000 (40 per cent), compared to both the STEM (25 per cent) and Non-STEM (15 per cent) cohorts.

Top ten industry sectors of employment for Earth Sciences graduates



HOW MANY EARTH SCIENCES GRADUATES ARE THERE IN AUSTRALIA?

In 2011, there were 18 396 Earth Sciences graduates (bachelor and above) in Australia. Nineteen per cent of graduates (3489) were not in the labour force or were unemployed (17 and 2 per cent, respectively). Approximately 76 per cent of all graduates in the workforce were male.

The majority of graduates held degrees in the field of Geology (72 per cent). The next most popular fields of study were Earth Sciences n.e.c. (not elsewhere classified), and Geophysics, both with 8 per cent of graduates.

HOW OLD IS THE EARTH SCIENCES GRADUATE WORKFORCE?

The age distribution of the Earth Sciences graduate workforce was somewhat different to that of the Non-STEM workforce, especially for males (Figure 7.1).

Just over half (51 per cent) of the male Earth Sciences graduates were aged 45 or over, while only 41 per cent of the male Non-STEM workforce were in the same age range. By contrast, around a quarter of females were aged 45 or over for Earth Sciences graduates and one-third for Non-STEM educated workforce, at 25 per cent and 35 per cent, respectively.

WHERE DO EARTH SCIENCES GRADUATES WORK?

The private sector employed 79 per cent of all Earth Sciences graduates. The proportion employed in the private sector varies with qualification as follows:

- Bachelor level: 85 per cent
- Postgraduate level: 69 per cent
  - Masters: 84 per cent
  - Doctorate: 52 per cent

INDUSTRY SECTORS OF EMPLOYMENT

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.

Two industry divisions employed the majority of graduates in Australia—Mining, which employed around one third of graduates (5207 individuals, 35 per cent), and Professional, Scientific and Technical Services, which employed around

Figure 7.1: Age distribution of employed graduates with qualifications at bachelor level and above, by field and gender

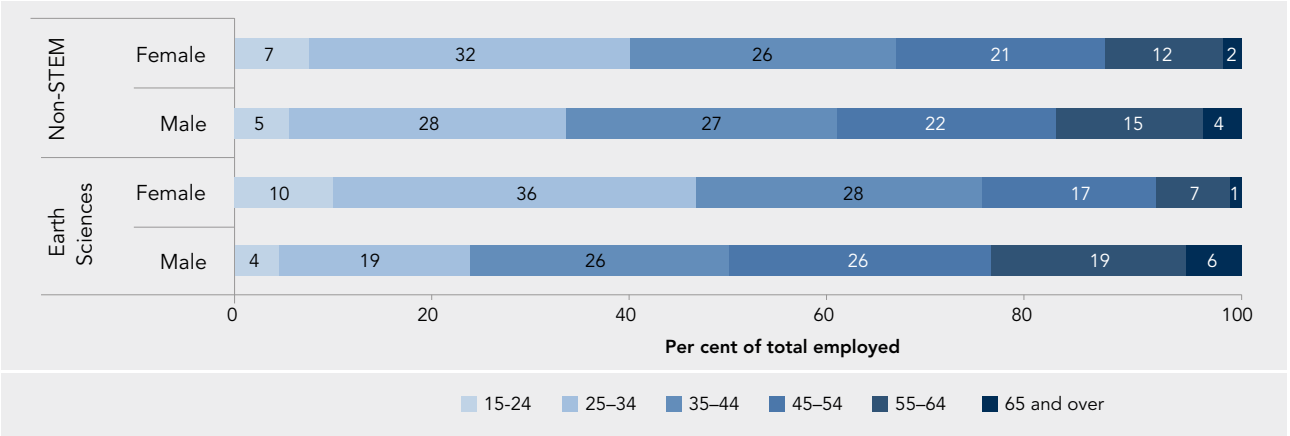


Figure 7.2: Top ten industry divisions of employment for Earth Sciences graduates with qualifications at bachelor level and above, by gender

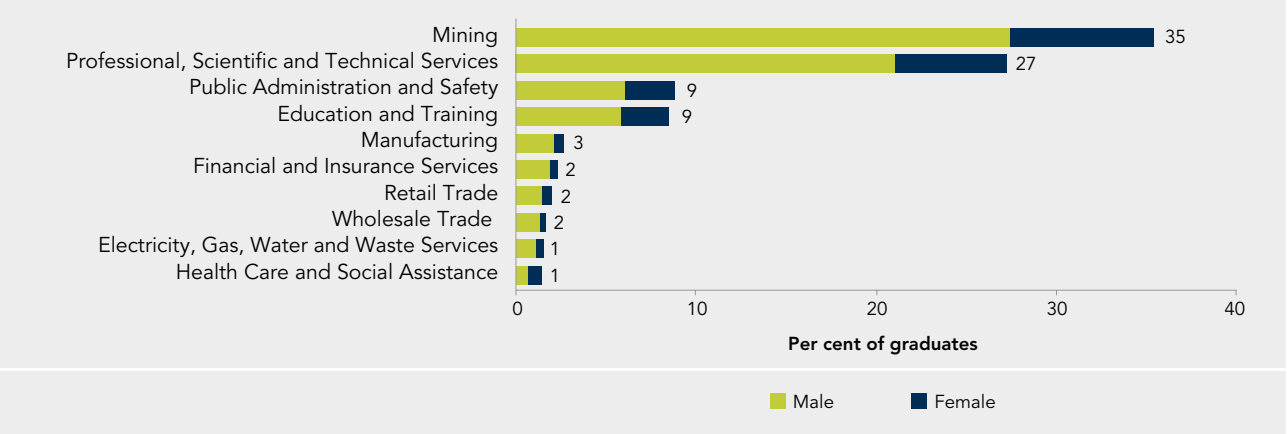
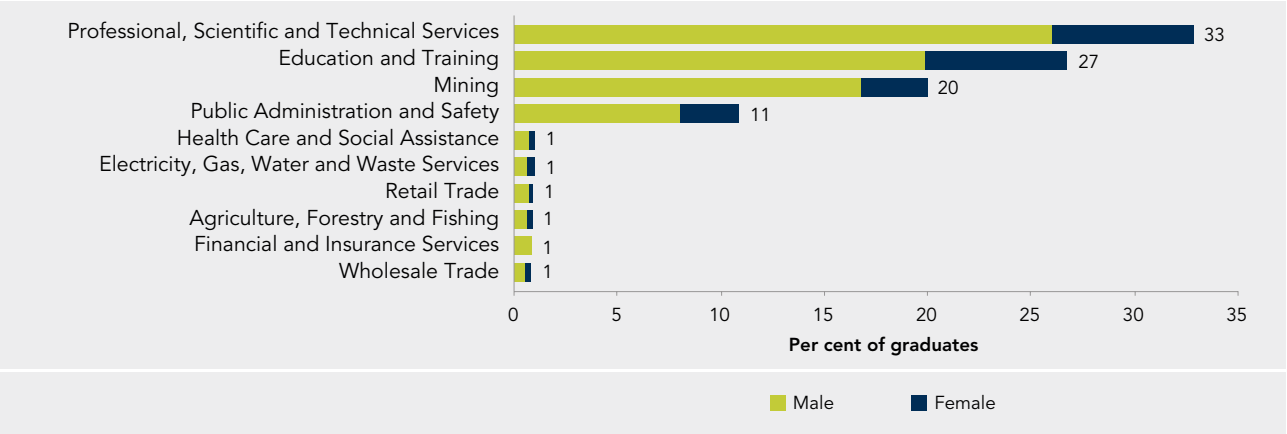


Figure 7.3: Top ten industry divisions of employment for Earth Sciences doctoral graduates, by gender



one quarter (3995 individuals, 27 per cent). Significantly fewer graduates were employed in the next most common industry, which was Public Administration and Safety, employing 9 per cent of graduates (Figure 7.2).

The top ten industry divisions were the same for male and female graduates, and they were employed in roughly the same proportion across the industry sectors, despite the difference in absolute numbers.

The top ten industry divisions for doctorate holders were similar to the graduate cohort as a whole; however, doctorate holders were more commonly found in Professional, Scientific and Technical Services (33 per cent) and Education and Training (27 per cent) than Mining (20 per cent)(Figure 7.3). These top three industry sectors for Earth Sciences doctorate holders were the same for both males and females. Manufacturing was not in the top ten industry divisions for doctorate holders, and was replaced by Agriculture, Forestry and Fishing.

Just over 50 per cent of graduates were accounted for in the top ten industry classes (Figure 7.4). As expected from Figure 7.2, most of the top ten industry classes were drawn from either the Mining or Professional, Scientific and Technical Services industries. The most common industry classes were Engineering Design and Engineering Consulting Services, Mineral Exploration, and Gold Ore Mining (8, 7 and 6 per cent of graduates, respectively).

Figure 7.4: Top ten industry classes of employment for Earth Sciences graduates with qualifications at bachelor level and above, by gender

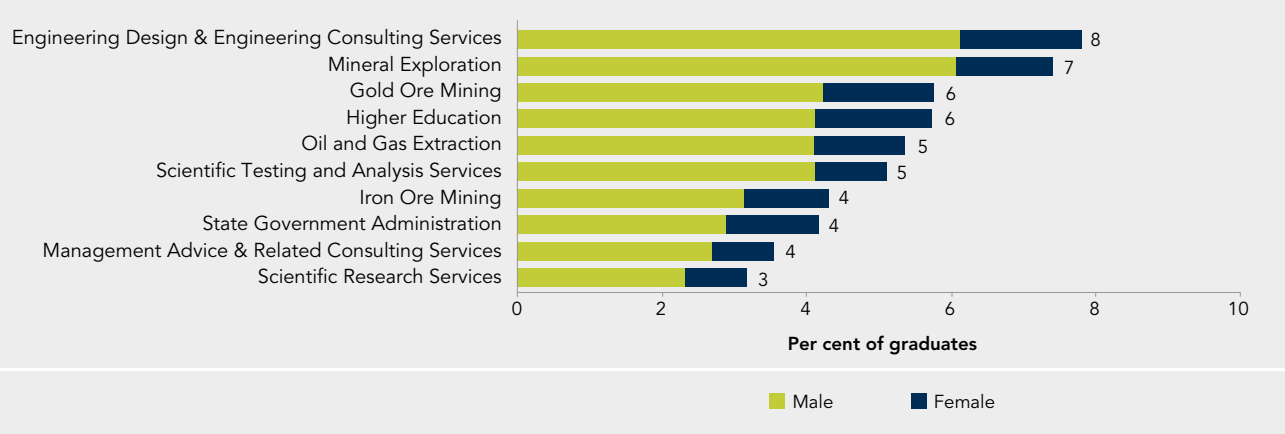
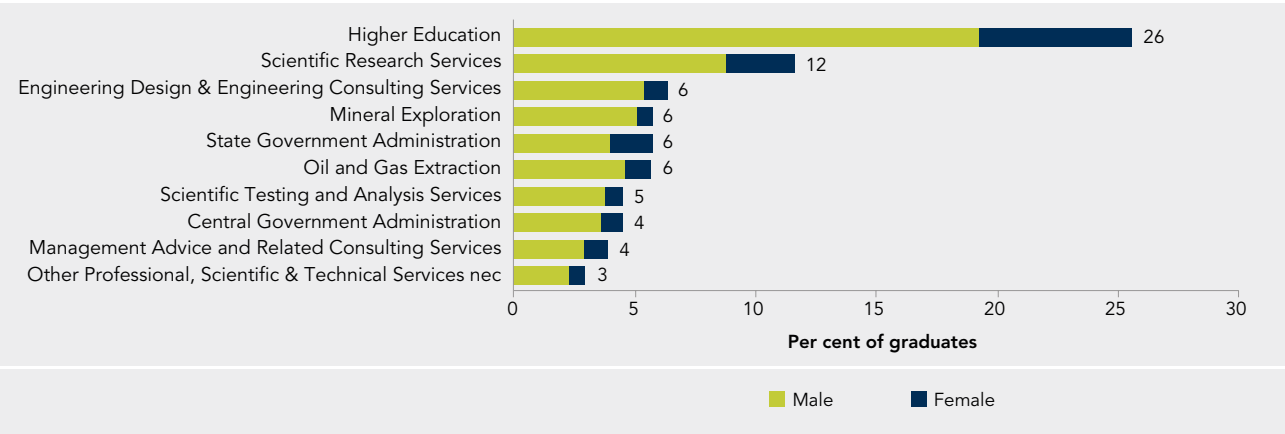


Figure 7.5: Top ten industry classes of employment for Earth Sciences doctoral graduates, by gender



Doctorate holders were most commonly employed in Higher Education, which employed 26 per cent of doctoral graduates, but only 6 per cent of Earth Sciences graduates as a whole (Figure 7.5). Scientific Research Services was the second most common industry class for employing Earth Sciences doctoral holders (12 per cent).

WHAT ARE THE OCCUPATIONS OF EARTH SCIENCES GRADUATES?

Over two-thirds of Earth Sciences graduates worked as Professionals (72 per cent). This was the largest category for both males and females, with 70 per cent of male and 82 per cent of female graduates. The next most common occupation was as Managers (15 per cent).

Figure 7.6: Top ten sub-major group level occupations of Earth Sciences graduates at bachelor level and above, by gender

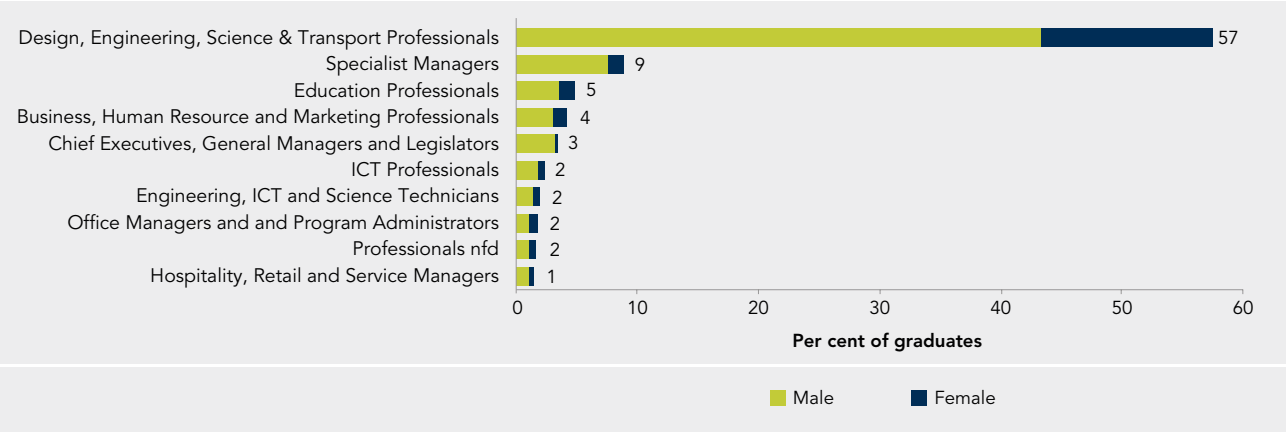


Figure 7.7: Top ten sub-major group level occupations of Earth Sciences doctorate graduates, by gender

As shown in Figure 7.6, the common occupations at the sub-major group level were mostly derived from Professionals and Managers. By a large margin, the top occupation at this more detailed level was as Design, Engineering, Science and Transport Professionals (57 per cent). The next most popular occupation was Specialist Managers (9 per cent).

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.

Doctorate holders were also most commonly employed as Design, Engineering, Science and Transport Professionals (57 per cent). However, in comparison to bachelor level graduates, they were more likely to be employed as Education Professionals than Specialist Managers (14 and 7 per cent, respectively) (Figure 7.7).

The occupation groups can be further broken down to the Unit-group level (Figure 7.8 and Figure 7.9).The top occupation by a substantial margin for both genders was Geologists and Geophysicists (45 per cent of both male and female graduates). Males were next most commonly employed as Other Specialist Managers, and Chief Executives and Managing Directors (both with 3 per cent of graduates). For female graduates, the next most popular occupations were as Environmental Scientists and Other Natural and Physical Science Professionals (5 and 3 per cent, respectively).

Figure 7.8: Top ten unit group level occupations of Earth Sciences graduates with qualifications at bachelor level and above, by gender

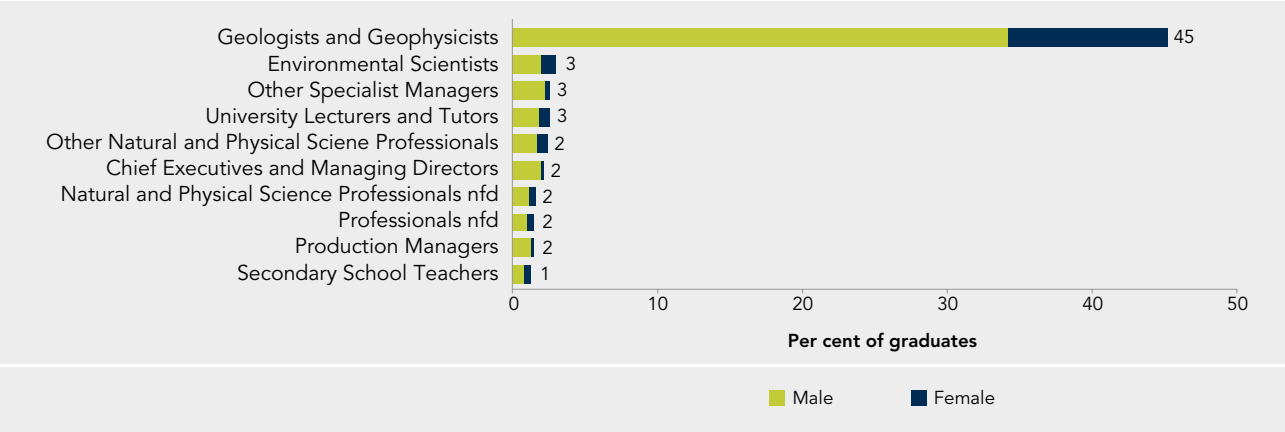
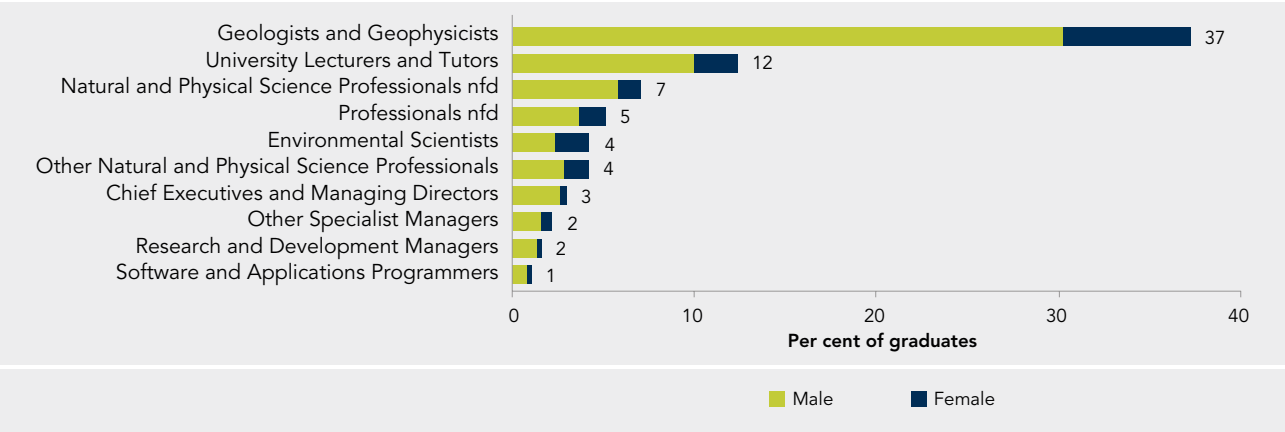


Figure 7.9: Top ten unit group level occupations of Earth Sciences doctorate graduates, by gender



Doctorate holders also most commonly worked as Geologists and Geophysicists (37 per cent). They were then more likely to be employed as University Lecturers and Tutors (12 per cent).

ARE EARTH SCIENCES GRADUATES HIGH EARNERS?

There were more Earth Sciences graduates at the bachelor level with a personal income in the highest bracket (more than $104 000) than in either the STEM or Non-STEM cohorts (41, 25 and 15 per cent, respectively) (Figure 7.10).

At the doctorate level, the distribution of people across the three income brackets was similar between Earth Sciences and Non-STEM cohorts, with 44 per cent and 45 per cent in the highest income bracket, 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 7.11).

More females worked part-time across both qualification levels and at all income levels, except at the highest income bracket: at the bachelor level, 44 per cent of women and 21 per cent of men worked part-time, while at the doctorate level 35 per cent of women and 19 per cent of men worked part-time.

Figure 7.10: Personal annual income of graduates, by field and level of qualification

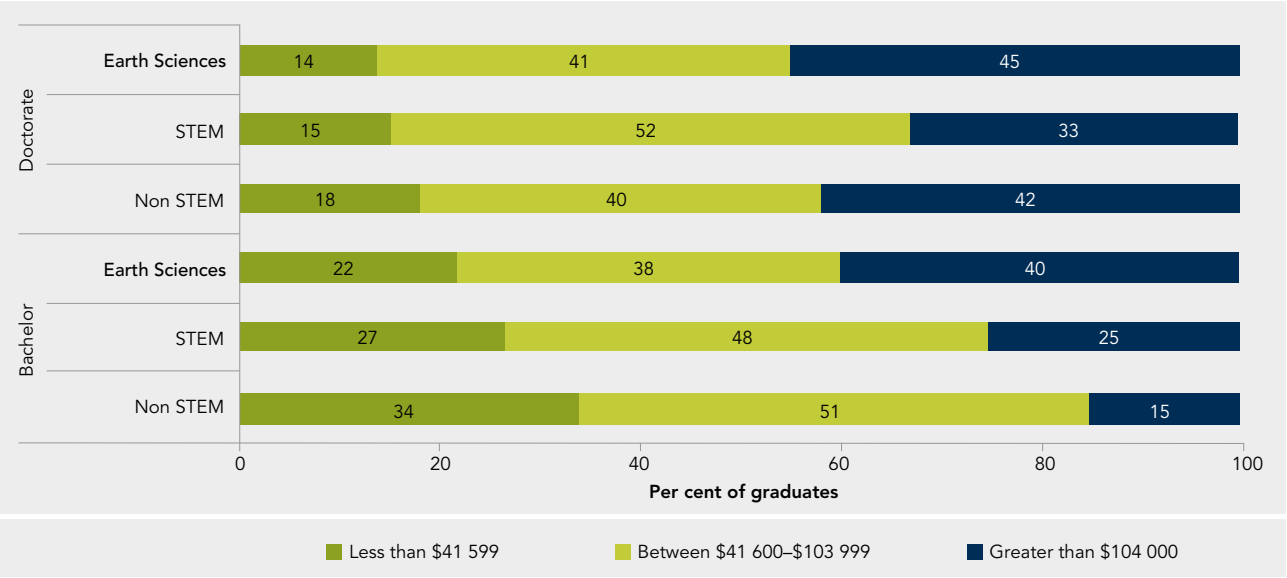
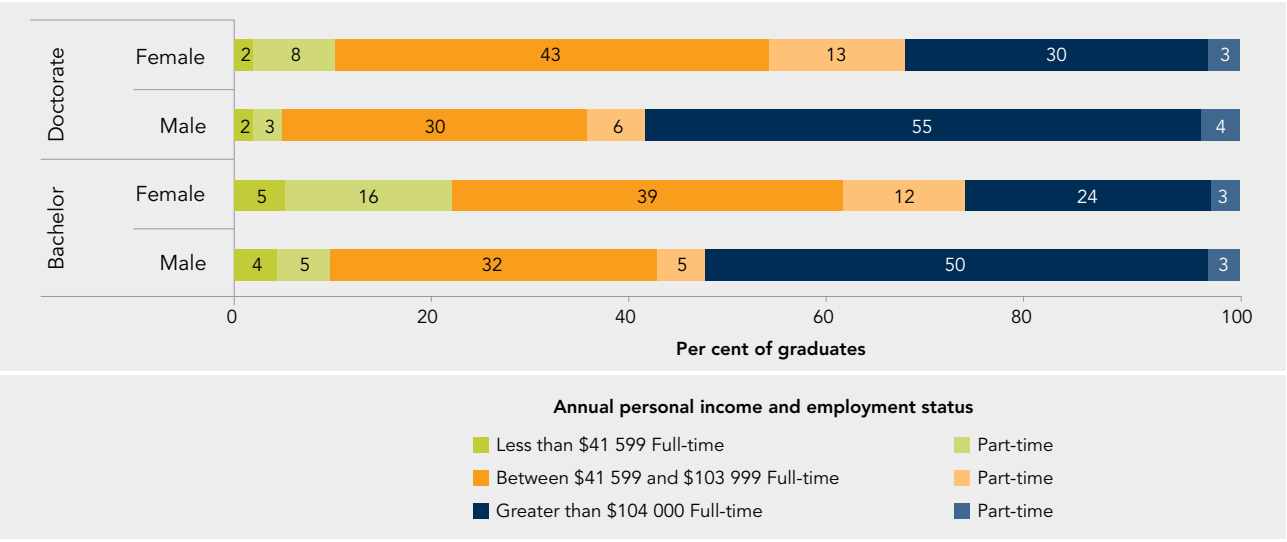


Figure 7.11: Personal annual income of Earth Sciences graduates working full-time and part-time, by field, gender and level of qualification



The proportion of male Earth Sciences graduates with earnings more than $104 000 peaked at 63 per cent between the ages of 40-44 for bachelor and at 66 per cent for doctorate graduates (Figure 7.12 and Figure 7.13). Compared to the total STEM cohort, a larger proportion of male Earth Sciences graduates were in the highest bracket for all age groups at the bachelor level and above the age of 25 at the doctorate level.

The proportion of female graduates in the highest income bracket was markedly less than the male graduates for all age groups at both the doctorate and bachelor level of qualification. The proportion peaked at 30 per cent between the ages of 25-29 for female bachelor graduates, and 47 per cent between ages of 50 to 54 for female doctorates. Compared to the total STEM cohort, a higher proportion of female bachelor Earth Sciences graduates were in the top income bracket up to the age of 34, and between the ages of 30 to 39 for doctorates.

Figure 7.12: Percentage of bachelor level graduates earning greater than $104 000 annually, by field, gender and age group

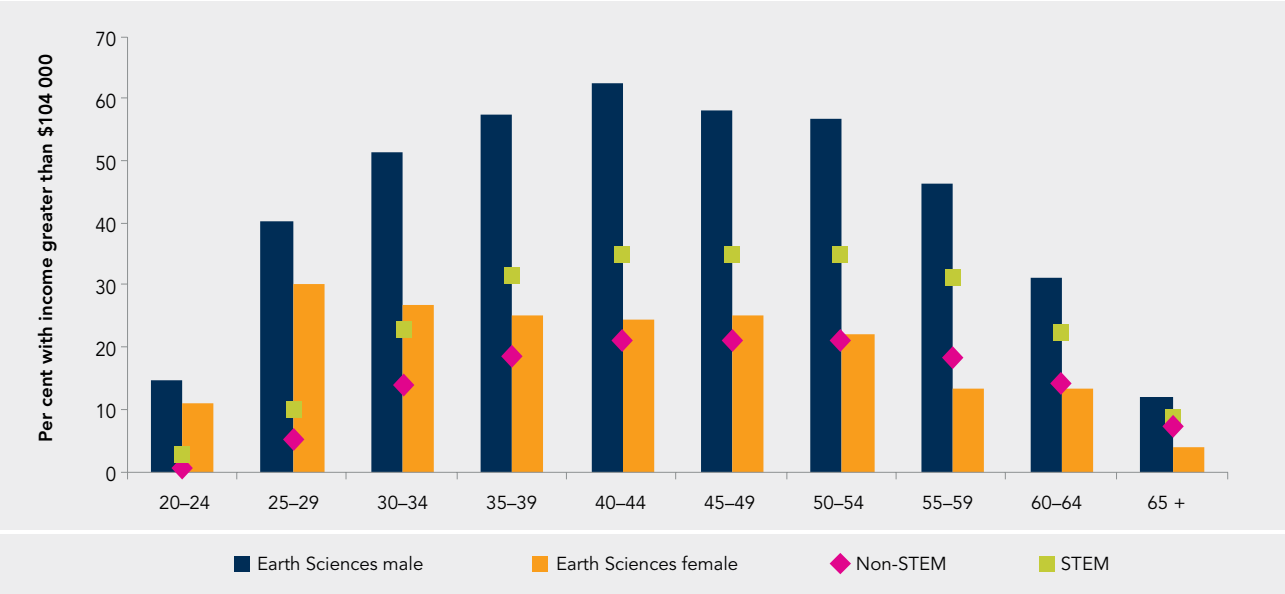
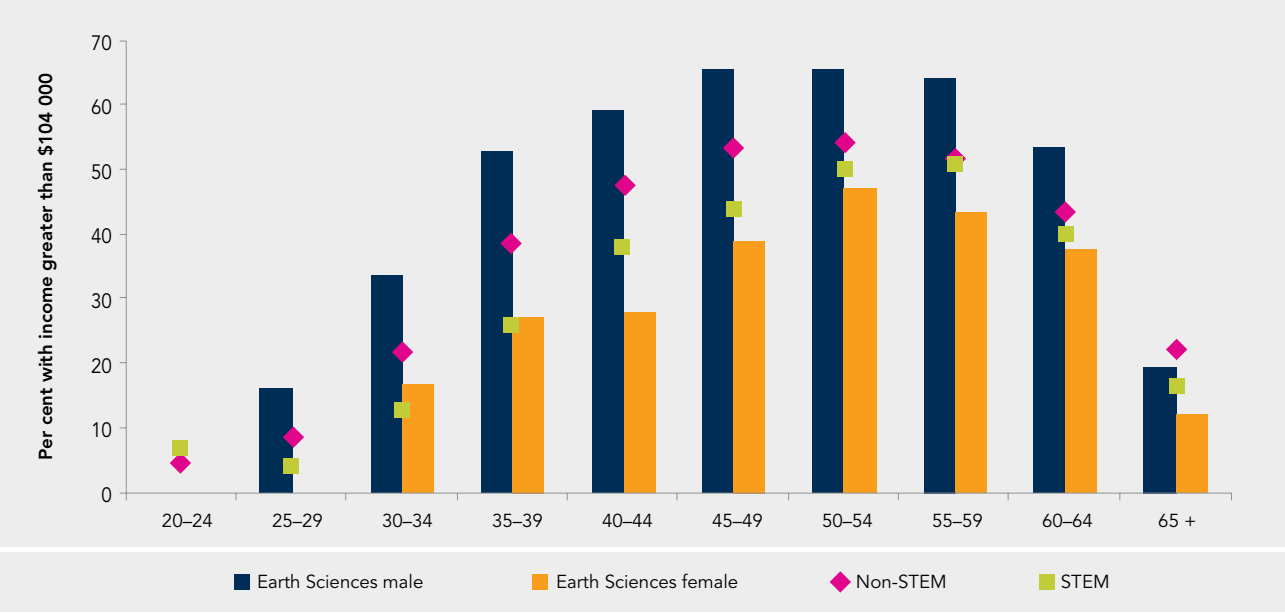


Figure 7.13: Percentage of doctoral level graduates earning greater than $104 000 annually, by field, gender and age group



CHAPTER 8

STEM PATHWAYS: BIOLOGICAL SCIENCES

WHAT ARE BIOLOGICAL SCIENCES?

The main purpose of studying and working in Biological Sciences is to understand and apply knowledge of the genetics and physiology of living organisms and the relationship of living organisms to one another as well as the physical environment. Biological Sciences is comprised of the following: Biochemistry and Cell Biology, Botany, Ecology and Evolution, Marine Science, Genetics, Microbiology, Human Biology, Zoology, and Other Biological Sciences, n.e.c. (not elsewhere classified) (ABS, 2001). In addition to the Biological Sciences, the related disciplines of Medical Sciences and Food Science and Biotechnology are separately examined.

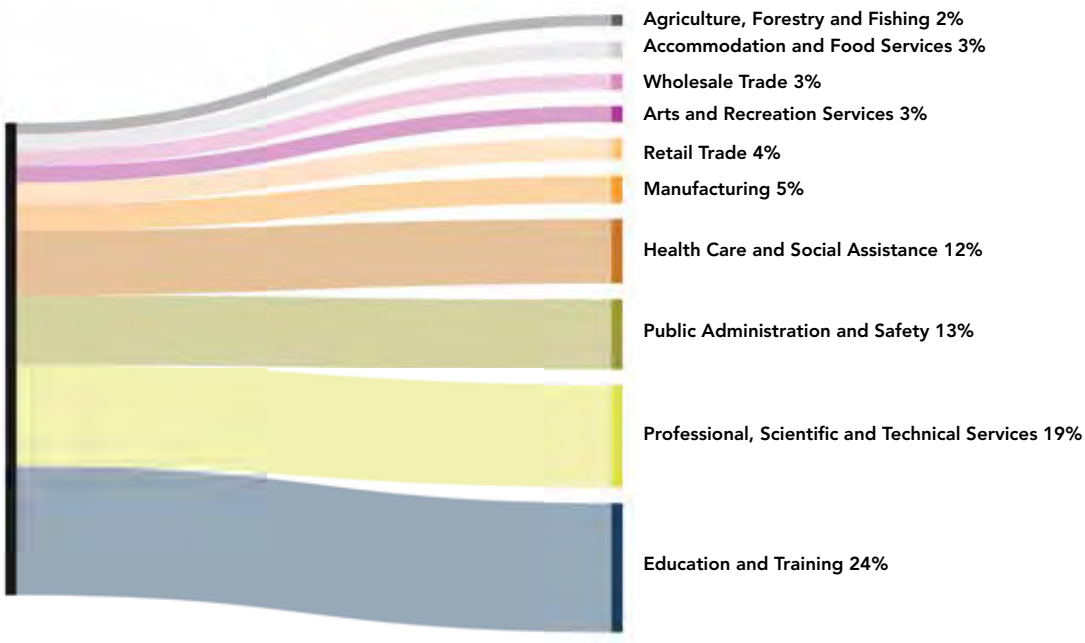
8

STEM PATHWAYS: BIOLOGICAL SCIENCES

KEY FACTS

1. In 2011, there were 44 164 Biological Sciences graduates.
2. The majority of graduates were female (55 per cent); however, of those in the workforce the majority was male (53 per cent).
3. Two-thirds of female, and over half of male graduates were aged under 45 (67 and 54 per cent, respectively).
4. 57 per cent worked in the private sector—varying from 68 per cent of bachelors to 37 per cent of doctorates.
5. Almost one quarter worked in the Education and Training industry (24 per cent), and one-fifth worked in Professional, Scientific and Technical Services (20 per cent).
6. The majority of graduates worked as Professionals (55 per cent), most commonly as Design, Engineering, Science and Transport (53 per cent), and Education (19 per cent) professionals.
7. Graduates with Biological Sciences qualifications aged 45-59 were more likely to earn more than $104 000 (the highest personal income bracket) per year compared to all STEM and all Non-STEM graduates.
8. Fewer Biological Sciences graduates earned more than $104 00 per year on average compared to all other graduates.

Top ten industry sectors of employment for Biological Sciences graduates



HOW MANY BIOLOGICAL SCIENCES GRADUATES ARE THERE IN AUSTRALIA?

In 2011, there were 44 164 Biological Sciences graduates (bachelor and above) in Australia. The top three fields of study were Biological Sciences, n.f.d. (not further defined), Biochemistry and Cell Biology, and Microbiology, with 30, 15 and 11 per cent of graduates respectively.

Just over one quarter of graduates (11 558, 26 per cent) were either not in the labour force or were unemployed (23 and 3 per cent, respectively).

Approximately, 31 per cent of Biological Sciences graduates in the workforce held a doctorate degree, compared to eight per cent of STEM graduates and three per cent of Non-STEM graduates.

The majority of graduates were females (55 per cent). This is in contrast with other STEM fields, such as Physics and Astronomy and Mathematics where the male population was in the majority. However, the majority of graduates in the workforce and the majority of doctorate degree holders were male (53 and 57 per cent, respectively).

HOW OLD IS THE BIOLOGICAL SCIENCES GRADUATE WORKFORCE?

The Biological Sciences skilled workforce had a similar age distribution to the Non-STEM-qualified workforce (Figure 8.1). The female workforce is slightly younger than males, with two-thirds of females aged under 45, compared to just over half of males (69 and 55 per cent, respectively).

WHERE DO BIOLOGICAL SCIENCES GRADUATES WORK?

The private sector employed 57 per cent of all Biological Sciences graduates; however the proportion varied depending on level of qualification as follows:

- Bachelor level: 68 per cent
- Postgraduate level: 43 per cent
  - Masters: 62 per cent
  - Doctorate: 37 per cent

Figure 8.1: Age distribution of employed Biological Sciences graduates at bachelor level and above, by field and gender

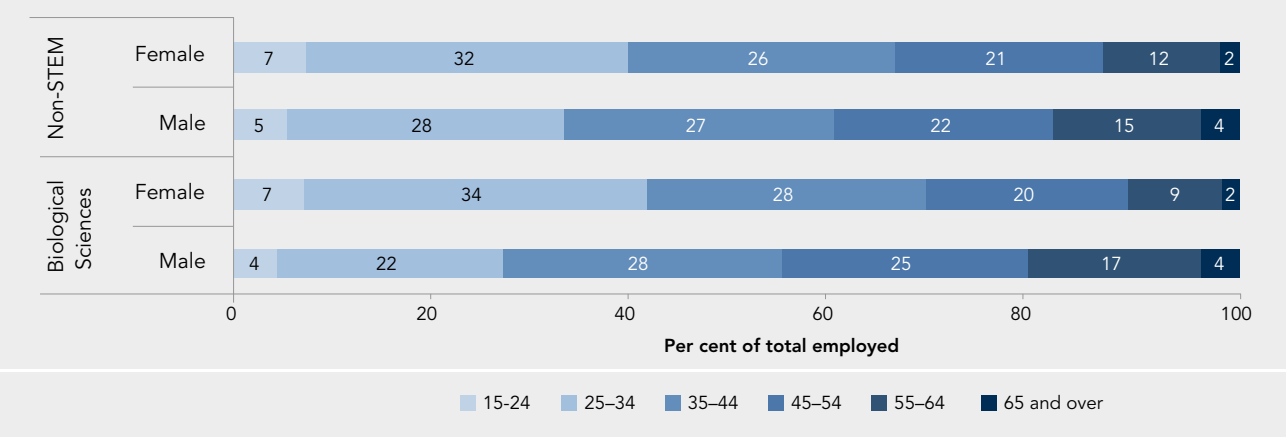


Figure 8.2: Top ten industry divisions of employment for Biological Sciences graduates with qualifications at bachelor level and above, by gender

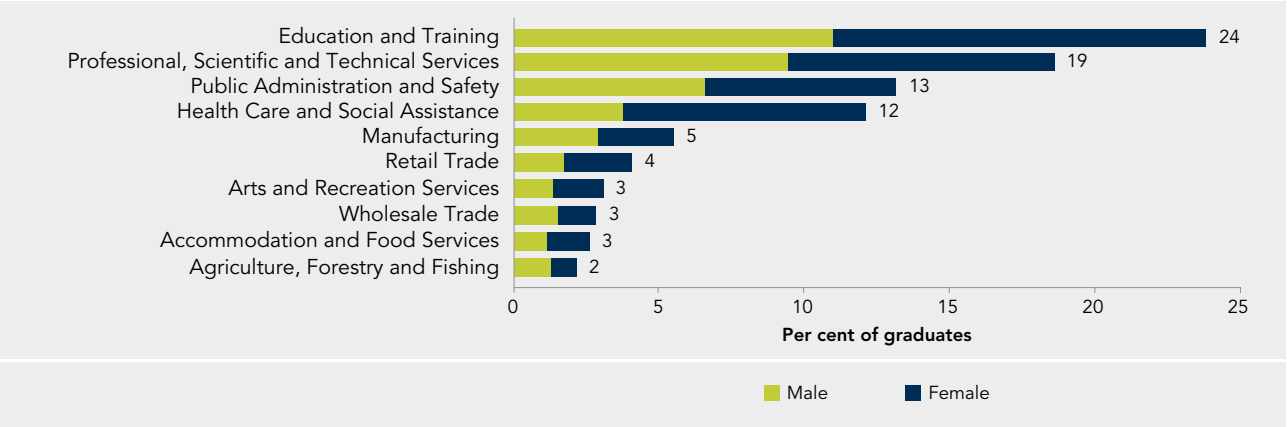
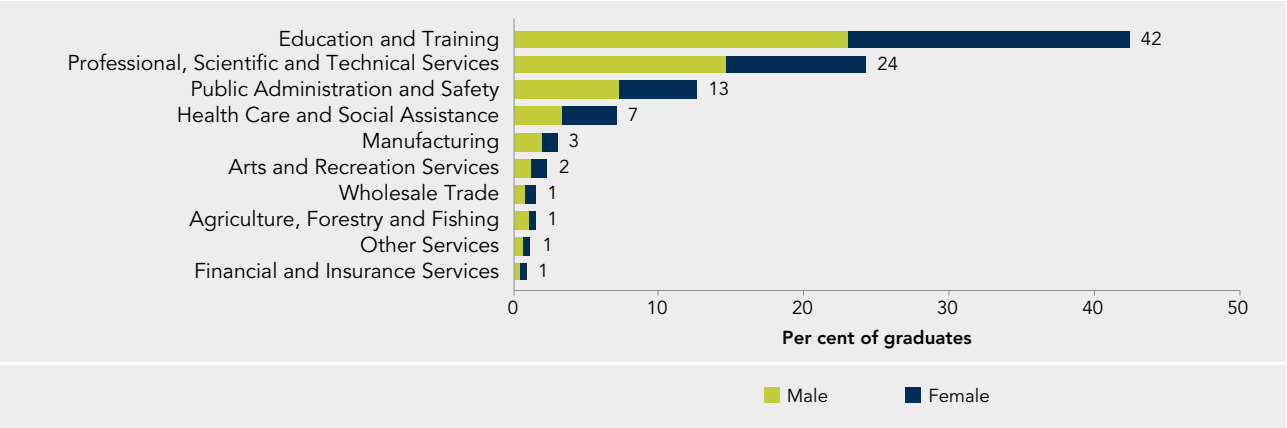


Figure 8.3: Top ten industry divisions of employment for Biological Sciences doctoral graduates, by gender



INDUSTRY SECTORS OF EMPLOYMENT

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.

The top two industries that employed Biological Sciences graduates were Education and Training and Professional, Scientific and Technical Services (24 and 19 per cent, respectively) (Figure 8.2). Males and females were generally equally represented in the top ten industries of employment, except for the Health Care and Social Assistance industry where females made up 69 per cent of the workforce with Biological Sciences qualifications.

The top industries of employment for doctorate holders were the same as the aggregated cohort, with Education and Training employing 42 per cent and Professional, Scientific and Technical Services employing 24 per cent. Male representation in this workforce was higher in all industries

Figure 8.4: Top ten industry classes of employment for Biological Sciences graduates with qualifications at bachelor level and above, by gender

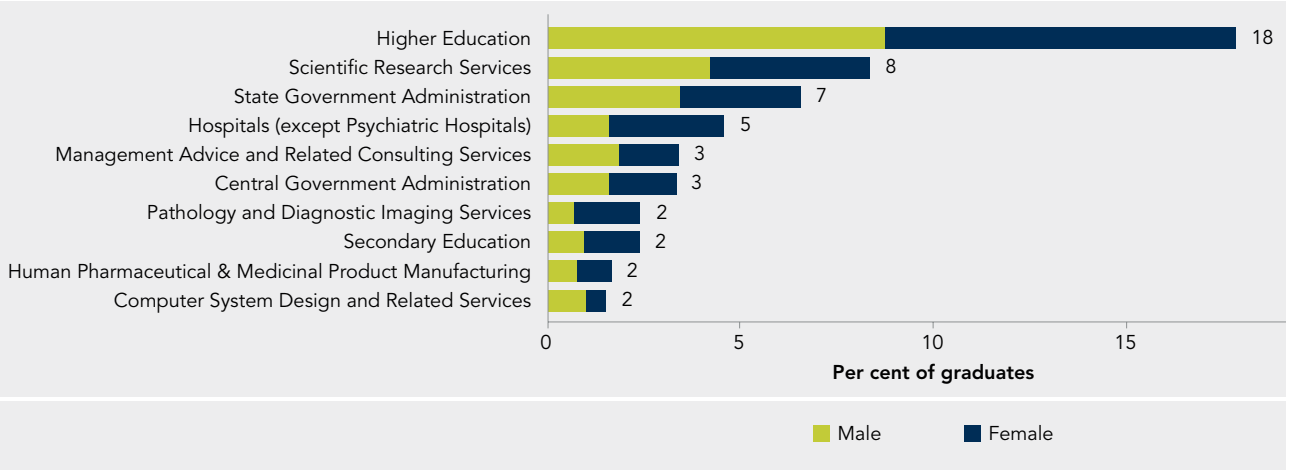
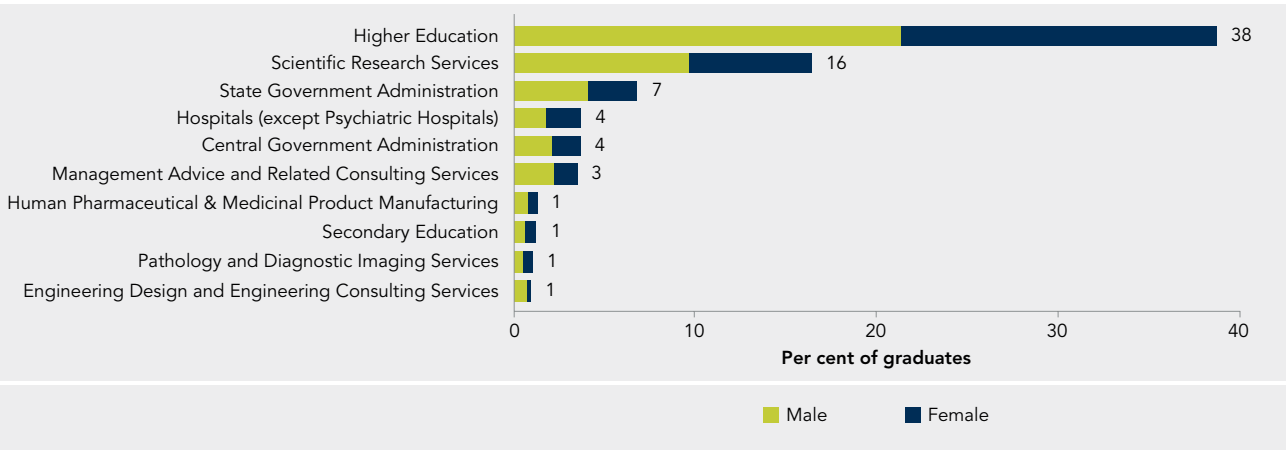


Figure 8.5: Top ten industry classes of employment for Biological Sciences doctoral graduates, by gender



except Healthcare and Social Assistance where 52 per cent of the workforce was female (Figure 8.3).

At the level of industry class, Higher Education was the dominant destination, employing 18 per cent of all graduates and 38 per cent of doctorates (Figure 8.4 and Figure 8.5). The next most popular destination was Scientific Research Services (8 per cent of bachelor and above and 16 per cent of doctorates).

WHAT ARE THE OCCUPATIONS OF BIOLOGICAL SCIENCES GRADUATES?

The majority of graduates in the Biological Sciences field worked as Professionals and Managers (55 and 14 per cent, respectively). Within the graduates employed as Professionals, the most common occupation sub-groups were:

- Design, Engineering, Science and Transport Professionals (53 per cent)
- Education Professionals (19 per cent)
- Business, Human Resource and Marketing Professionals (10 per cent).

Figure 8.6: Top ten unit group level occupations of Biological Sciences graduates with qualifications at bachelor level and above, by gender

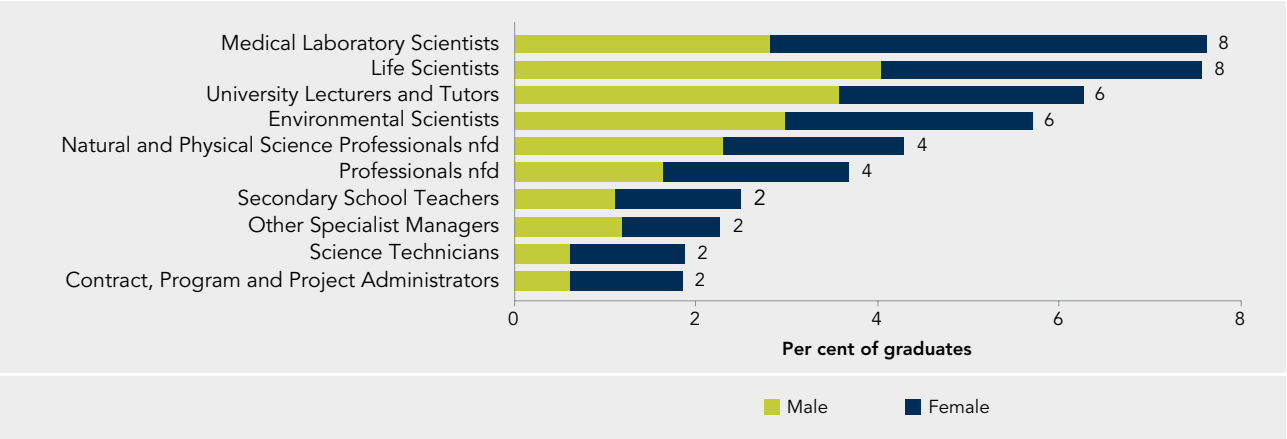
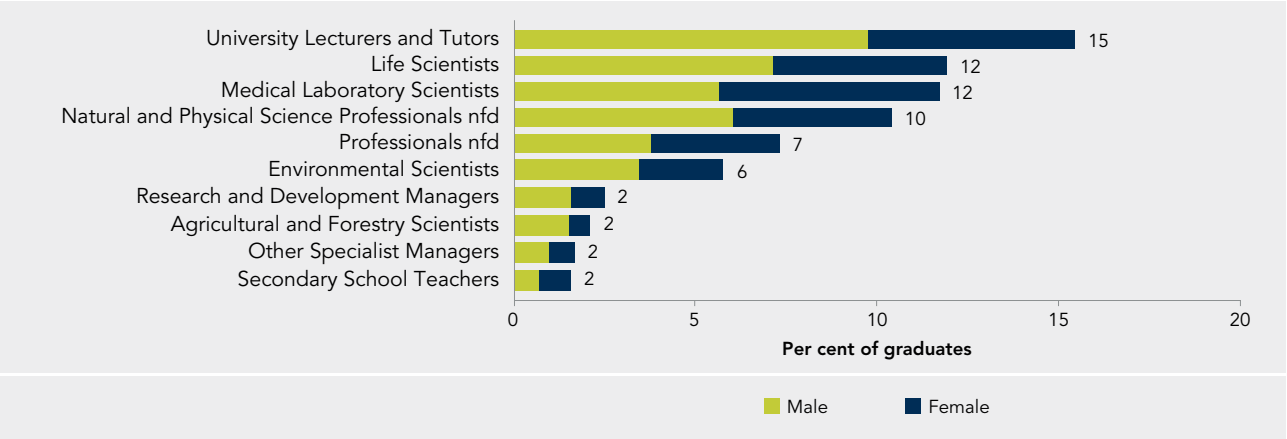


Figure 8.7: Top ten unit group level occupations of Biological Sciences doctoral graduates, by gender



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.

At the finer unit group level of detail, Medical Laboratory Scientists (8 per cent) and Life Scientists (8 per cent) were the most common occupations (Figure 8.6).

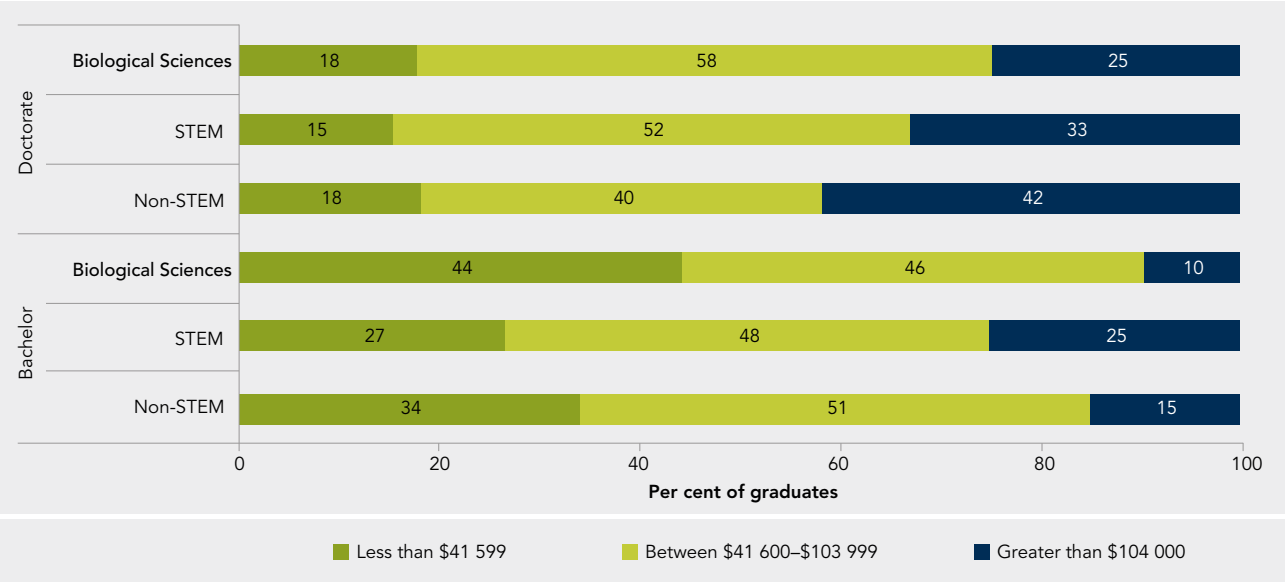
Most occupations had an equal distribution of males and females; an exception is Medical Laboratory Scientists, where more females were employed at a ratio of 1:1.7.

ARE THE OCCUPATIONS OF BIOLOGICAL SCIENCES DOCTORATE HOLDERS DIFFERENT FROM BACHELOR DEGREE HOLDERS?

Almost 80 per cent of Biological Sciences doctorate holders were employed as Professionals and 13 per cent were employed as Managers. Of the Professionals, 32 per cent were employed in the private sector.

The most common occupations for doctorate holders at the unit level were University Lecturers and Tutors, Life Scientists, and Medical Laboratory Scientists (15, 12 and 12 per cent of graduates, respectively) (Figure 8.7).

Figure 8.8: Personal annual income of graduates, by field and level of qualification



ARE BIOLOGICAL SCIENCES GRADUATES HIGH EARNERS?

Ten per cent of Biological Sciences bachelor degree holders and 25 per cent of doctorate holders had an income in the highest bracket (more than $104 000) (Figure 8.8). In comparison, 15 per cent of bachelor and 42 per cent of doctorate graduates from Non-STEM fields had incomes in the highest range. Graduates earning less than $41 599 made up 44 per cent of all Biological Sciences graduates at bachelor level and 18 per cent of those with a doctorate degree.

Figure 8.9: Personal annual income of Biological Sciences graduates working full-time and part-time, by field, gender and level of qualification

Graduate income levels were dependent on both gender and full-time or part-time employment, with fewer females and fewer part-time workers in the higher income brackets. More women were employed in a part-time role compared to men in all income brackets except those earning more than $104 000 per year (Figure 8.9).

Compared to the total STEM graduate cohort, a lower percentage of graduates with a bachelor degree in Biological Sciences reached the highest income bracket (more than $104 000) across all age groups and for both males and females (Figure 8.10).

The percentage of Biological Sciences bachelor graduates with earnings in the highest income bracket peaked for males at 26 per cent between the ages of 45 to 54. This was lower than the peak for the total STEM cohort, which was 35 per cent between 40 and 54; but higher than that for the total Non-STEM cohort, which peaked at 21 per cent at the same age groups. In comparison, the peak for females was lower than both the STEM and Non-STEM cohorts, and was 10 per cent between 45 and 54. The percentage of male graduates with earnings in the highest bracket was at least double that for females across all age groups, except above the age of 65.

At the doctorate level, the difference between the proportion in the top income bracket of the total STEM graduate cohort and those from Biological Sciences was not as large as for bachelors. The percentage of males in the top bracket exceeded that of the total STEM cohort between the ages of 50 and 59, reaching a maximum of 54 per cent in the 55 to 59 year age group. The percentage of males in the top bracket was around double that of females between the ages of 35 and 64 (Figure 8.11).

Figure 8.10: Percentage of bachelor level graduates earning greater than $104 000 annually, by field, gender and age group

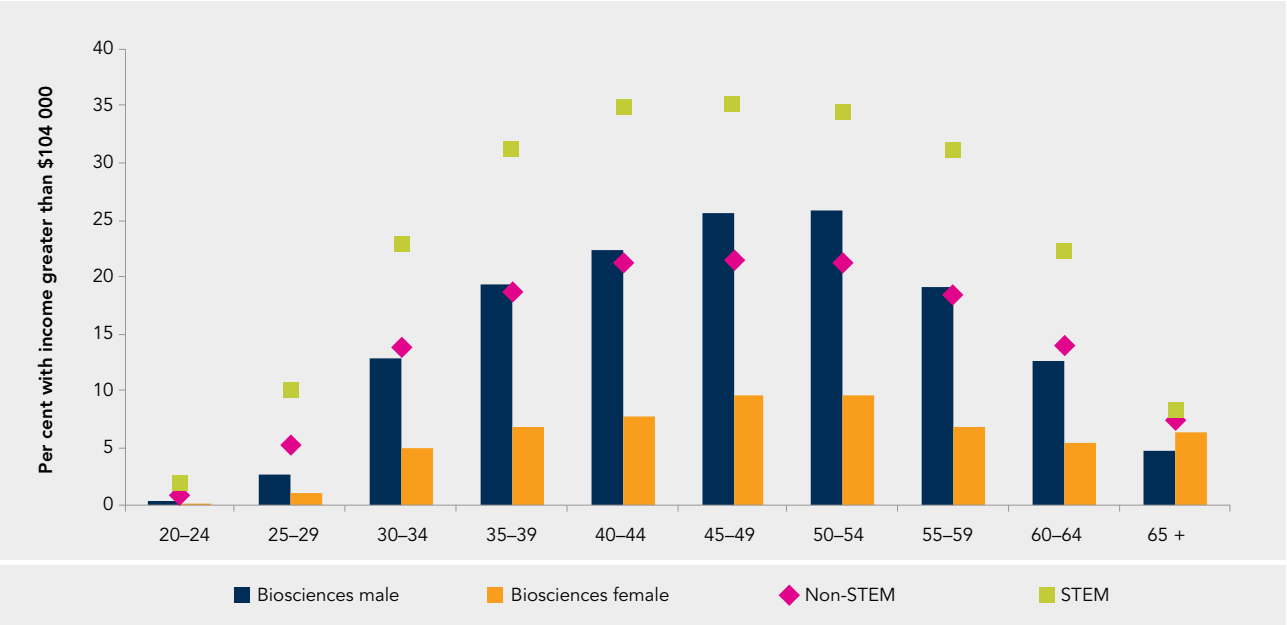
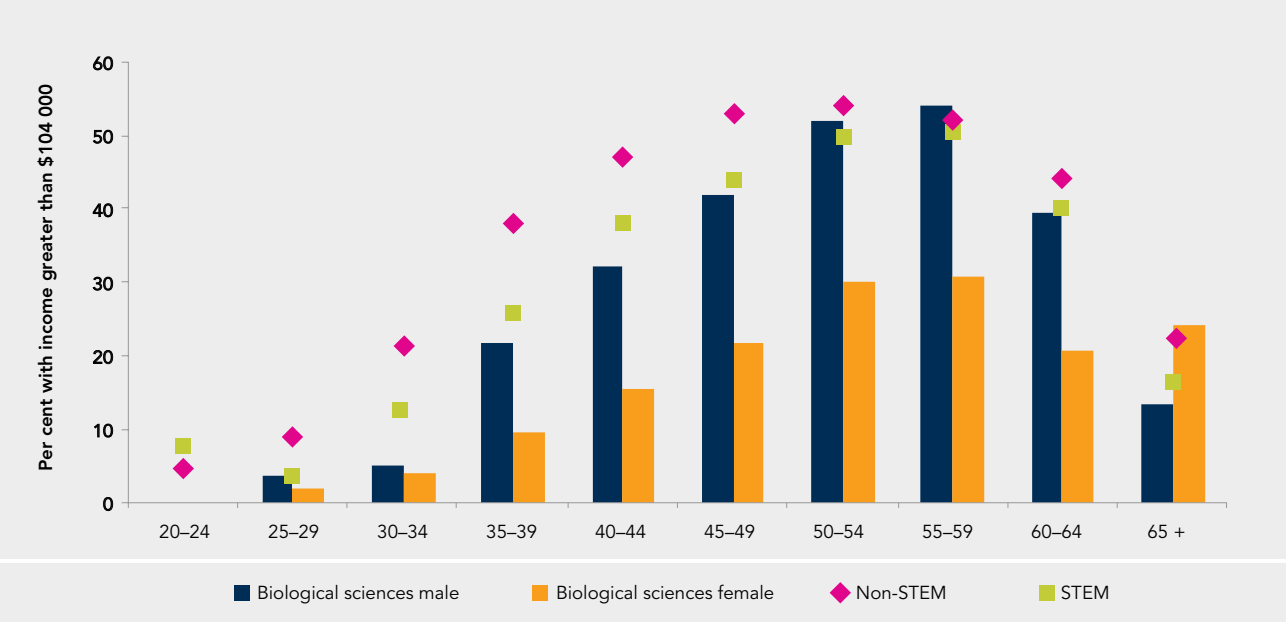


Figure 8.11: Percentage of doctoral level graduates earning greater than $104 000 annually, by field, gender and age group



STEM PATHWAYS: MEDICAL SCIENCE

There were 17 045 Medical Science graduates (bachelor and above) in Australia. One quarter of graduates (4189, 25 per cent) were not in the labour force (21 per cent) or were unemployed (3 per cent). The majority of graduates in the workforce were female (66 per cent).

Almost half of the male (48 per cent), and 56 per cent of female graduates were younger than 34, suggesting a recent increase in the popularity of studying in this field (Figure 8.12).

Healthcare industry subdivisions such as Medical and Other Healthcare Services and Hospitals employed approximately 45 per cent of Medical Science graduates (Figure 8.13). The most common occupation for graduates was as Design, Engineering, Science and Transport Professionals (43 per cent)(Figure 8.14). The personal incomes reported by Medical Science graduates is shown in Figure 8.15, and is similar to those reported by the Biological Sciences graduates. The level of qualification influences income, with higher proportions of graduates with a doctorate reporting higher income levels compared to bachelor qualified graduates (25 and 6 per cent, respectively).

Figure 8.12: Age distribution of employed Medical Science graduates with qualifications at bachelor level and above, by field and gender

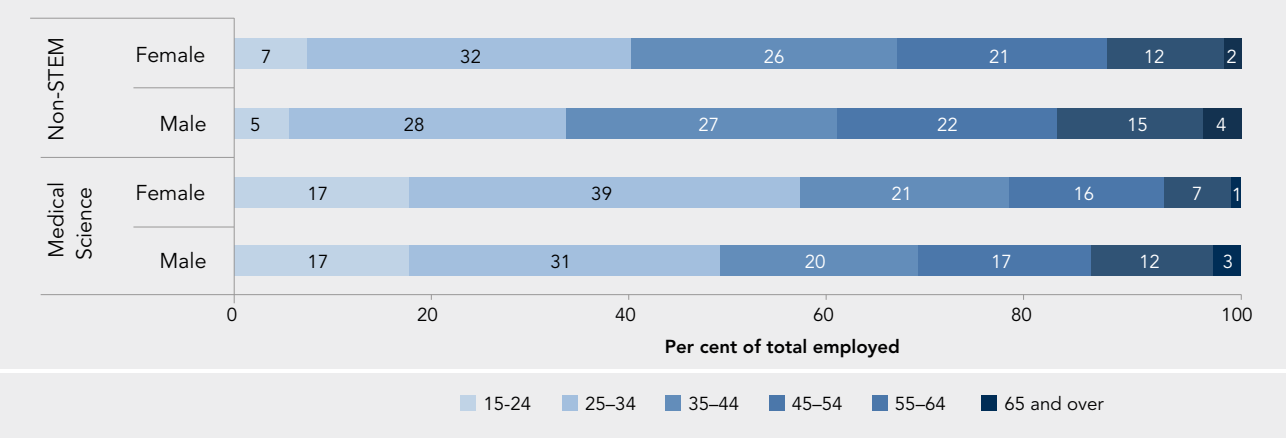


Figure 8.13: Top five industry subdivisions employing Medical Science graduates, by gender

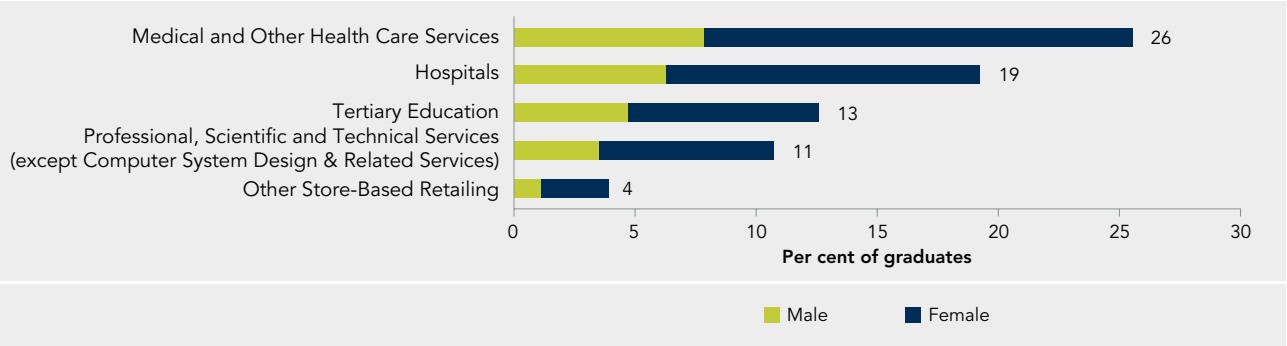


Figure 8.14: Top five sub-major group occupations of Medical Science graduates, by gender

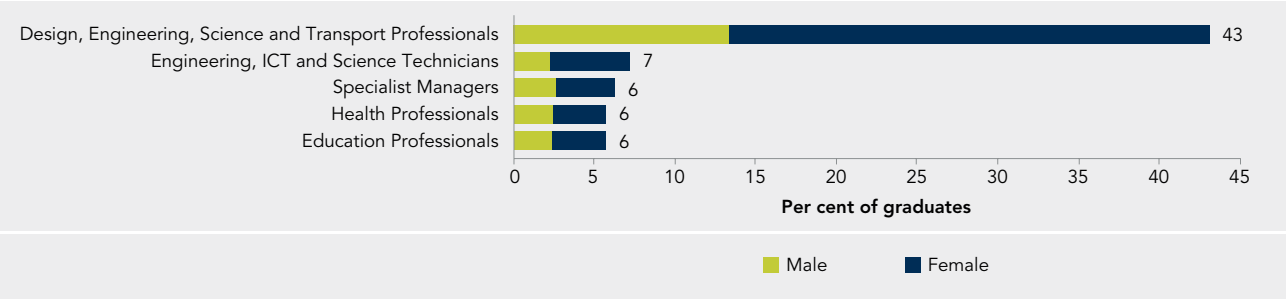
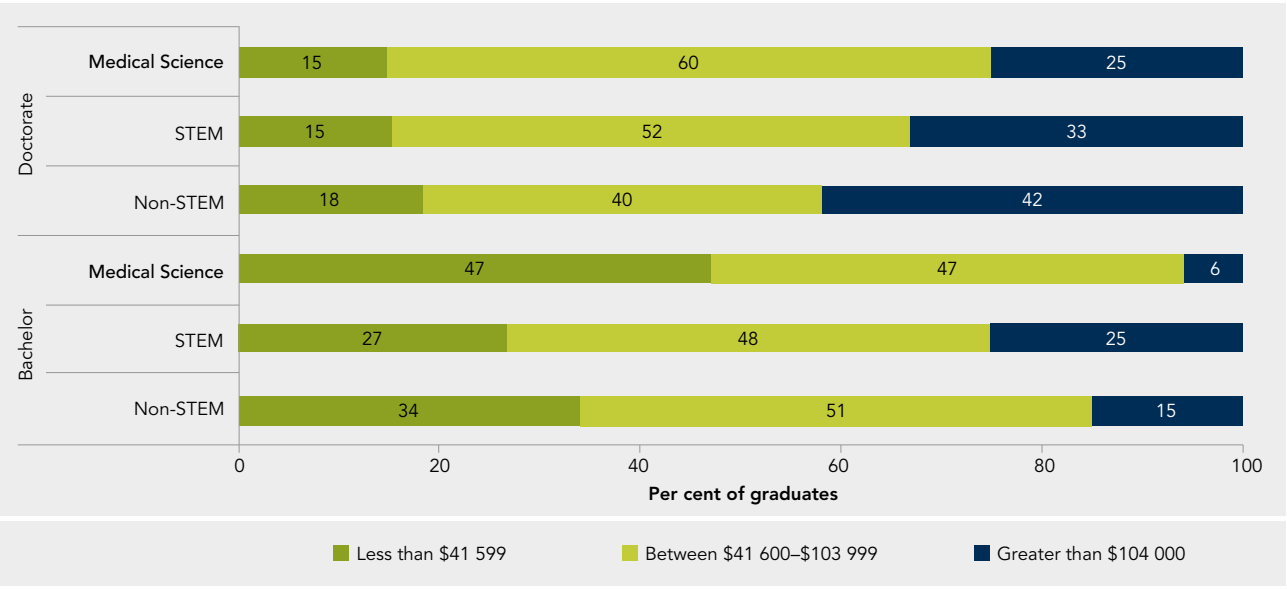


Figure 8.15: Personal annual income of graduates, by field and level of qualification



STEM PATHWAYS: FOOD SCIENCE AND BIOTECHNOLOGY

In 2011, there were 7700 Food Science and Biotechnology graduates (bachelor and above) in Australia. Twenty three per cent of graduates were not in the labour force (18 per cent) or were unemployed (3 per cent).

The gender ratio of this workforce was almost evenly balanced, at 49 per cent male and 51 per cent female.

Almost 51 per cent of males and 63 per cent of females were below the age of 34 (Figure 8.16). The largest proportions were observed in the 25-34 year age bracket for both genders, indicating a recent increase in the emphasis of this field.

The top industries of employment were the food, beverage and tobacco manufacturing industries (Figure 8.17). These graduates were employed mostly as Design, Engineering and Science Professionals (27 per cent) or as Specialist Managers (13 per cent) (Figure 8.18). Personal annual incomes reported were marginally higher than Biological Sciences graduates at bachelor and doctorate level of education with fewer individuals reporting annual incomes of less than $41 599 (Figure 8.19).

Figure 8.16: Age distribution of employed Food Science and Biotechnology graduates with qualifications at bachelor level and above, by field and gender

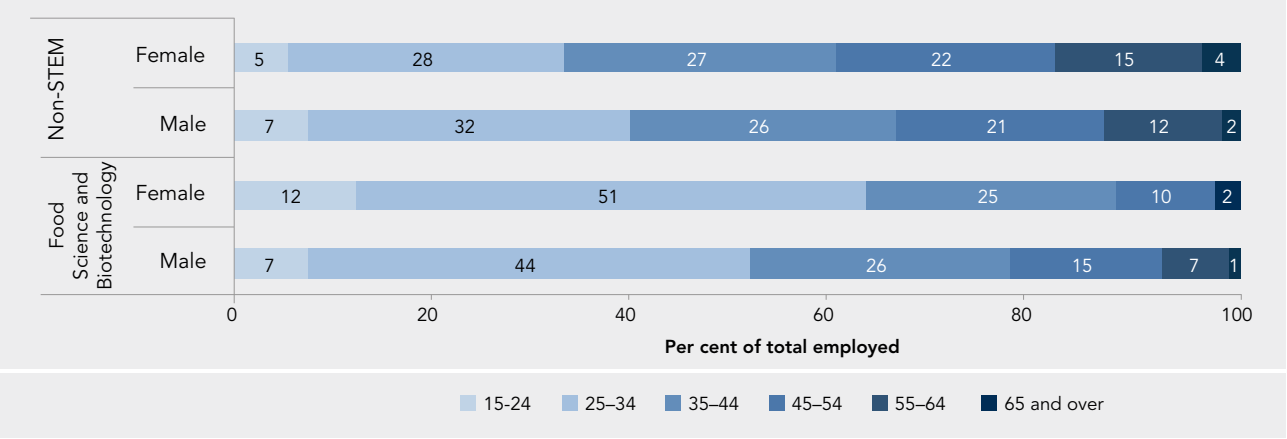


Figure 8.17: Top five industry subdivisions employing Food Science and Biotechnology graduates, by gender

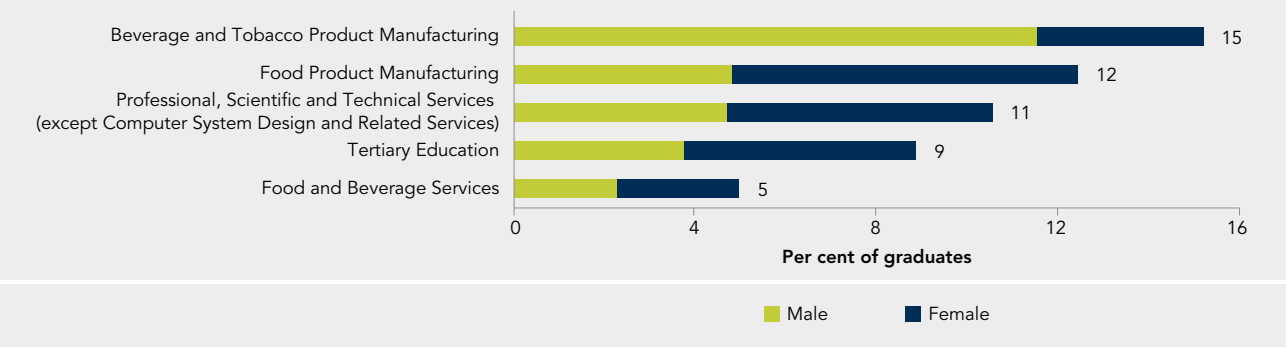


Figure 8.18: Top five sub-major group occupations of Food Science and Biotechnology graduates, by gender

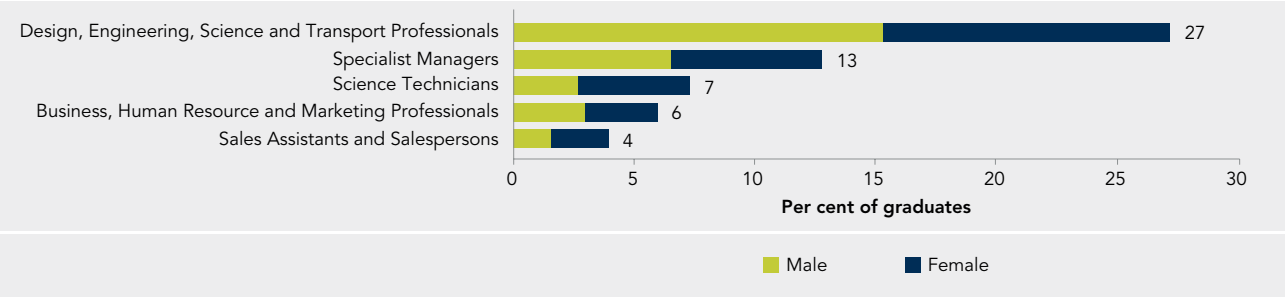
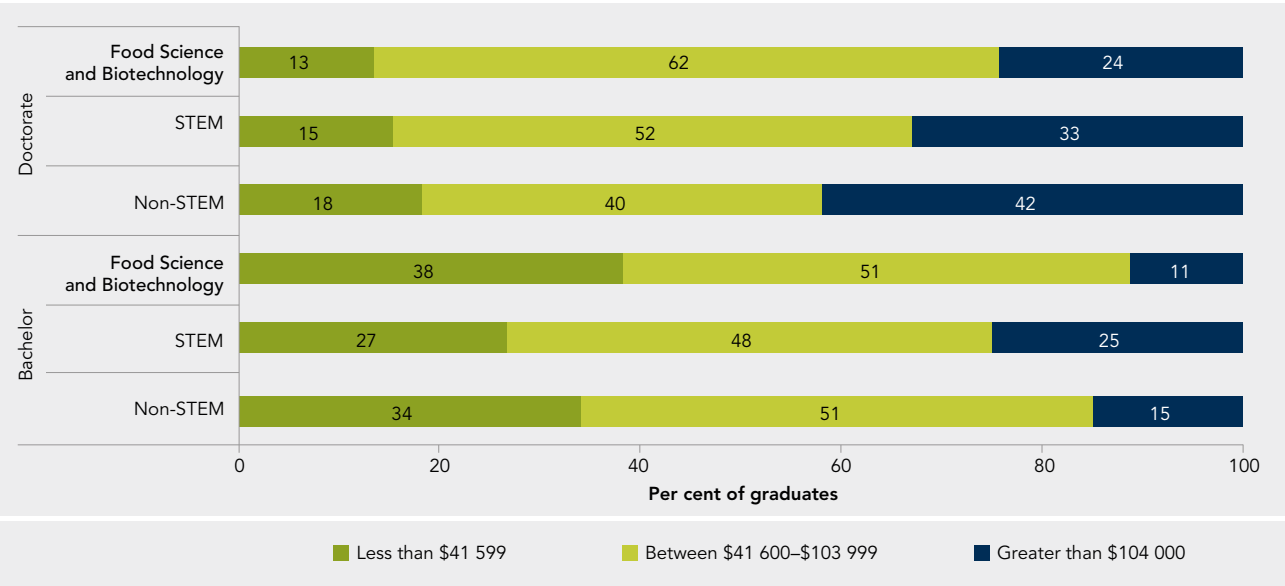


Figure 8.19: Personal annual income of graduates, by field and level of qualification



CHAPTER 9

STEM PATHWAYS: AGRICULTURAL SCIENCES

WHAT ARE AGRICULTURAL SCIENCES?

This report combines the ASCED fields of Agriculture and Horticulture and Viticulture into Agricultural Sciences for this chapter. The main purpose of studying and working in Agriculture is to understand and apply knowledge of livestock reproduction, the production of primary plant and animal products, and the theory and practice of farming. The main purpose of studying and working in Horticulture and Viticulture is to understand and apply knowledge of the factors affecting plant propagation, growth and physiology. Both Agriculture and Horticulture and Viticulture also involve utilising current technology, principles and practices (ABS, 2001). The fields of Fisheries Studies and Forestry Studies have been examined separately.

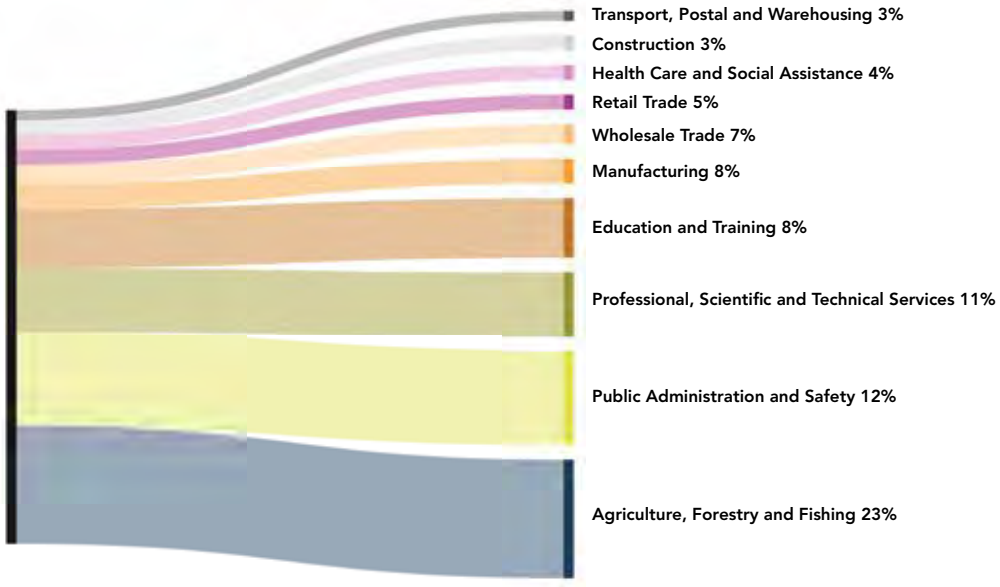
9

STEM PATHWAYS: AGRICULTURAL SCIENCES

KEY FACTS

1. In 2011, there were 24 410 Agricultural Sciences graduates, two-thirds of whom were male (combining the sub-classifications of Agriculture; and Horticulture and Viticulture).
2. The female workforce was younger than the male workforce: less than one third of females were aged 45 or over (29 per cent), compared to 47 per cent of males.
3. 79 per cent worked in the private sector—varying from 83 per cent of bachelors to 47 per cent of doctorates.
4. The top two industries of employment were Agriculture, Forestry and Fishing (23 per cent), and Public Administration and Safety (12 per cent).
5. Graduates most commonly worked as Professionals (31 per cent) and Managers (31 per cent); and 11 per cent were Technicians and Trades Workers.
6. At a more detailed level, the most common occupations were as Agricultural and Forestry Scientists (11 per cent) and Livestock Farmers (6 per cent).
7. For those with doctorates, the most common occupation were as Agricultural and Forestry Scientists (25 per cent), and University lecturers and tutors (11 per cent).
8. The proportion of graduates earning over $104 000 per year more than doubles from 11 per cent at bachelor level of qualification to 24 per cent at doctorate level of qualification.

Top ten industry sectors of employment for Agricultural Sciences graduates



HOW MANY AGRICULTURAL SCIENCES GRADUATES ARE THERE IN AUSTRALIA?

In 2011, there were 24 410 Agricultural Science graduates (combining the sub classifications of Agriculture; and Horticulture and Viticulture) in Australia. Of these, 84 per cent held a degree in Agriculture and the remaining 16 per cent in Horticulture and Viticulture.

Twenty-one per cent of graduates (5038) were either not in the labour force or were unemployed (approximately 18 and 2 per cent, respectively).

There were 1694 graduates (7 per cent of the total cohort) in Agricultural Science who held a doctoral degree: 3 per cent of Horticulture and Viticulture graduates and 8 per cent of Agriculture graduates. Comparatively, 8 per cent of STEM graduates and 3 per cent of Non-STEM graduates held a doctoral degree.

Approximately two thirds of all graduates in Agricultural Science were male, which increased to 74 per cent of graduates with doctoral level qualifications.

HOW OLD IS THE AGRICULTURAL SCIENCES GRADUATE WORKFORCE?

The female Agricultural Sciences graduate workforce is younger than the male workforce, and has a similar age distribution to the Non-STEM graduate workforce (Figure 9.1). Less than one third of females were aged 45 or over (29 per cent), compared to 47 per cent of males.

WHERE DO AGRICULTURAL SCIENCES GRADUATES WORK?

The private sector employed 79 per cent of all Agricultural Sciences graduates; however the proportion varied depending on level of qualification as follows:

- Bachelor level: 83 per cent
- Postgraduate level: 59 per cent
  - Masters: 69 per cent
  - Doctorate: 47 per cent

INDUSTRY SECTORS OF EMPLOYMENT

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.

Figure 9.1: Age distribution of employed Agricultural Sciences graduates at bachelor level and above, by field and gender

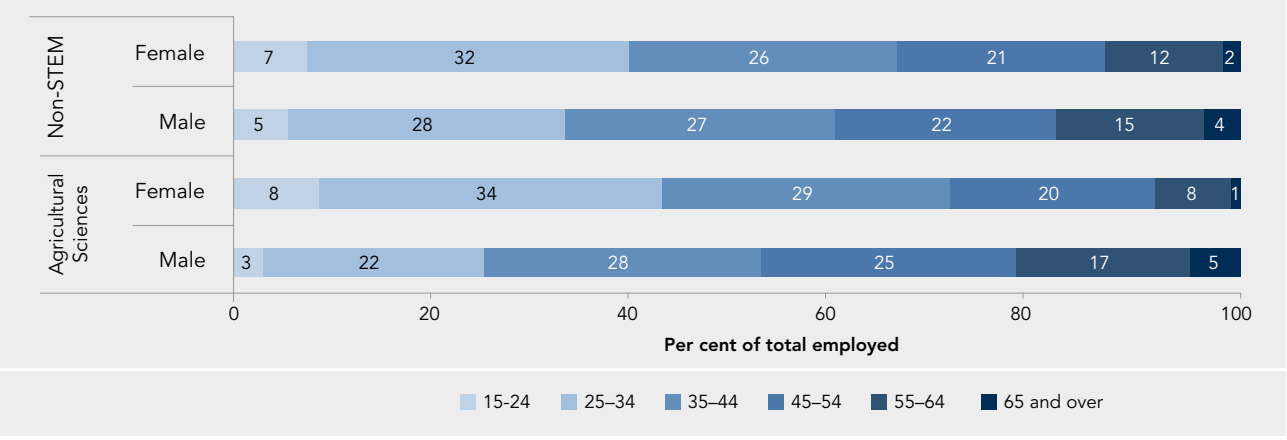


Figure 9.2: Top ten industry divisions of employment for Agricultural Sciences graduates with qualifications at bachelor level and above, by gender

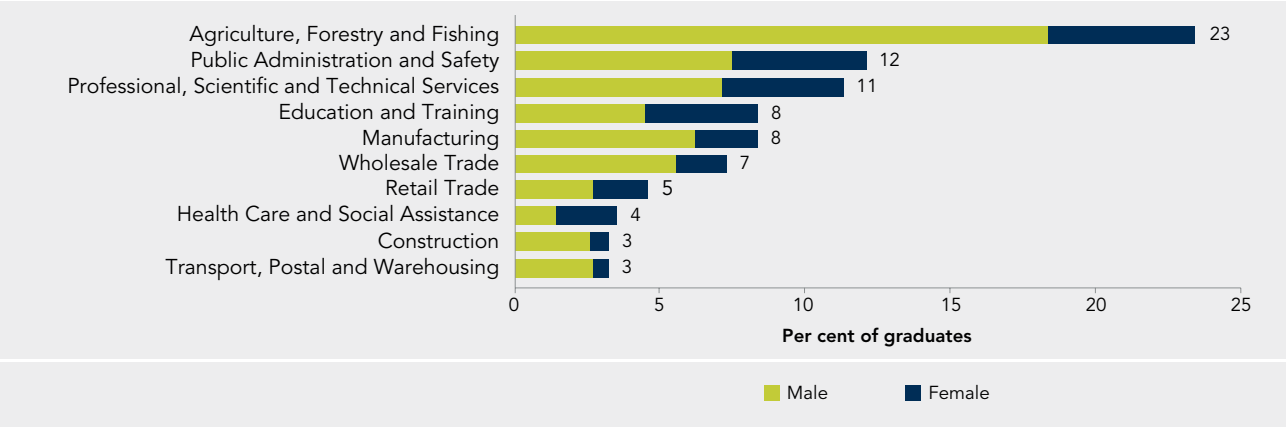
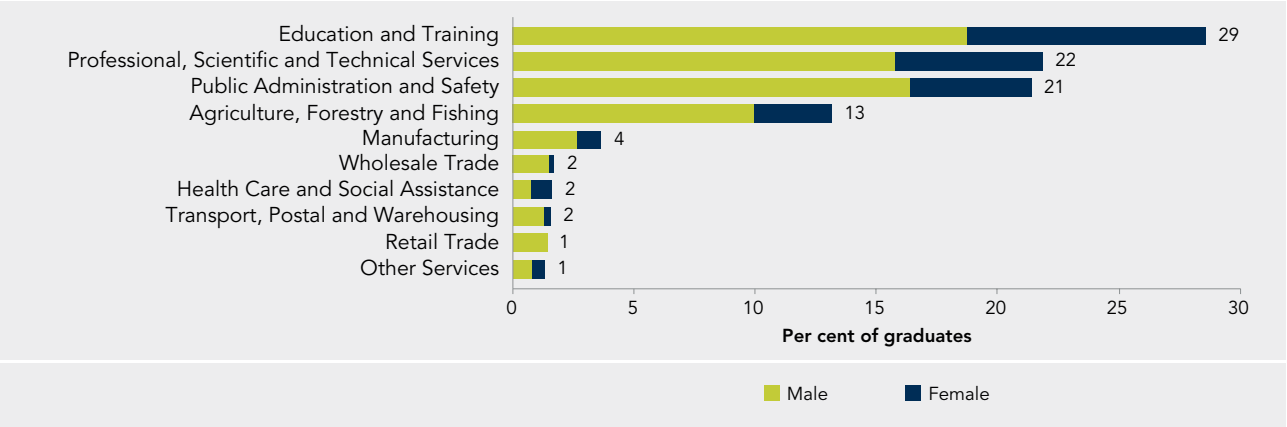


Figure 9.3: Top ten industry divisions of employment for Agricultural Sciences doctoral graduates, by gender



The top industries of employment for Agricultural Science graduates were Agriculture, Forestry and Fishing and Public Administration and Safety (23 and 12 per cent of graduates, respectively) (Figure 9.2).

For individuals with a doctoral degree, Education and Training, and Professional, Scientific and Technical Services were the top destinations, with 29 and 22 per cent of graduates, respectively. The top four industries employed 85 per cent of all doctoral graduates (Figure 9.3).

At a finer level of detail, the industry classes that employed the most graduates were State Government Administration, Science Research Services, and Higher Education (7, 4 and 4 per cent, respectively) (Figure 9.4). Several specialised agriculture industries also appear in the top ten industries of employment suggesting that the degree serves a strong basis for specialised expertise.

The top three industry subgroups employed more than half of all Agricultural Sciences doctorates (Figure 9.5). One quarter of these were employed in Higher Education industry. The second highest industry of employment was Scientific Research Services, followed by State Government Administration (16 and 15 per cent, respectively).

Figure 9.4: Top ten industry classes of employment for Agricultural Sciences graduates with qualifications at bachelor level and above, by gender

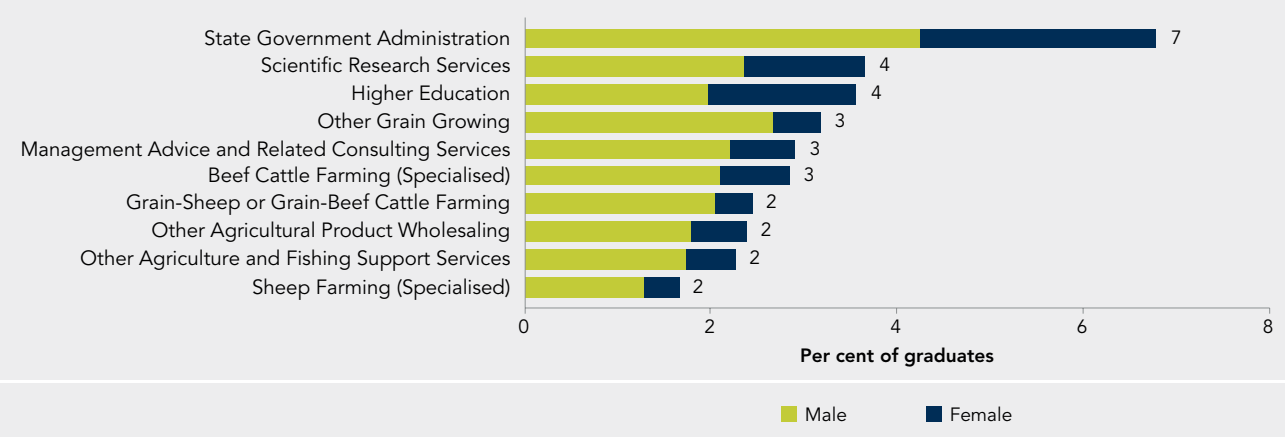
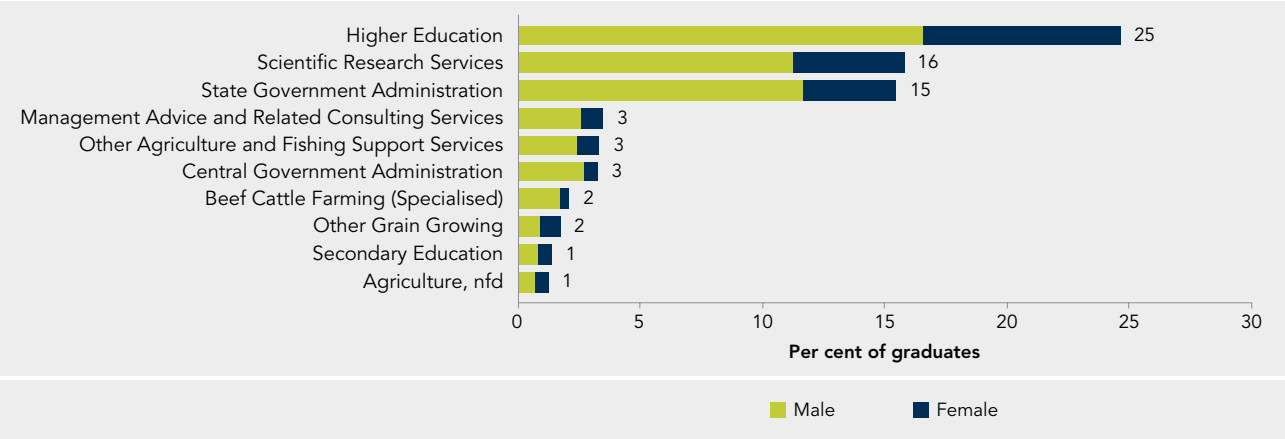


Figure 9.5: Top ten industry classes of employment for Agricultural Sciences doctoral graduates, by gender



WHAT ARE THE OCCUPATIONS OF AGRICULTURAL SCIENCE GRADUATES?

Approximately 62 per cent of all graduates were employed as Professionals or Managers (31 per cent each)(data not shown) Among the Professionals, the most common sub-groups of occupation were:

- Design, Engineering, Science and Transport Professionals (54 per cent)
- Business, Human Resource and Marketing Professionals (20 per cent), and
- Education Professionals (14 per cent).

Among the Managers, the most common sub-groups of occupation were:

- Farmers and Farm Managers (50 per cent)
- Specialist Managers (12 per cent), and
- Hospitality, Retail and Service Managers (12 per cent).

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 9.6: Top ten unit group level occupations of Agricultural Sciences graduates with qualifications at bachelor level and above, by gender

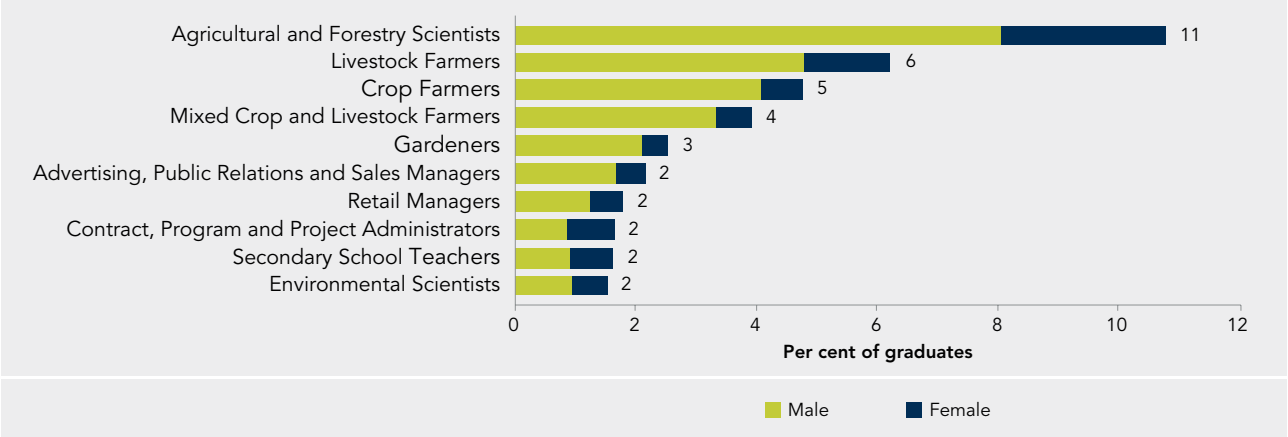
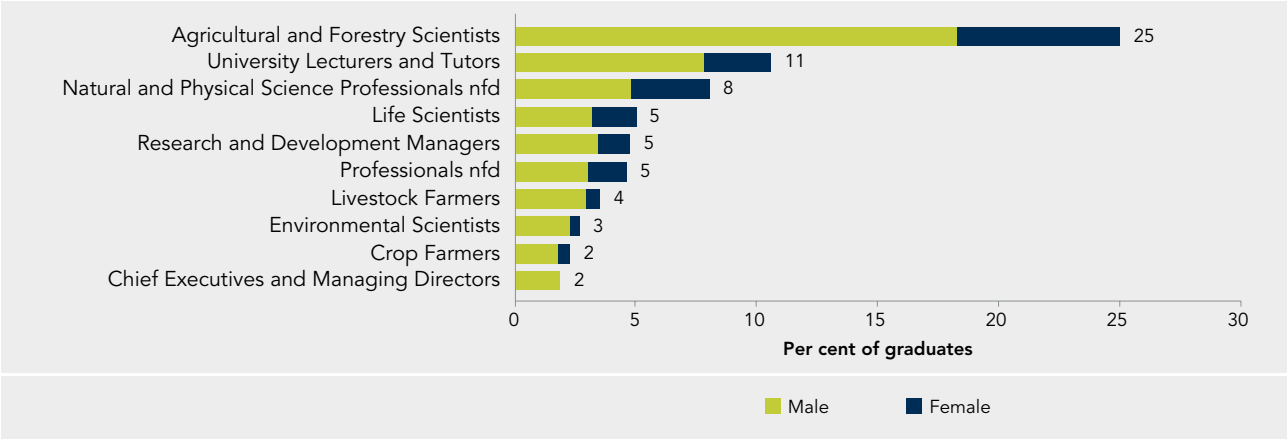


Figure 9.7: Top ten unit group level occupations of Agricultural Sciences doctoral graduates, by gender



At the more detailed unit group level, Agricultural and Forestry Scientists and Livestock Farmers were the most common occupations (11 and 6 per cent, respectively) (Figure 9.6).

The majority of the graduates in the most common occupations were male, in line with the fact that approximately two thirds of all Agricultural Science graduates were male. The difference was least skewed for Contract, Program and Project administrators, which has an equal male to female ratio.

ARE THE DESTINATIONS FOR AGRICULTURAL SCIENCE DOCTORATE HOLDERS DIFFERENT FROM BACHELOR DEGREE HOLDERS?

Almost 68 per cent of Agricultural Science doctorate holders were employed as Professionals and 21 per cent as Managers. Overall, the private sector employed 46 per cent of all Agricultural Science doctorate holders. However, among the doctorate holders employed as Professionals, only 36 per cent were employed by the private sector.

At the unit level of occupation, one quarter of doctorate holders worked as Agricultural and Forestry Scientists. The next most common occupation was University Lecturers and Tutors, and Natural and Physical Science Professionals with 11 and 8 per cent of graduates, respectively (Figure 9.7). There was a higher proportion of male doctorate holders compared to females in all occupation sub-groups, and none of the Chief Executives and Managing Directors were female.

Figure 9.8: Personal annual income of graduates, by field and level of qualification

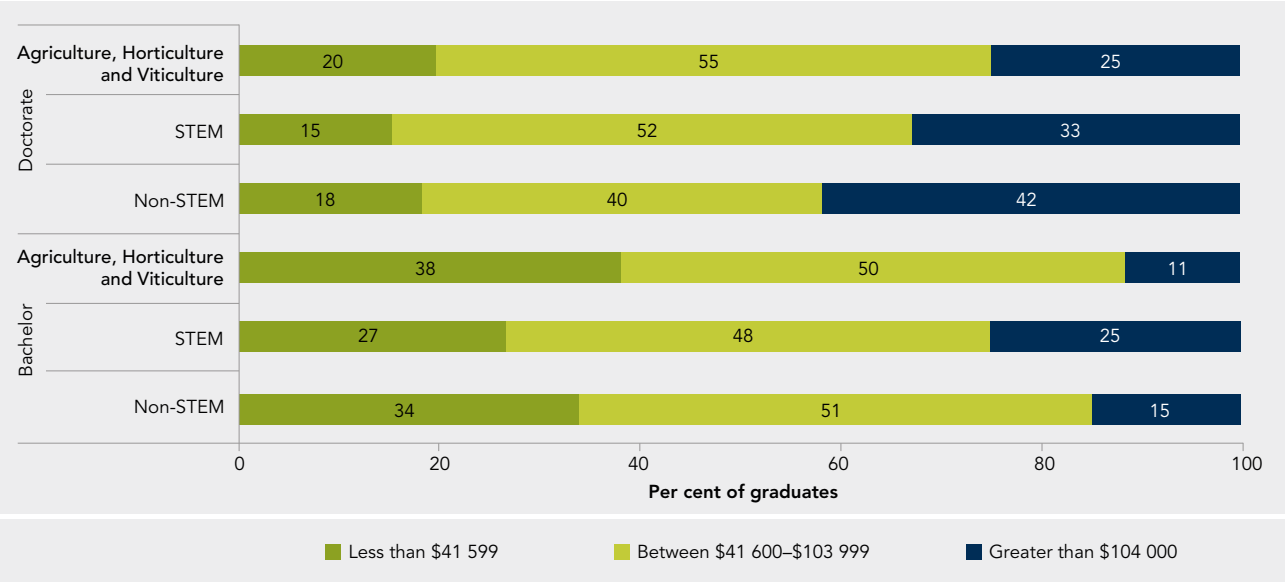
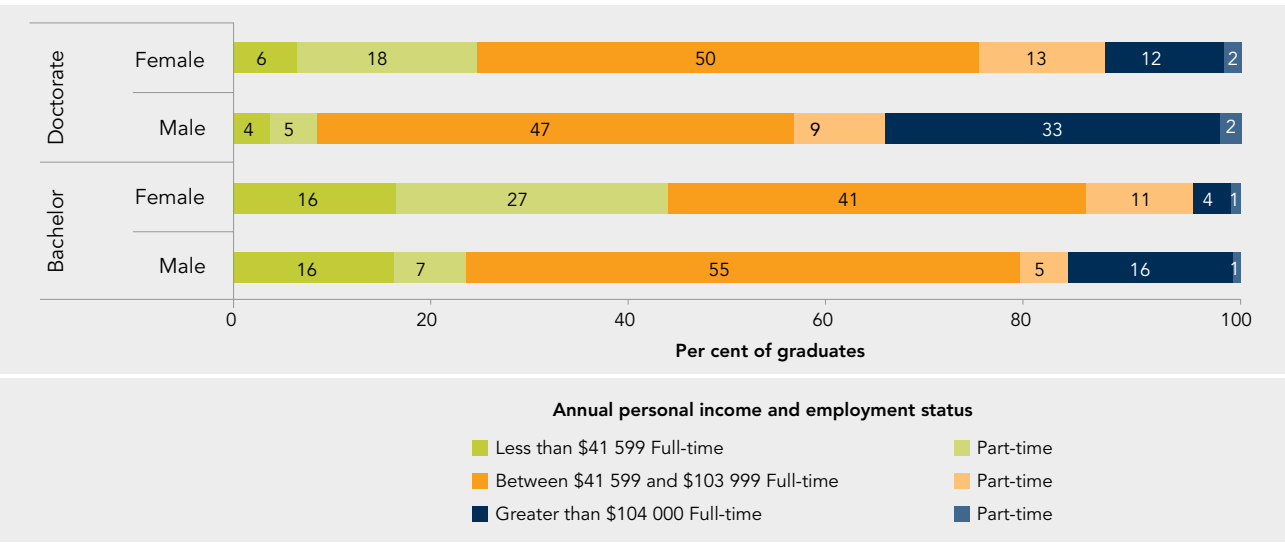


Figure 9.9: Personal annual income of Agricultural Sciences graduates working full-time and part-time, by gender and level of qualification



ARE AGRICULTURAL SCIENCES GRADUATES HIGH EARNERS?

Agricultural Sciences graduates generally had lower incomes compared to Non-STEM graduates (Figure 9.8). Eleven per cent of bachelors and 25 per cent of doctorates had an income in the highest bracket (more than $104 000), less than both the total STEM and Non-STEM cohorts.

There were twice as many females with a personal income in the lowest bracket (less than $41 599) compared to males with a bachelor degree, and four times as many females were employed part-time compared to males (at both bachelor and doctoral qualified levels) (Figure 9.9).

At the bachelor level, 3.5 times more males had an income in the highest bracket compared to females. Among doctoral qualified individuals, this gender difference was 2.5 times. This gender difference in income is present across

Figure 9.10: Percentage of bachelor level graduates earning greater than $104 000 annually, by field, gender and age group

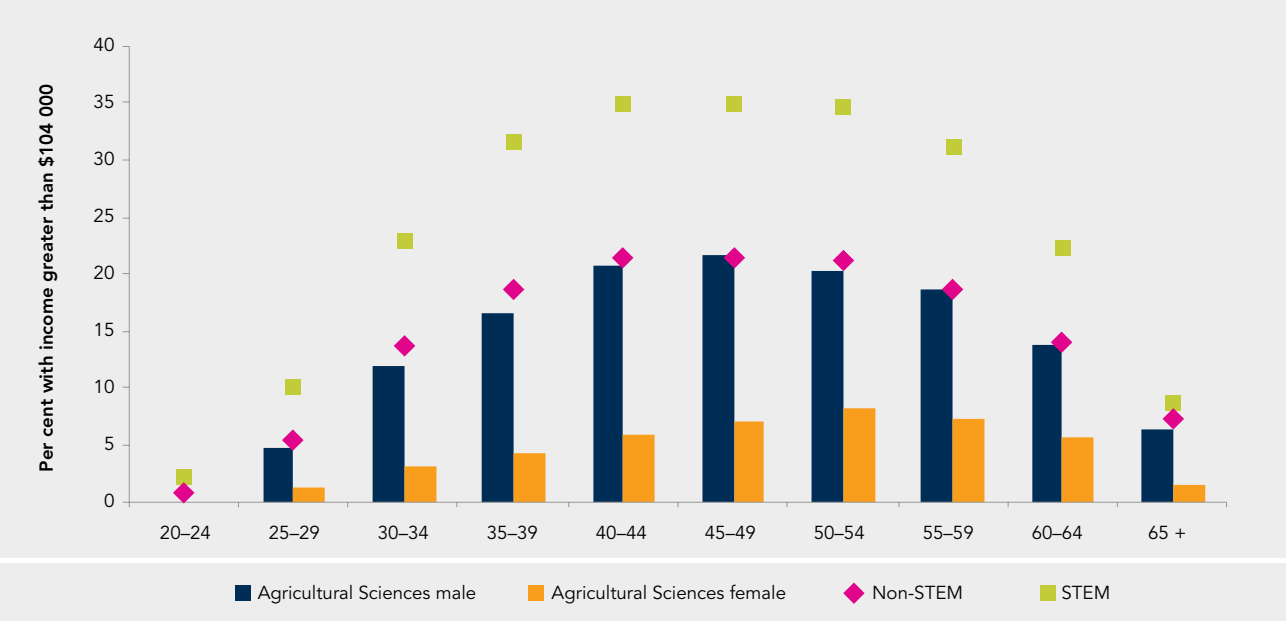
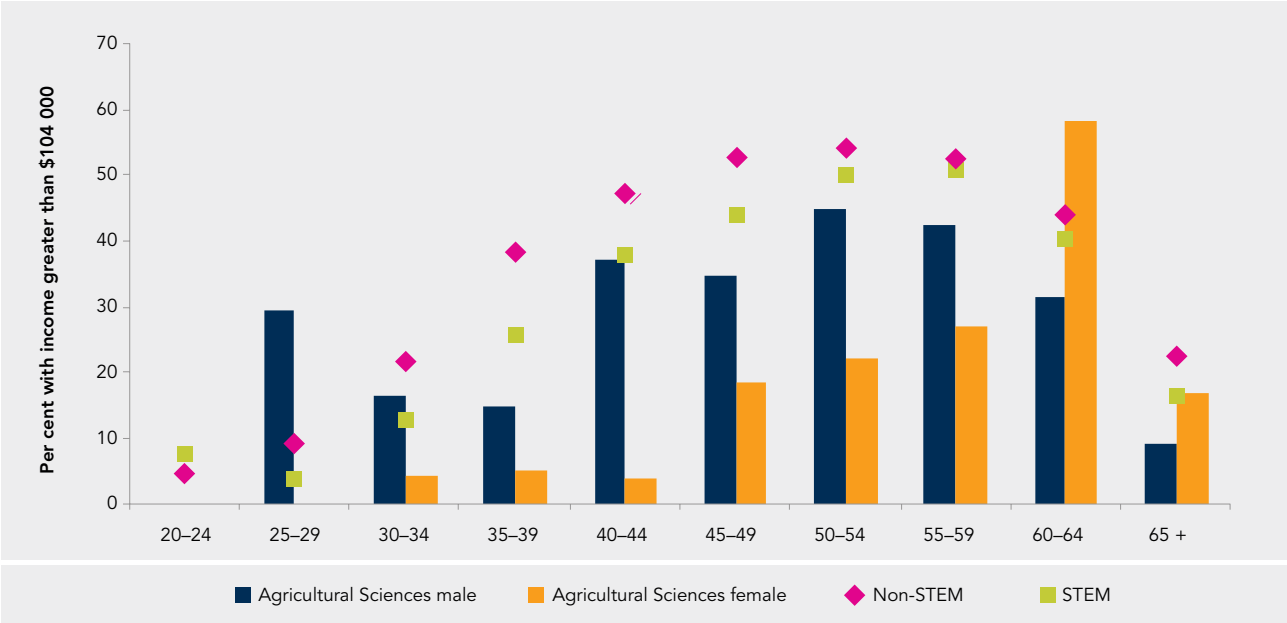


Figure 9.11: Percentage of doctoral level graduates earning greater than $104 000 annually, by field, gender and age group



all age groups for bachelor graduates—reaching a maximum between the ages of 25 to 34 and again at 65 and over, where four times as many males had an income in the highest bracket compared to females (Figure 9.10).

Compared to the total STEM cohort, fewer Agricultural Sciences bachelor graduates had an income in the highest bracket for both males and females and across all age groups (Figure 9.10). At the doctorate level, the differences were not as consistent across age groups and gender (Figure 9.11). Until the 30 to 34 year age group, no female Agricultural Sciences doctorate graduates reached the highest income bracket; and there were considerably higher proportions of males in this bracket between the ages of 30 and 54, peaking at 45 per cent between the ages of 50 to 54. Above the age of 60 there was a higher proportion of females in the highest bracket; however only 30 females in total were in this cohort.

STEM PATHWAYS: FISHERIES STUDIES

There were 1287 Fisheries Studies graduates (bachelor and above) in Australia in 2011. Fifteen per cent of graduates (195) were not in the labour force or were unemployed. The majority of graduates were male (77 per cent).

Almost half of all Fisheries Studies graduates were employed in the five most common industries at the sub-division level (49 per cent) (Figure 9.12); while the top five sub-major occupations also employed 49 per cent of all graduates (Figure 9.13).

Figure 9.12: Most common industry sub-division of employment for Fisheries Studies graduates at bachelor level and above, by gender

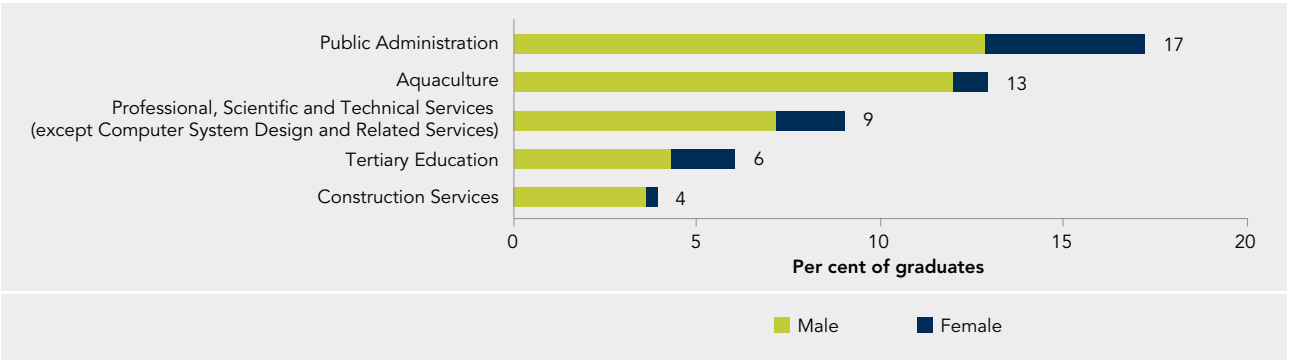
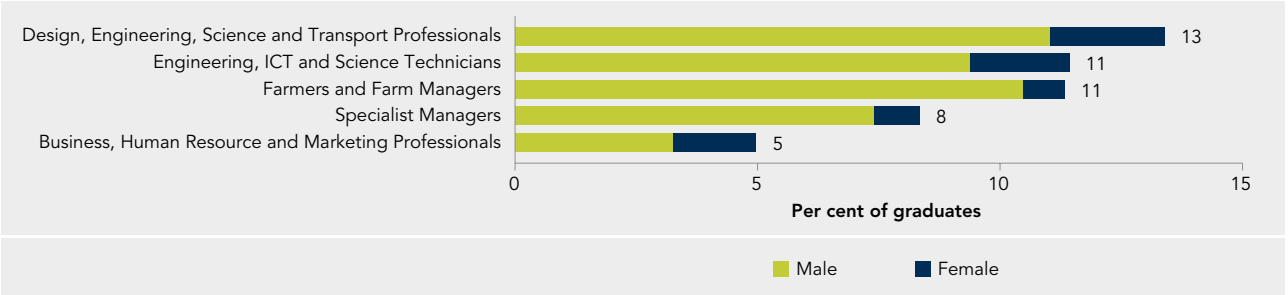


Figure 9.13: Most common sub-major occupations of Fisheries Studies graduates at bachelor level and above, by gender



STEM PATHWAYS: FORESTRY STUDIES

In 2011, there were 2342 graduates in Forestry Studies (bachelor and above) in Australia. Over one quarter of graduates were not in the labour force or unemployed (650, 28 per cent). Of those graduates in the labour force, the majority were male (81 per cent).

The top 5 industries of occupation (2-digit level) employed approximately 60 per cent of all graduates (Figure 9.14).

The five most common sub-major occupations covered 62 per cent of all graduates, with just over one third employed as Design, Engineering, Science and Transport Professionals (Figure 9.15).

Figure 9.14: Most common industry sub-division of employment for Forestry Studies graduates at bachelor level and above, by gender

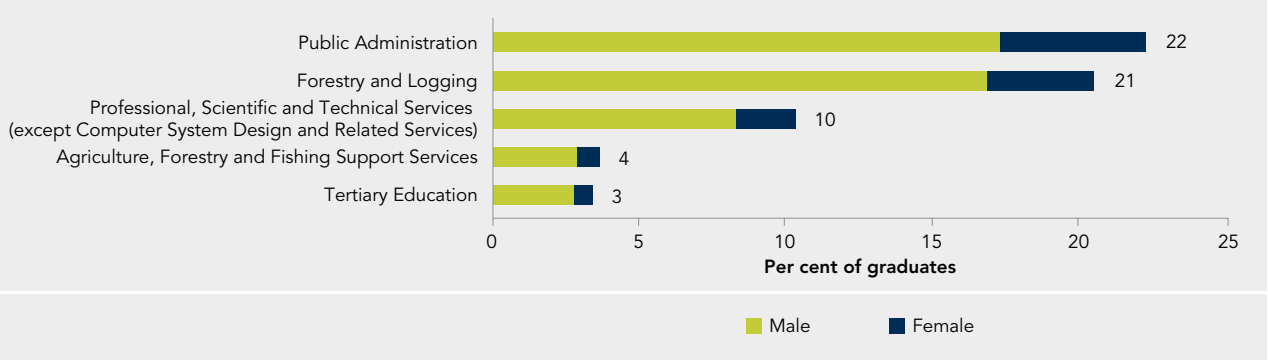
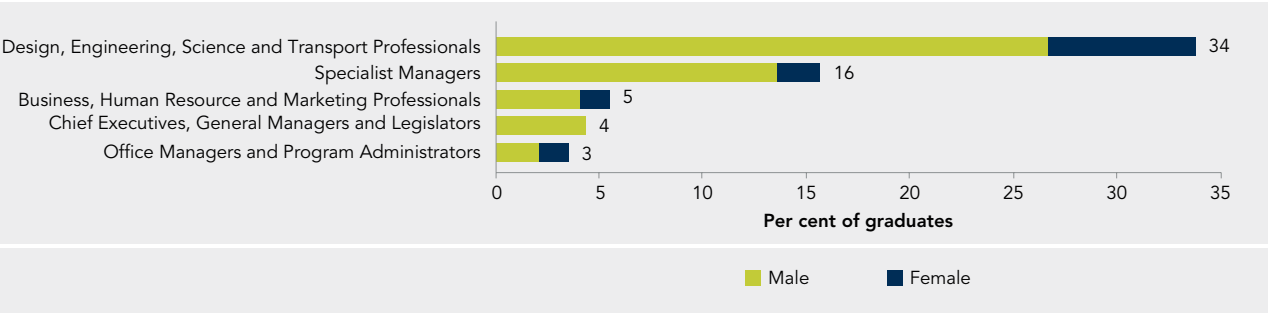


Figure 9.15: Most common sub-major occupations of Forestry Studies graduates at bachelor level and above, by gender



CHAPTER 10

STEM PATHWAYS: ENVIRONMENTAL STUDIES

WHAT ARE ENVIRONMENTAL STUDIES?

The main purpose of studying and working in Environmental Studies is to understand and apply knowledge of the scientific aspects of the environment and the procedures required to establish an environmentally sustainable society. It also involves developing an understanding of how physical, economic, social and technological factors affect the environment. Environmental Studies is comprised of Land, Parks and Wildlife Management; and Environmental Studies, n.e.c. (not elsewhere classified)(ABS, 2001).

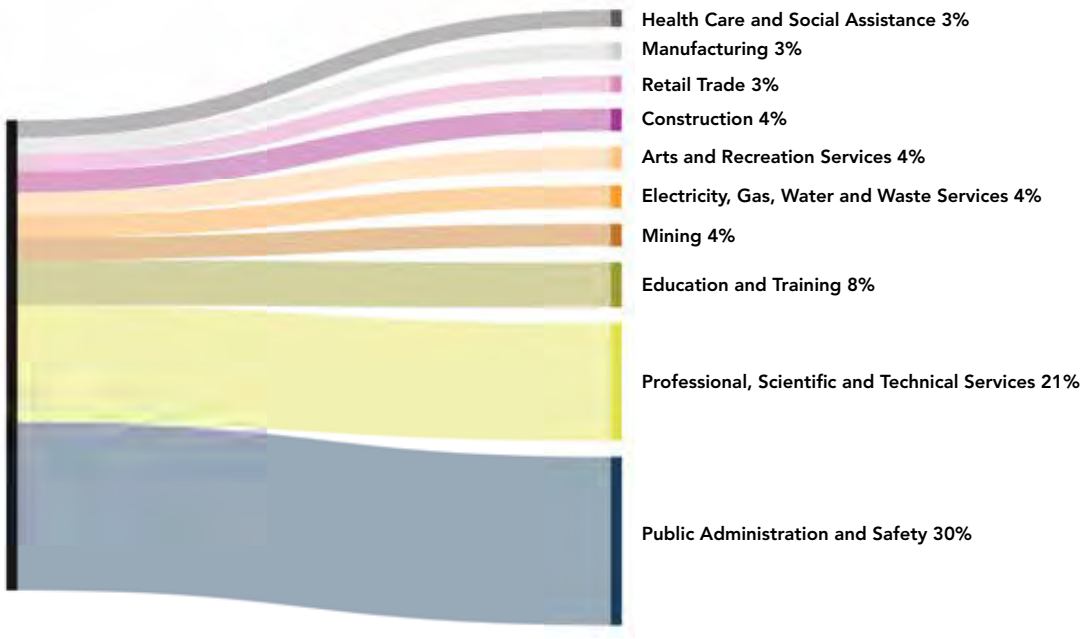
10

STEM PATHWAYS: ENVIRONMENTAL STUDIES

KEY FACTS

1. In 2011, there were 24 884 Environmental Studies graduates, spread equally between males and females.
2. Graduates in this field were comparatively young—54 per cent of females and 39 per cent of males were younger than 35 years old.
3. The private sector employed 56 per cent of all Environmental Studies graduates—varying from 58 per cent of bachelors to 34 per cent of doctorates.
4. Almost one third worked in Public Administration and Safety (30 per cent), and one fifth in Professional, Scientific and Technical Services (21 per cent).
5. Environmental Studies graduates most commonly worked as Professionals (53 per cent) and Managers (17 per cent).
6. At a more detailed level, the most common occupations were as Environmental Scientists (27 per cent).
7. Having a doctorate in Environmental Studies increased the likelihood of earning over $104 000 per year from 12 per cent to 24 per cent compared to a bachelor qualification.

Top ten industry sectors of employment for Environmental Studies graduates



HOW MANY ENVIRONMENTAL STUDIES GRADUATES ARE THERE IN AUSTRALIA?

In 2011, there were 24 884 Environmental Studies graduates (bachelor and above) in Australia. Of these, 73 per cent had qualifications in Environmental Studies, n.e.c; and 27 per cent in Land, Parks and Wildlife Management. There were roughly similar numbers of male (12 208) and female (12 676) graduates. Fifteen per cent of graduates (3689) were either not in the labour force or were unemployed (12 and 3 per cent, respectively).

Over one third of Environmental Studies graduates (7104 individuals, 34 per cent) had post graduate qualifications, 4 per cent of which had doctorates.

HOW OLD IS THE ENVIRONMENTAL STUDIES GRADUATE WORKFORCE?

Over half (54 per cent) of female graduates in the workforce were younger than 34 years; and only 16 per cent were older than 45 years. In contrast, 39 per cent of Non-STEM educated females in the workforce were younger than 34 years; and 24 per cent were older than 45 years (Figure 10.1).

Male graduates who were employed showed a similar, but slightly younger age distribution compared to their Non-STEM-qualified male counterparts.

WHERE DO ENVIRONMENTAL STUDIES GRADUATES WORK?

The private sector employed 56 per cent of all Environmental Studies graduates. This proportion varied depending on level of qualification as follows:

- Bachelor level: 58 per cent
- Postgraduate level: 52 per cent
  - Masters: 56 per cent
  - Doctorate: 34 per cent

INDUSTRY SECTORS OF EMPLOYMENT

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.

Figure 10.1: Age distribution of employed Environmental Studies graduates at bachelor level and above, by field and gender

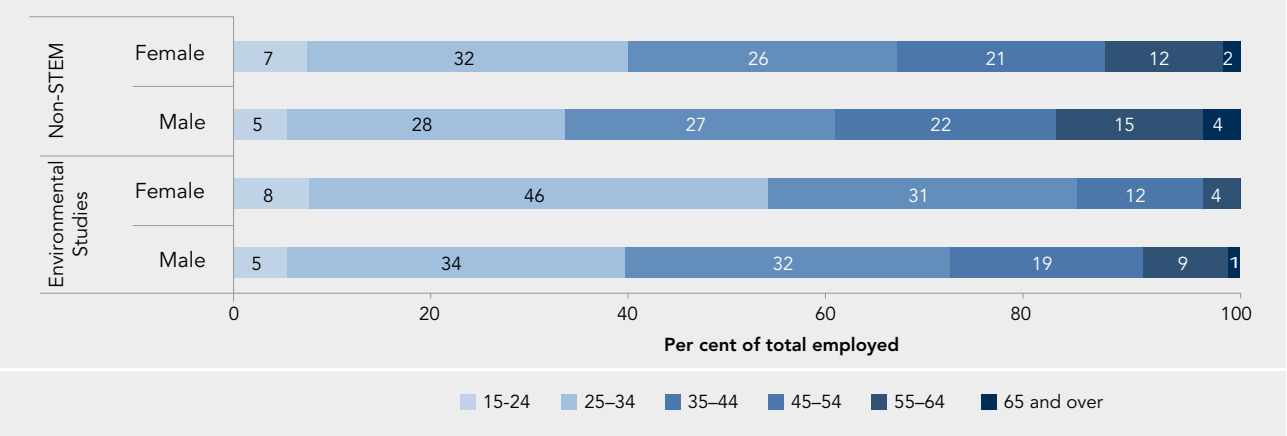


Figure 10.2: Top ten industry divisions of employment for Environmental Studies graduates with qualifications at bachelor level and above, by gender

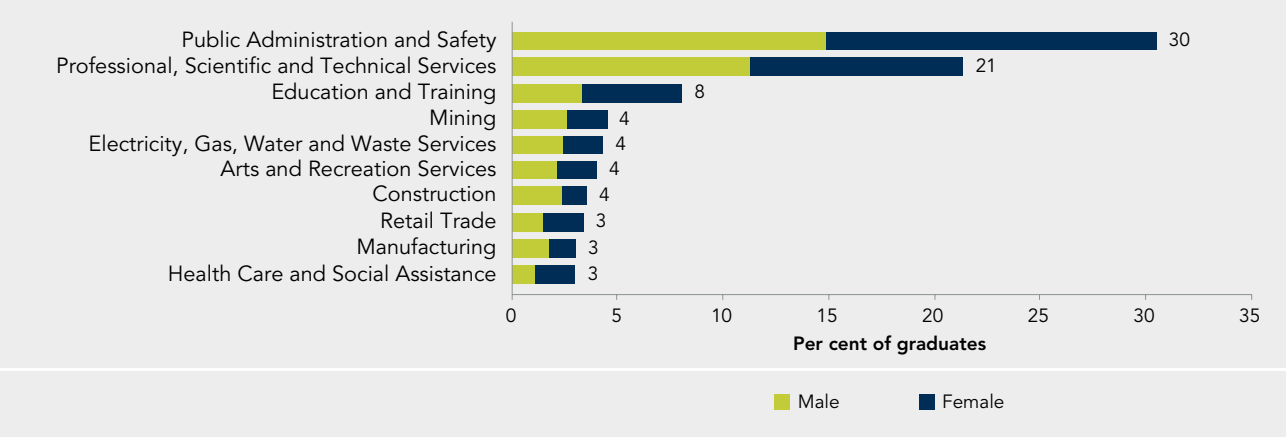
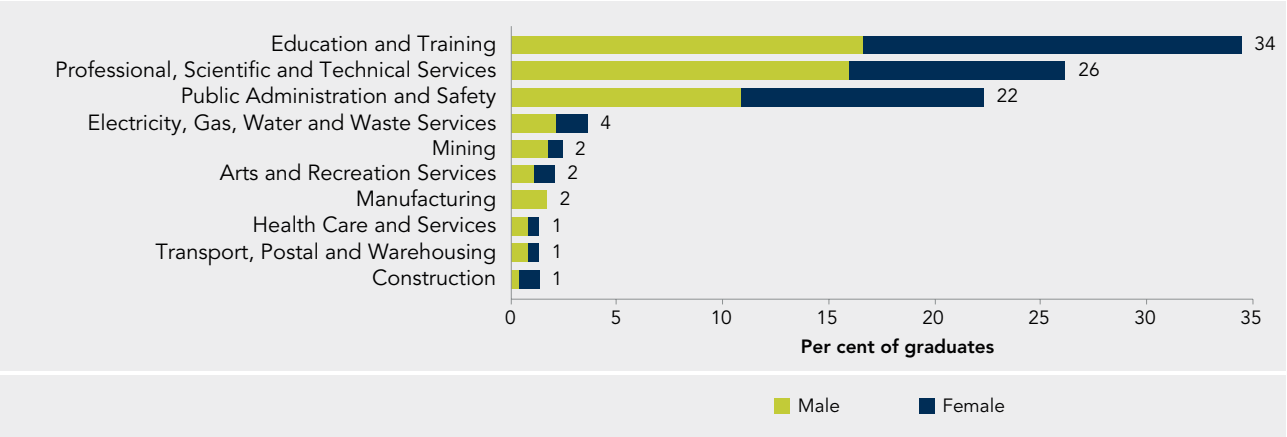


Figure 10.3: Top ten industry divisions of employment for Environmental Studies doctoral graduates, by gender



Approximately one third (30 per cent) of graduates worked in the Public Administration and Safety industry; and one fifth (21 per cent) in Professional, Scientific and Technical Services (Figure 10.2).

Doctorate holders worked in the same top three industry divisions as the total bachelor and above population; however the percentages in each were different (Figure 10.3). For example, only eight per cent of the total Environmental Studies graduate workforce were employed in the Education and Training division; compared to over one third (34 per cent) of doctorate holders.

At a more detailed level, the total graduate population was spread across a much wider range of industries than those with doctorates. In addition, while the top ten industry classes were the same for both the whole graduate cohort and for those with doctorates they were in a very different order (Figure 10.4 and Figure 10.5). The largest difference was in Higher Education (an industry class of Education and Training), which employed only 4 per cent of the total cohort, but one third of the doctoral graduates. The industry class of State Government Administration was the top destination for graduates as a whole at 16 per cent, and employed a similar percentage of doctorates, at 15 per cent.

There was an overall parity in the number of male and female graduates employed in each industry class. In some industries, such as Higher Education and Central Government Administration, slightly more females were employed compared to males. This parity did not alter significantly for individuals with doctorates.

Figure 10.4: Top ten industry classes of employment for Environmental Studies graduates with qualifications at bachelor level and above, by gender

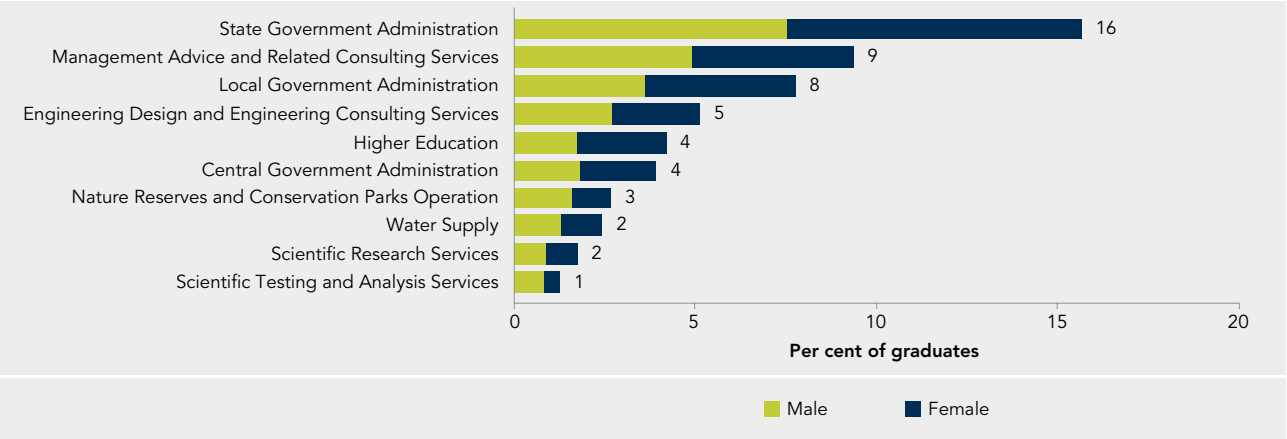
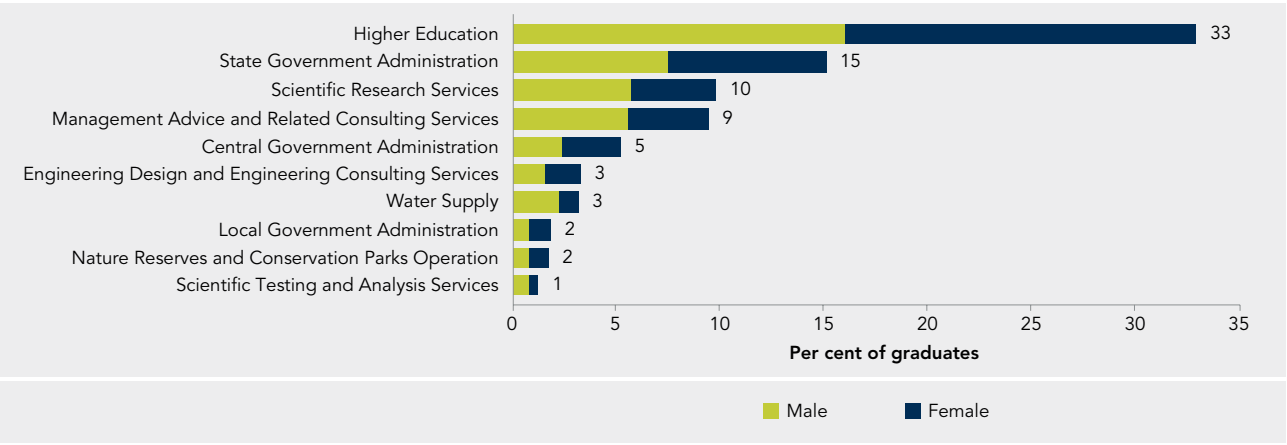


Figure 10.5: Top ten industry classes of employment for Environmental Studies doctoral graduates, by gender



WHAT ARE THE OCCUPATIONS OF ENVIRONMENTAL STUDIES GRADUATES?

Over half of all Environmental Studies graduates were employed as Professionals (53 per cent), and 17 per cent were Managers. Among the Professionals, the most common sub-groups of occupation were:

- Design, Engineering, Science and Transport Professionals (69 per cent)
- Business, Human Resource and Marketing Professionals (12 per cent)
- Education Professionals (8 per cent).

Among the Managers, the most common sub-groups of occupation were:

- Specialist Managers (71 per cent)
- Hospitality, Retail and Service Managers (12 per cent)
- Chief Executives, General Managers and Legislators (8 per cent).

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 10.6: Top ten unit group level occupations of Environmental Studies graduates with qualifications at bachelor level and above, by gender

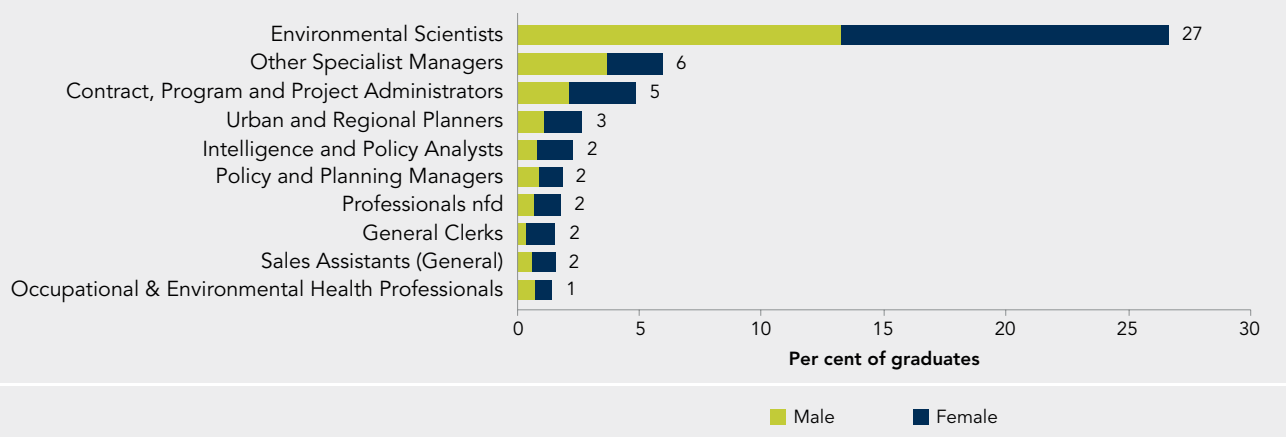
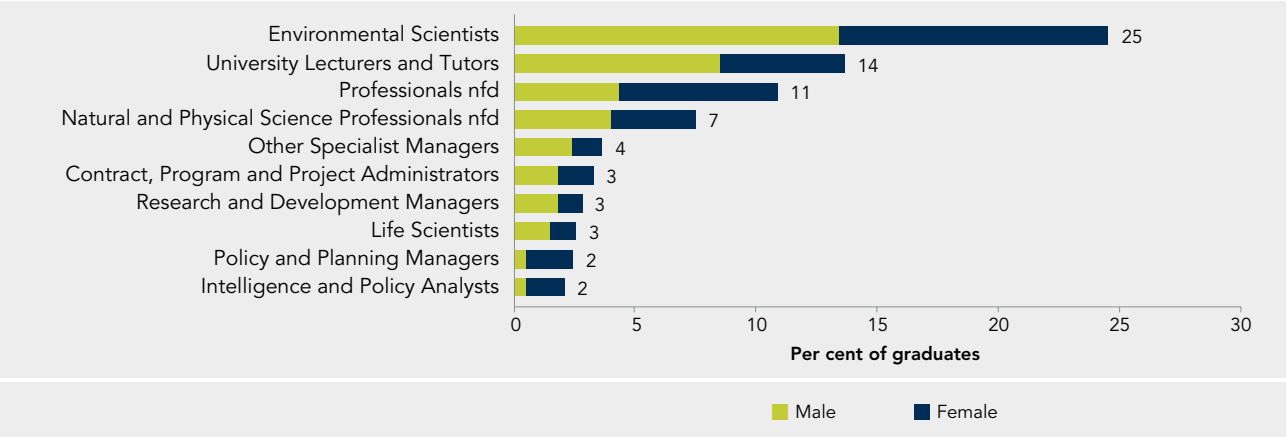


Figure 10.7: Top ten unit group level occupations of Agricultural Science doctoral graduates, by gender



The most common unit level occupation by a large percentage was Environmental Scientists (27 per cent), followed by Other Specialist Managers (6 per cent) (Figure 10.6)

ARE THE OCCUPATIONS FOR ENVIRONMENTAL STUDIES DOCTORATE HOLDERS DIFFERENT FROM BACHELOR DEGREE HOLDERS?

Most Environmental Studies doctorate holders were employed as Professionals, followed by Managers (76 and 14 per cent of graduates, respectively). The private sector employed one third of all Environmental Studies doctorate holders; however, among the doctorate holders employed as Professionals, only 30 per cent were employed by the private sector.

At the more detailed unit level, one quarter of doctorate holders were employed as Environmental Scientists, while 14 per cent were University Lecturers and Tutors and a further 11 per cent were Professionals, n.f.d (Figure 10.7).

ARE ENVIRONMENTAL STUDIES GRADUATES HIGH EARNERS?

Fewer Environmental Studies graduates earned an income in the highest bracket (more than $104 000) compared to STEM and Non-STEM graduates (Figure 10.8). At the bachelor level, 12 per cent of graduates earned an income in the highest bracket, which was less than half the proportion of STEM graduates, and comparable to the proportion of Non-STEM graduates (25 and 15 per cent, respectively).

Figure 10.8: Personal annual income of graduates, by field and level of qualification

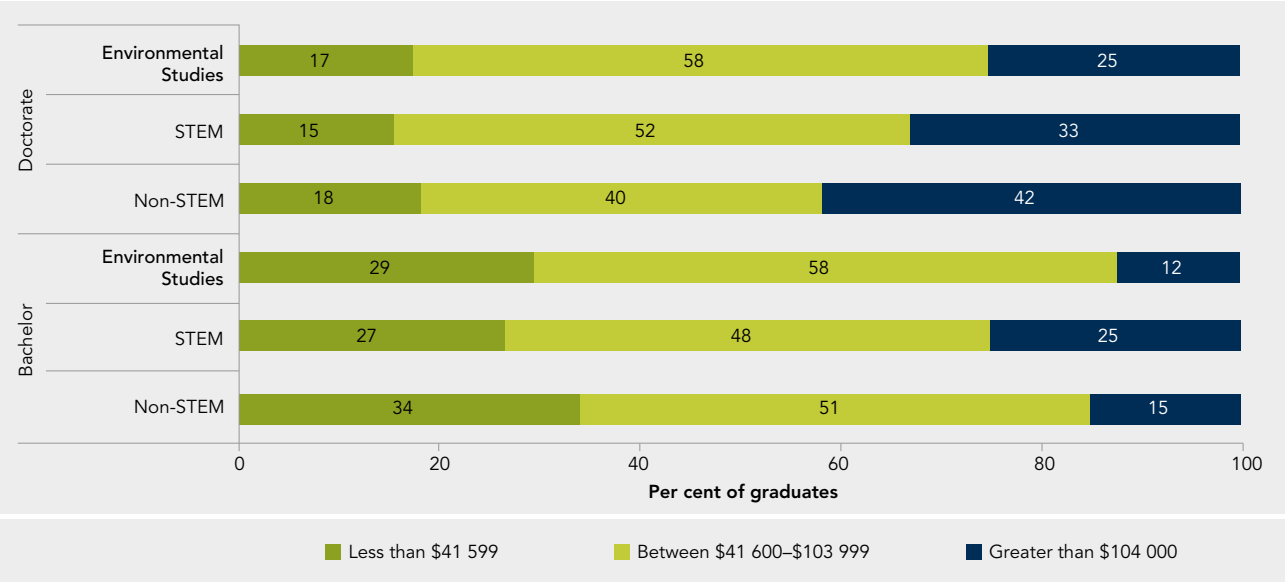
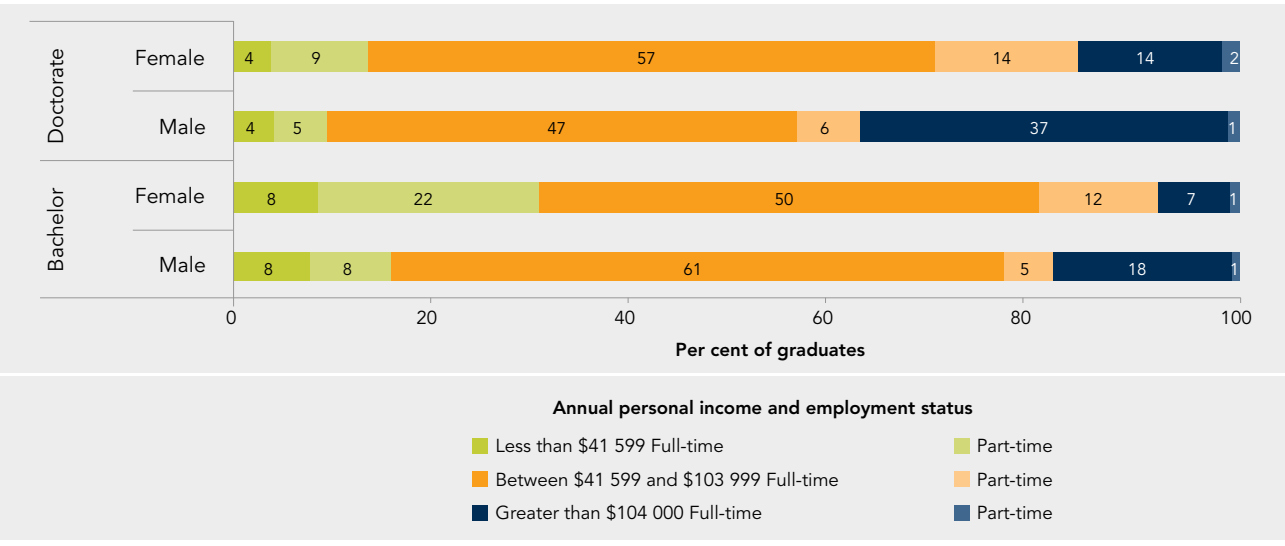


Figure 10.9: Personal annual income of Environmental Studies graduates working full-time and part-time, by gender and level of qualification



A higher proportion of Environmental Studies doctorate holders had an income in the highest bracket, but this was still less than that for STEM and Non-STEM, at 25, 33 and 42 per cent, respectively.

Income was dependent on gender and full-time or part-time employment, with more men and more full-time graduates in the higher income brackets (Figure 10.9). More than twice the proportion of male than female graduates had an income above $104 000 at both the bachelor and doctorate level of qualification.

Figure 10.10: Percentage of bachelor level graduates earning greater than $104 000 annually, by field, gender and age group

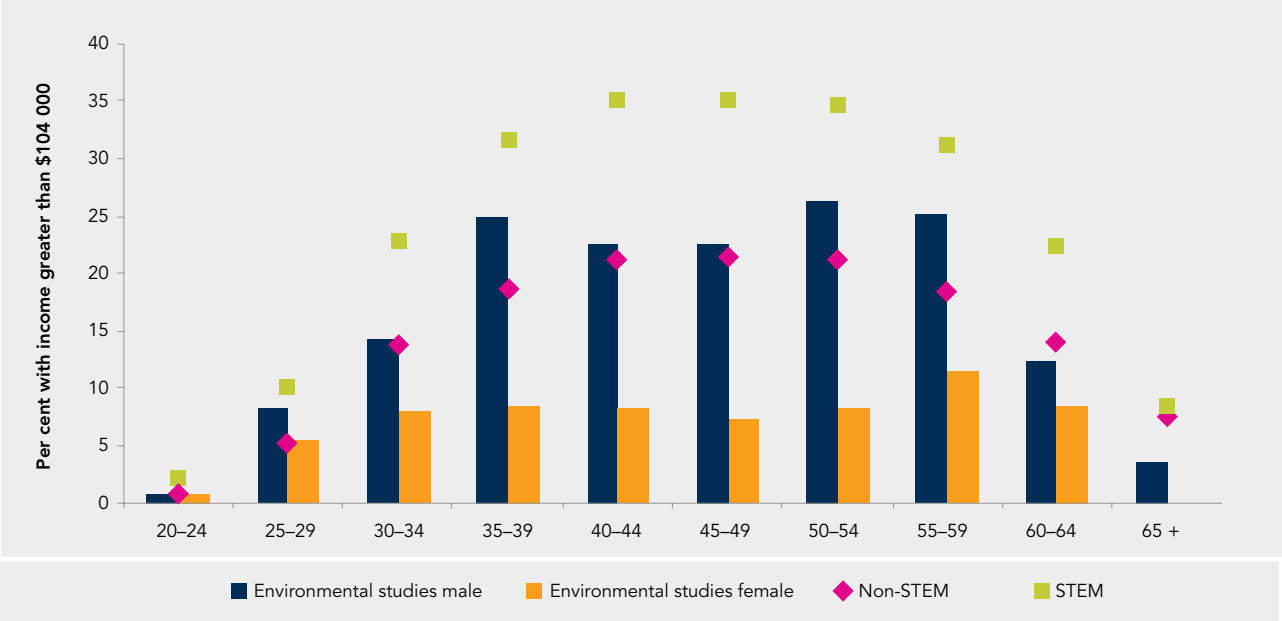
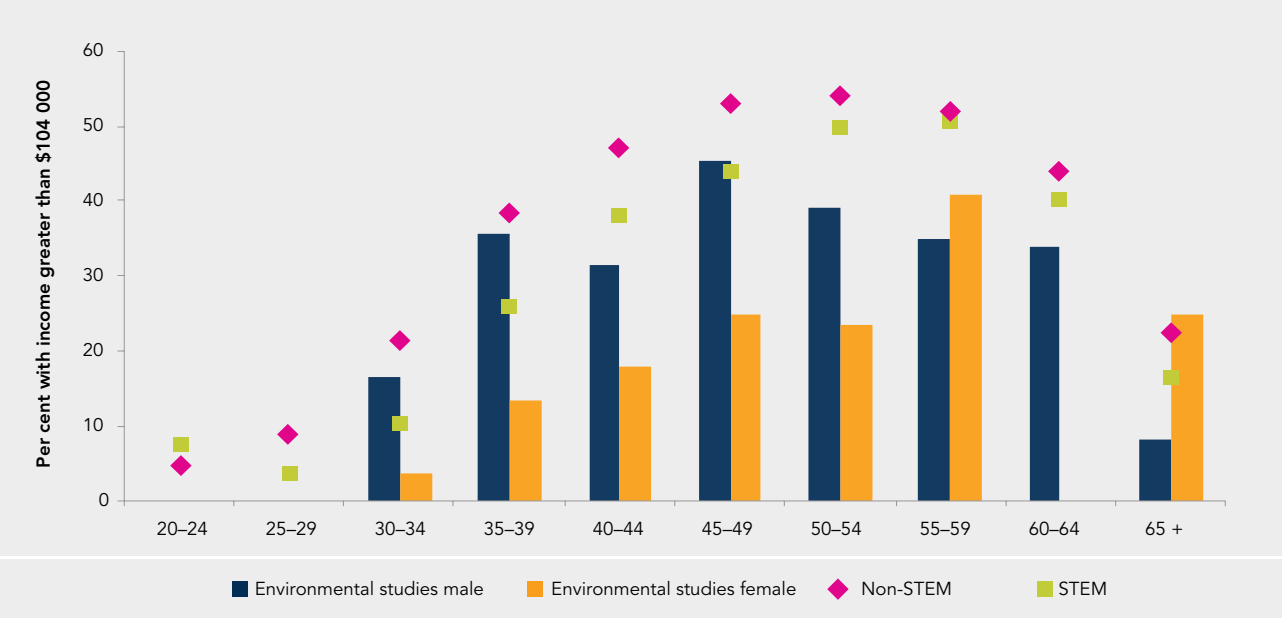


Figure 10.11: Percentage of doctoral level graduates earning greater than $104 000 annually, by field, gender and age group



Around one quarter of male bachelor graduates had earnings in the highest bracket between the ages of 35 to 59, peaking at a maximum of 26 per cent at 50 to 54 (Figure 10.10). In comparison, fewer than 10 per cent of female graduates reached the highest bracket across all age groups, except for between the ages of 55 to 59, where 12 per cent earned over $104 000.

At the doctorate level, a higher proportion of male Environmental Studies graduates between the ages of 30 to 39 and 45 to 49 had an income in the highest bracket compared to the total STEM cohort (Figure 10.11). A lower proportion of female doctorate graduates reached the highest bracket at all age groups except for between the ages of 55 to 59 and above 65 (however only 12 individuals were in this age cohort).

CHAPTER 11

STEM PATHWAYS: INFORMATION TECHNOLOGY

WHAT IS INFORMATION TECHNOLOGY?

The main purpose of studying and working in Information Technology (IT) is to understand and apply knowledge of information systems, programming languages, information management and artificial intelligence, and the ability to apply them to solve problems. IT is comprised of Computer Science, Information Systems, and Other Information Technology. (ABS, 2001)

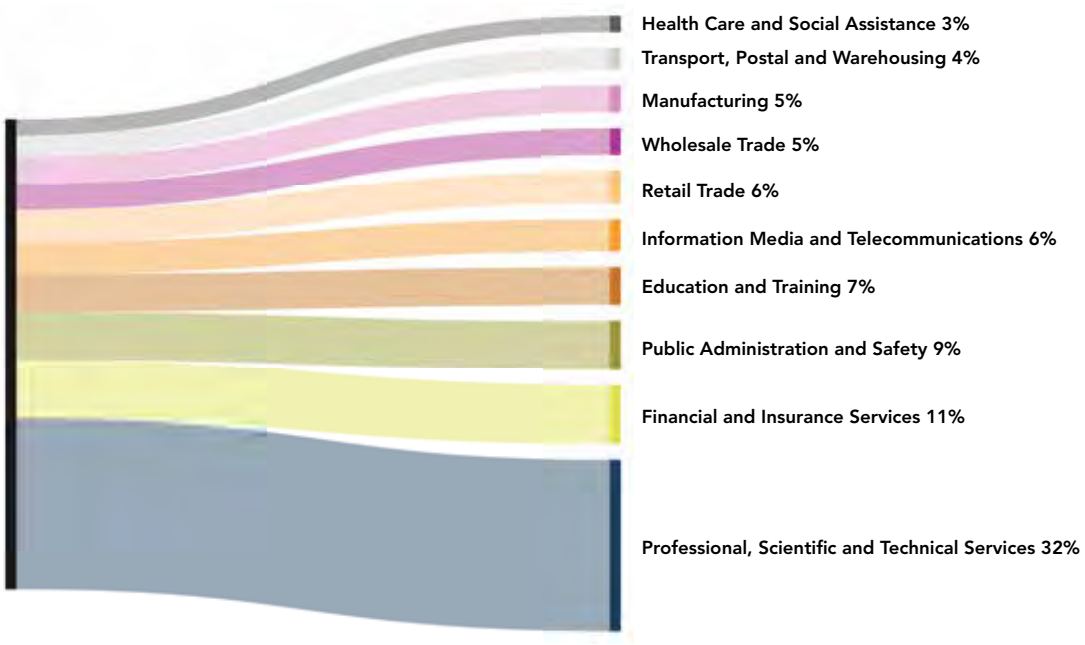
11

STEM PATHWAYS: INFORMATION TECHNOLOGY

KEY FACTS

1. In 2011, there were 160 919 Information Technology (IT) graduates, the majority of which were male (75 per cent).
2. Around one quarter of graduates held postgraduate qualifications: 24 per cent masters and 2 per cent doctorates.
3. The IT workforce was younger than the Non-STEM workforce, with one half under the age of 35 (50 and 37 per cent, respectively).
4. The private sector employed 82 per cent of all IT graduates—varying from 84 per cent of bachelors and masters to 44 per cent of doctorates.
5. One-third (32 per cent) of all IT graduates were employed in the Professional, Scientific and Technical Services industry.
6. The majority (58 per cent) of graduates were employed as Professionals, 21 per cent as Software and Applications Programmers.
7. A larger proportion of IT graduates had a personal income in the highest bracket (more than $104 000) than Non-STEM graduates (24 and 15 per cent, respectively), and this difference was particularly pronounced in the younger age groups.

Top ten industry sectors of employment for Information Technology graduates



HOW MANY INFORMATION TECHNOLOGY GRADUATES ARE THERE IN AUSTRALIA?

In 2011, there were 160 919 Information Technology (IT) in Australia. Three quarters of graduates were male. Around one quarter of IT graduates had postgraduate qualifications (41 579), with 24 per cent holding masters degrees and two per cent doctorates. The majority of graduates with postgraduate qualifications were male (75 per cent). Fourteen per cent of graduates (22 321) were either not in the labour force or were unemployed (10 and 4 per cent, respectively).

The field of IT has four sub fields: Information Technology, n.f.d. (not further defined), Computer Science, Information Systems, and Other Information Technology. Just under two thirds (65 per cent) of IT graduates recorded their field of study as Information Technology, n.f.d. This chapter reports on the workforce characteristics of all the sub-fields together.

HOW OLD IS THE INFORMATION TECHNOLOGY GRADUATE WORKFORCE?

The IT workforce was substantially younger than the Non-STEM workforce, with almost one half under the age of 35 (Figure 11.1). 47 per cent of females and 50 per cent of males were 35 years old or under, compared to 33 per cent of females and 39 per cent of males in the Non-STEM workforce.

Similar percentages of the workforce were aged between 35 and 54 for both IT and Non-STEM, while in the over 55 age brackets, there are far fewer IT graduates in the workforce.

WHERE DO INFORMATION TECHNOLOGY GRADUATES WORK?

The private sector employed 82 per cent of all IT graduates. The proportion employed in the private sector varies with qualification as follows:

- Bachelor level: 84 per cent
- Postgraduate level: 81 per cent
  - Masters: 84 per cent
  - Doctorate: 44 per cent

INDUSTRY SECTORS OF EMPLOYMENT

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.

Figure 11.1: Age distribution of employed Information Technology graduates at bachelor level and above, by field and gender

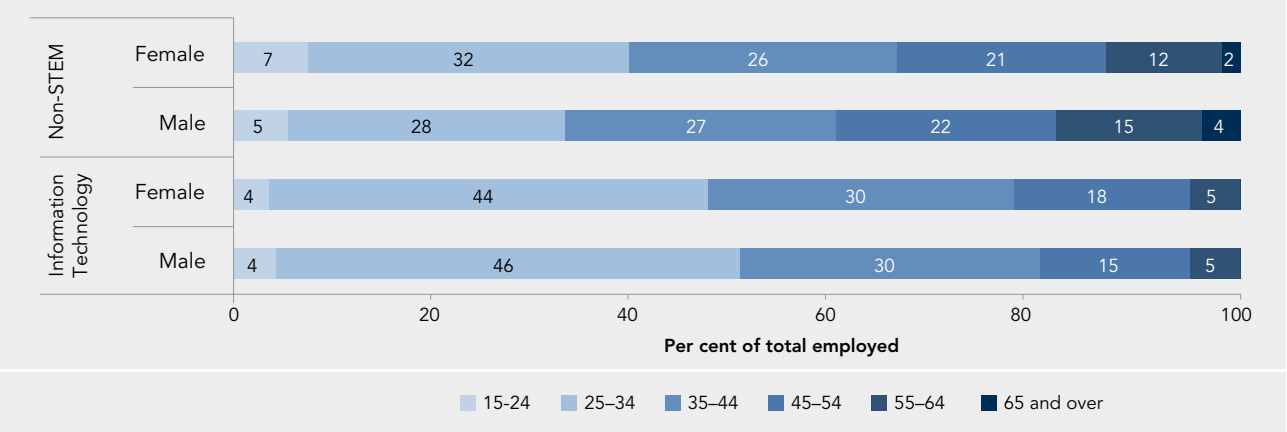


Figure 11.2: Top ten industry divisions of employment for Information Technology graduates with qualifications at bachelor level and above, by gender

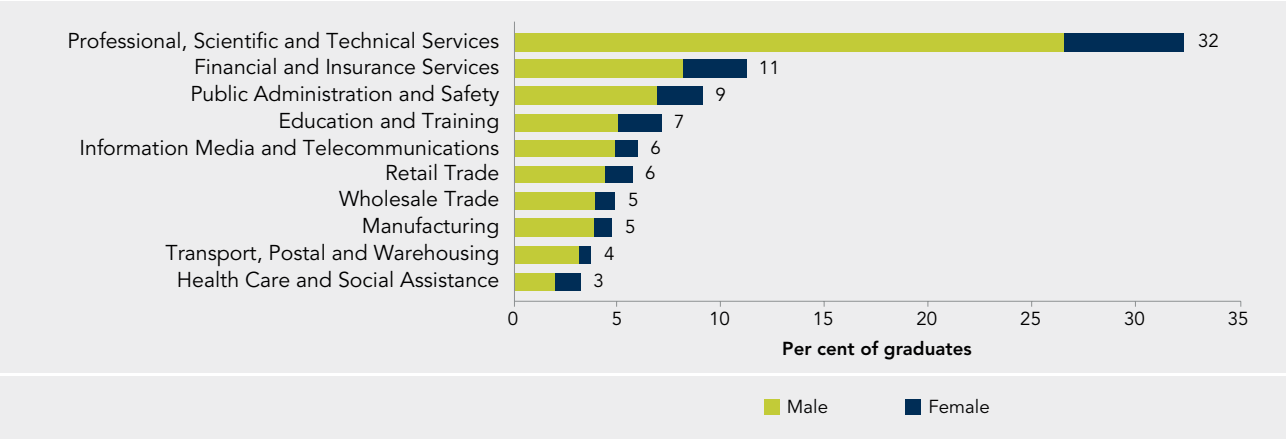
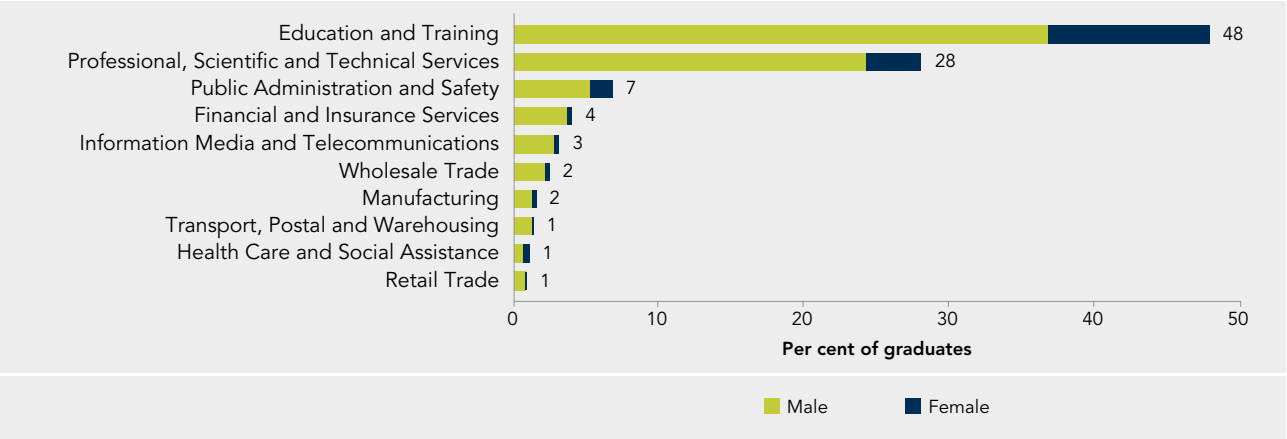


Figure 11.3: Top ten industry divisions of employment for Information Technology doctoral graduates, by gender



Before reporting on the industry sectors of employment for IT graduates, it is important to first note that only 85 per cent of respondents (136 066 out of 160 919) provided adequate information in this section of the Census.

Almost one third of IT graduates worked in the Professional, Scientific and Technical Services industry (32 per cent) (Figure 11.2). This was the top destination of employment for both males and females, employing 34 per cent of male graduates and 26 per cent of female graduates. The next most common industries were Financial and Insurance Services, and by Public Administration and Safety (11 and 9 per cent, respectively).

At the doctoral level of qualification, almost one half worked in the Education and Training industry (48 per cent)(Figure 11.3). In contrast, just 7 per cent of the total cohort of IT graduates at the bachelor level and above worked in the Education and Training industry. Professional, Scientific and Technical Services (28 per cent) and Public Administration and Safety (7 per cent) were the next most common industries of employment for IT doctoral graduates. The top three industries of employment were the same for both male and female doctoral graduates.

The industry of employment can be broken down to the class level to show more detail of the destinations of graduates, as shown in Figure 11.4 and Figure 11.5. These were broadly the same for male and female graduates. The most common industry class of employment for IT graduates was in Computer System Design and Related Services, which employed just over one quarter of all graduates (26 per cent). The second most popular industry

Figure 11.4: Top ten industry classes of employment for Information Technology graduates with qualifications at bachelor level and above, by gender

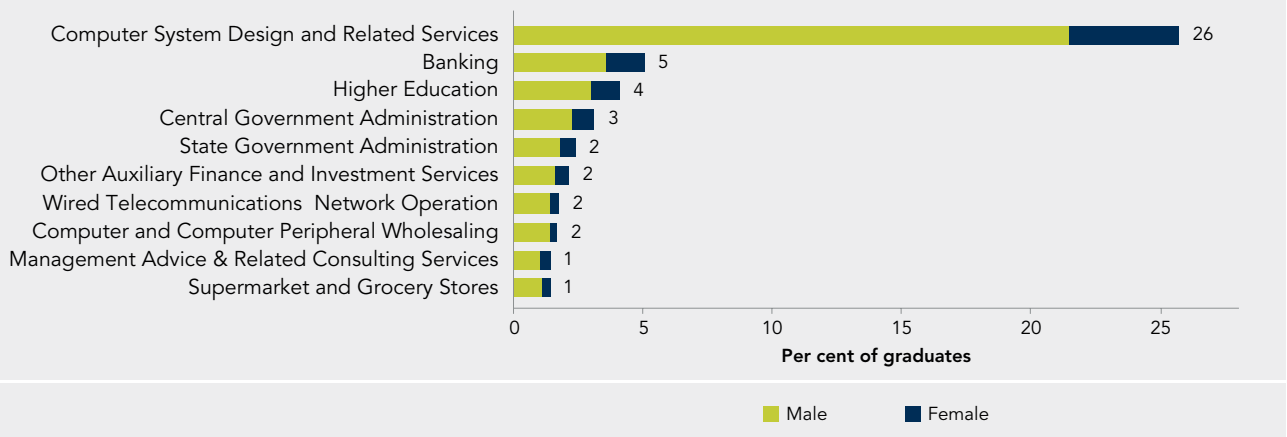
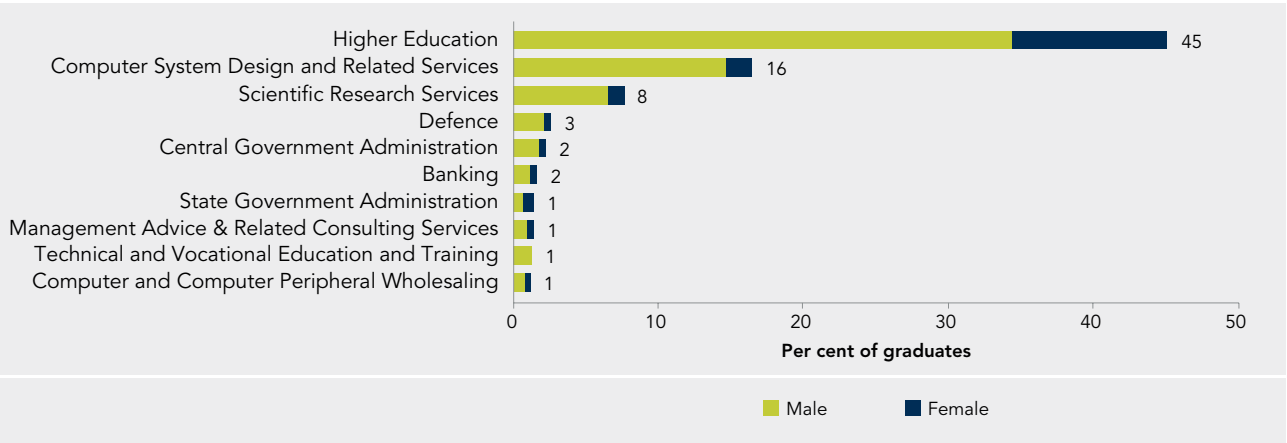


Figure 11.5: Top ten industry classes of employment for Information Technology doctoral graduates, by gender



class was Banking, which employed 5 per cent of all graduates. The rest of the top ten industry classes were then dispersed across a range of industries, including Public Administration and Telecommunications.

At the doctoral level, graduates were more concentrated in fewer industry classes, with 45 per cent employed in Higher Education, and 16 per cent in Computer System Design and Related Services. The third highest industry class was Scientific Research Services (8 per cent of doctoral graduates), which does not appear in the top ten industry classes for the whole cohort of IT graduates.

Figure 11.6: Top ten sub-major group occupations of Information Technology graduates at bachelor level and above, by gender

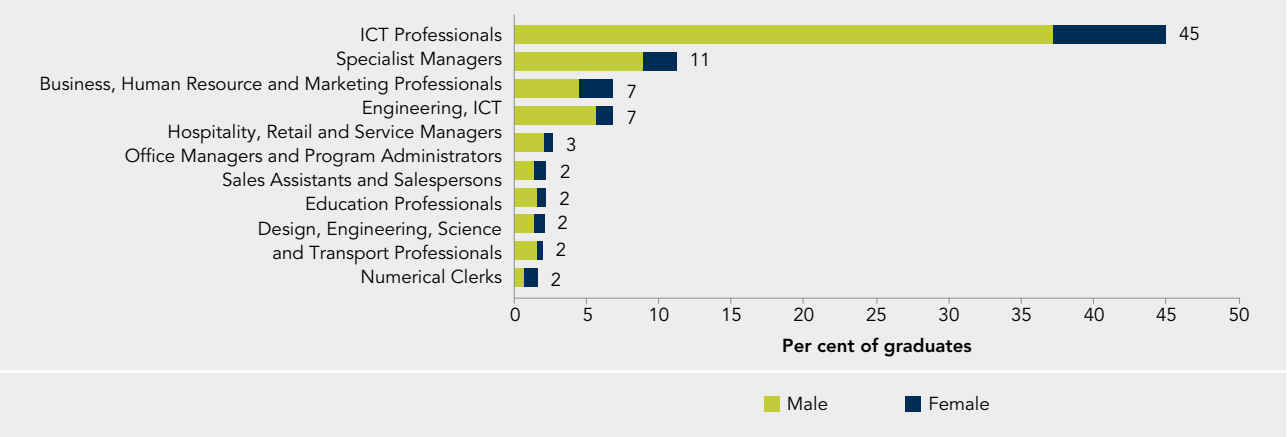
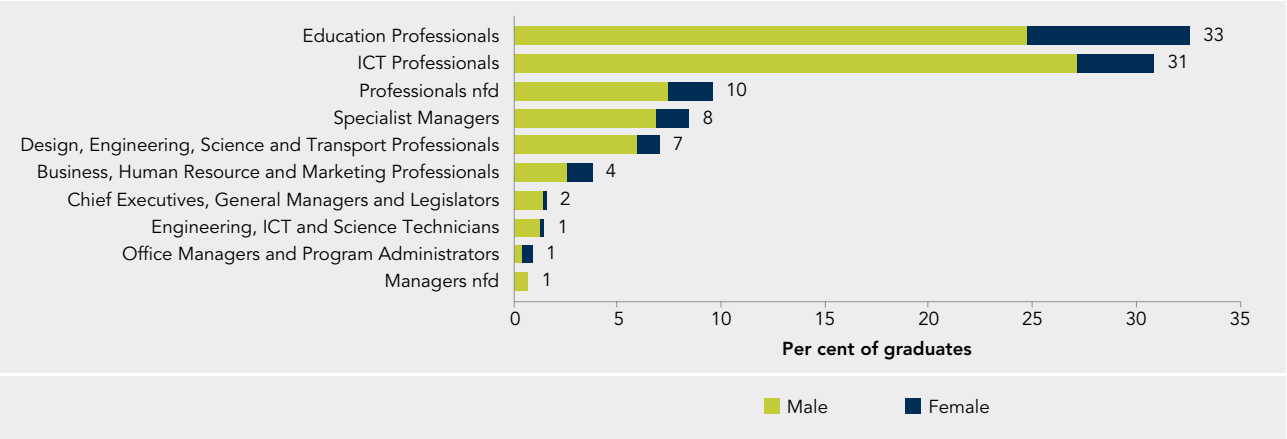


Figure 11.7: Top ten sub-major group occupations of Information Technology doctorate graduates, by gender



Managers, and Business, Human Resources and Marketing Professionals (11 and 7 per cent, respectively).

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.

The most common occupation for IT graduates with doctorates was as Education Professionals, with one-third employed in this role (33 per cent), with a higher percentage of women (41 per cent) than men (31 per cent) (Figure 11.7).

The occupation groups can be broken down further to the unit group level to provide more detail on the destinations of graduates (Figure 11.8 and Figure 11.9). The top ten unit group occupations for IT graduates are all ICT professional, management and technician specialties. The top occupation was as Software and Applications Programmers, with just over one-fifth of graduates (21 per cent). The second most popular occupation employed 8 per cent of graduates and was ICT Managers.

The unit-group level occupations for IT graduates at the doctoral level were different to those of the whole graduate cohort (Figure 11.9). The most common occupation was as University Lecturers and Tutors, with almost 1 in 3

Figure 11.8: Top ten unit group level occupations of Information Technology graduates with qualifications at bachelor level and above, by gender

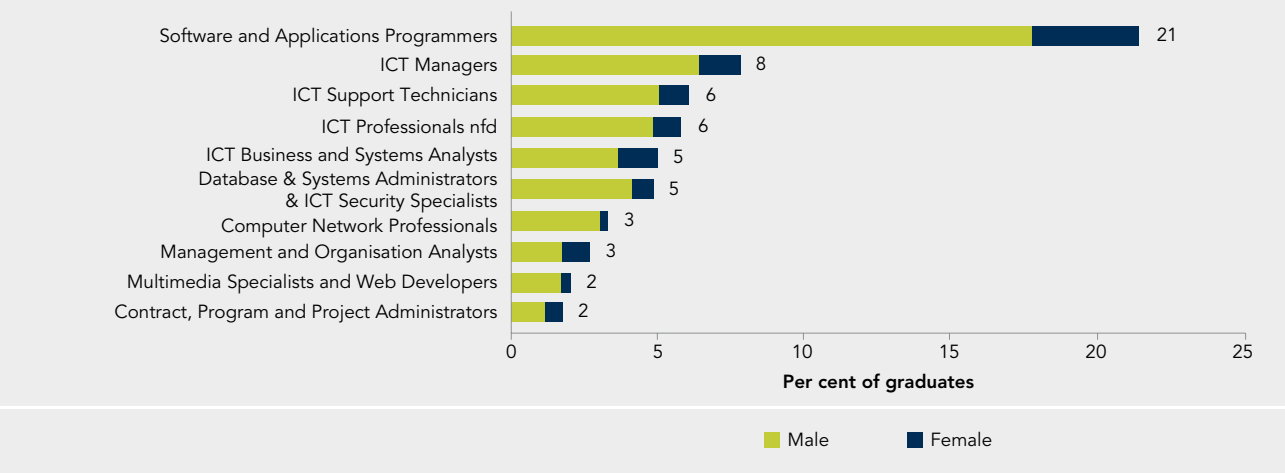
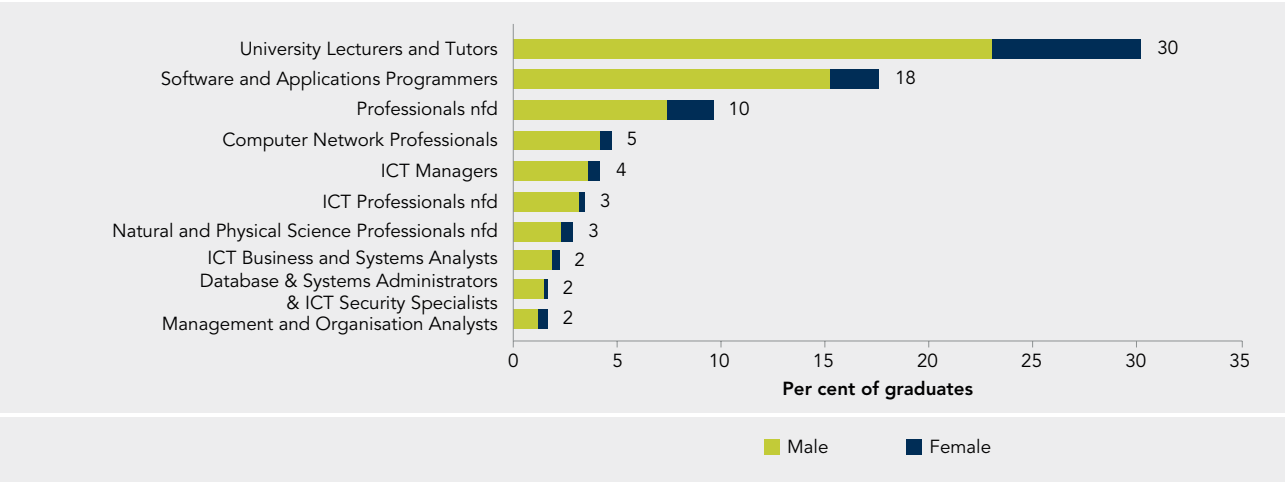


Figure 11.9: Top ten unit group level occupations of Information Technology doctorate graduates, by gender



(30 per cent) doctorates, in contrast to 1 per cent of the total IT graduate cohort.

ARE INFORMATION TECHNOLOGY GRADUATES HIGH EARNERS?

Around one quarter of graduates with a bachelor degree in IT had a personal income in the highest bracket (more than $104 000), which is comparable to the proportion of the STEM graduate cohort with bachelor degrees as a whole, and more than the Non-STEM cohort (26, 25 and 15 per cent, respectively) (Figure 11.10). Additionally, IT graduates were least likely to have a personal income in the lowest bracket compared to both STEM and Non-STEM bachelor graduates (20, 27 and 34 per cent, respectively).

Completing a doctorate in IT can be financially rewarding compared to having a bachelor degree, with the proportion of graduates earning in the highest income bracket growing from 26 per cent to 39 per cent with the higher qualification.

Graduate income levels were dependent on both gender and full-time or part-time employment. A lower percentage of females earned an income in the highest bracket for both bachelor and doctorate holders (Figure 11.11). At the bachelor level, around one-fifth of female graduates had a personal income in the highest bracket, compared to around one-third for male graduates (19 and 30 per cent, respectively). At the doctorate level of qualification 32 per cent of females and 44 per cent of males had an income in the top bracket.

Figure 11.10: Personal annual income of graduates, by field and level of qualification

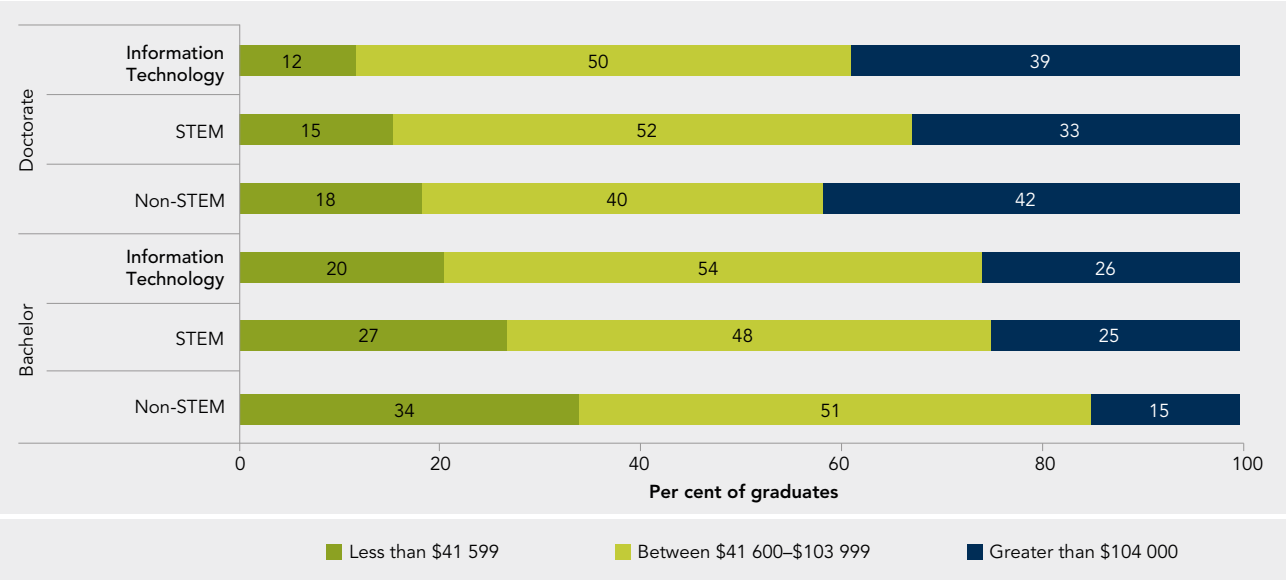
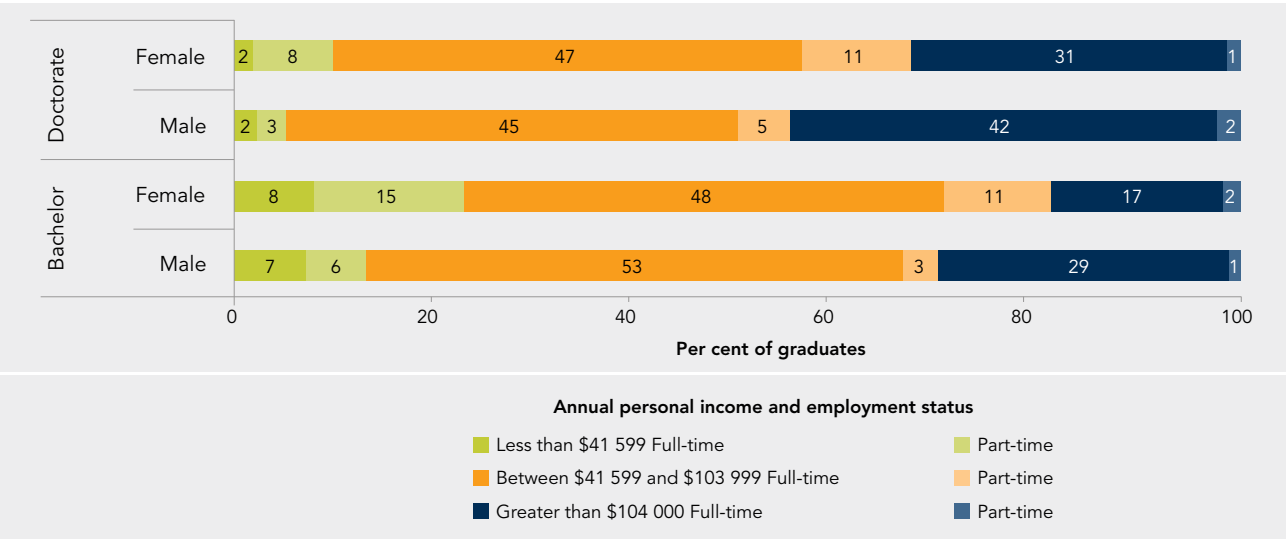


Figure 11.11: Personal annual income of Information Technology graduates working full-time and part-time, by gender and level of qualification



At the other end of the income scale, almost one quarter (23 per cent) of female bachelor graduates earned less than $41 599, 15 per cent of which worked part-time. This is substantially more than males, where 15 per cent had a personal income in the same bracket, and only 6 per cent worked part-time.

A higher proportion of women than men worked part-time across both qualification levels. At the bachelor level, 27 per cent of women and 10 per cent of men worked part-time, while at the doctorate level 20 per cent of women and 10 per cent of men worked part-time.

Compared to the STEM and Non-STEM cohorts, a higher percentage of male IT graduates reached the highest income bracket at both the bachelor and doctorate level, across most age groups (Figure 11.12 and Figure 11.13). The percentage of males in the highest bracket was at least 1.5 times that of females up to the age of 65 and above for bachelor graduates.

Figure 11.12: Percentage of bachelor level graduates earning greater than $104 000 annually, by gender, field and age group

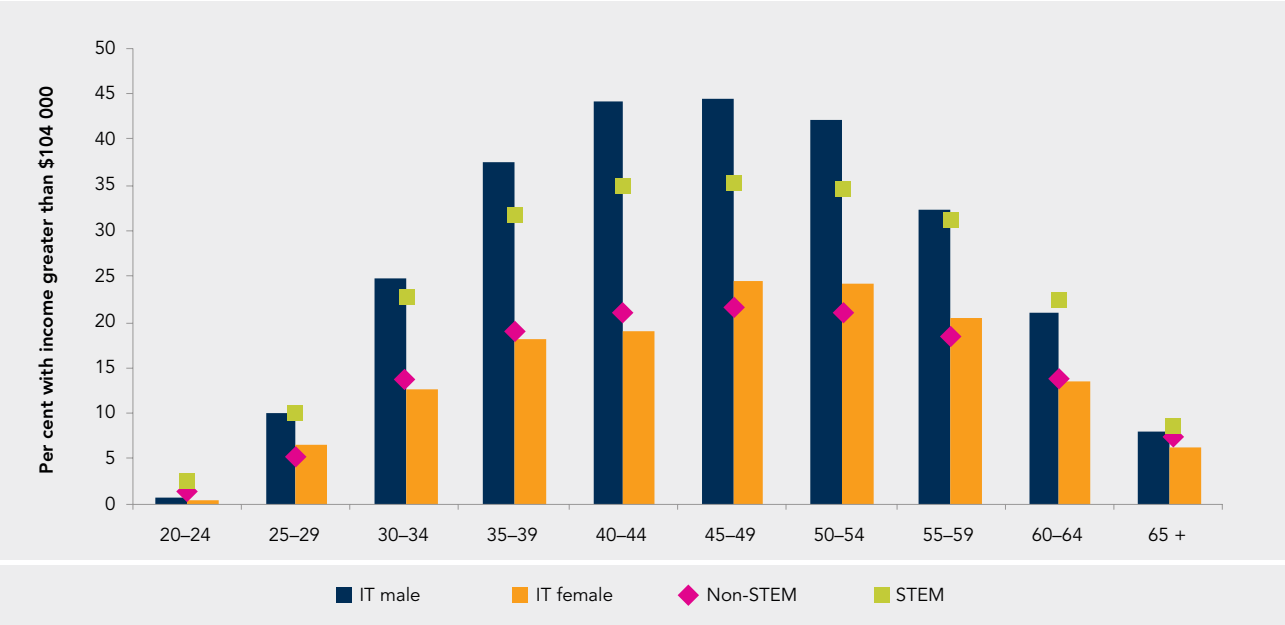
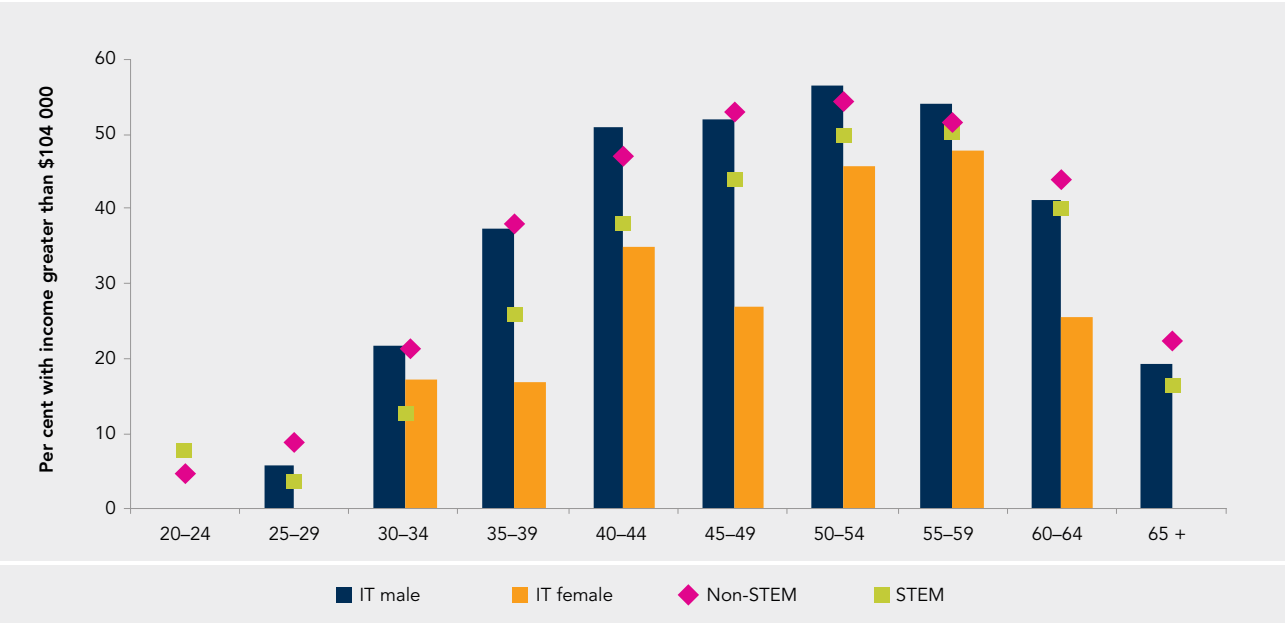


Figure 11.13: Percentage of doctoral level graduates earning greater than $104 000 annually, by gender, field and age group



The proportion of IT graduates with earnings more than $104 000 peaked at 44 per cent between the ages of 40 to 49 for males with bachelor qualifications, and at 25 per cent for females with bachelor qualifications. At the doctoral level, the proportion with highest earnings peaked at 57 per cent between the ages of 50 to 54 for males, and at 48 per cent between the ages of 55 to 59 for females.

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).

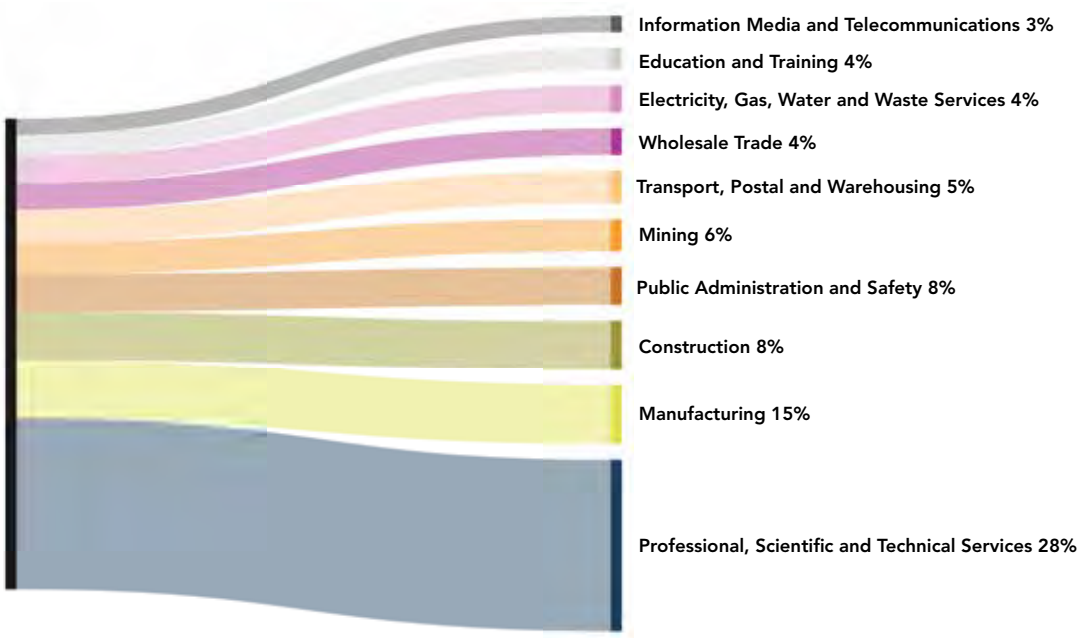
12

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

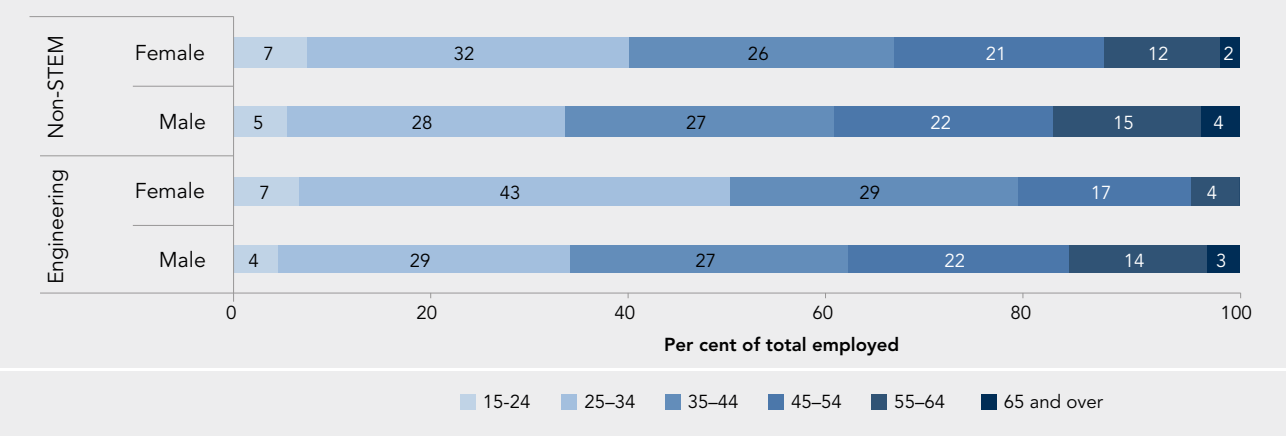


Figure 12.2: Top ten industry divisions of employment for Engineering and Related Technologies graduates with qualifications at bachelor level and above, by gender

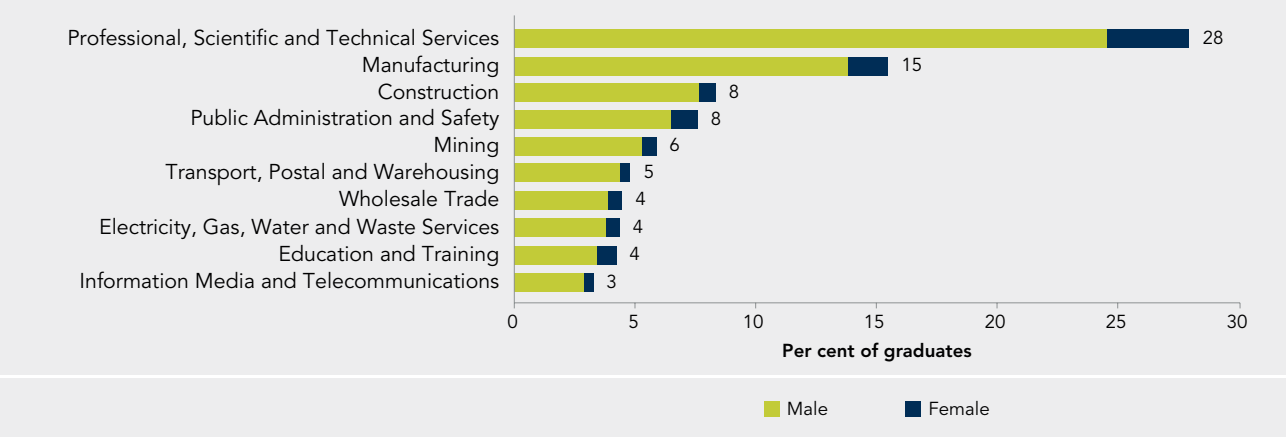
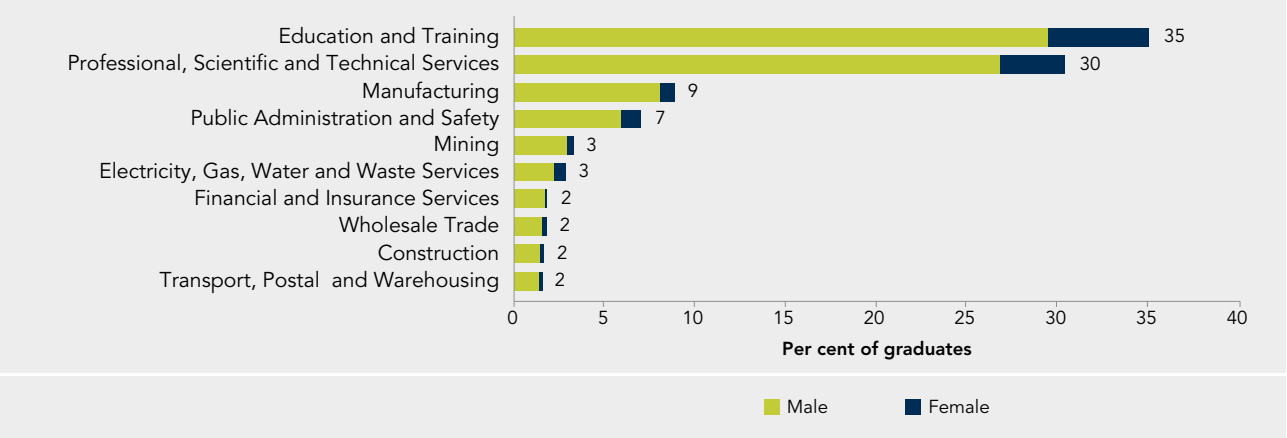


Figure 12.3: Top ten industry divisions of employment for Engineering and Related Technologies doctoral graduates, by gender



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

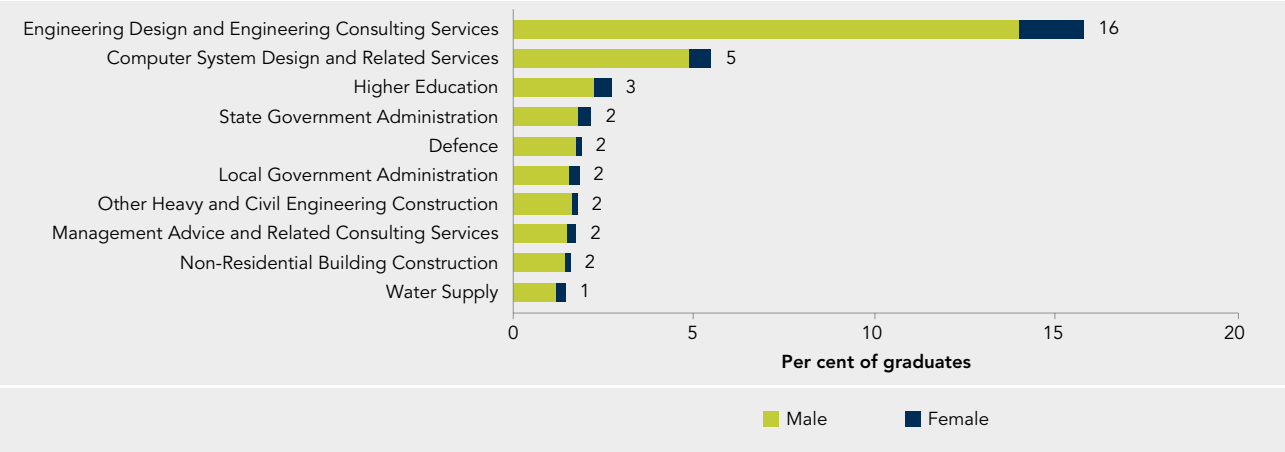
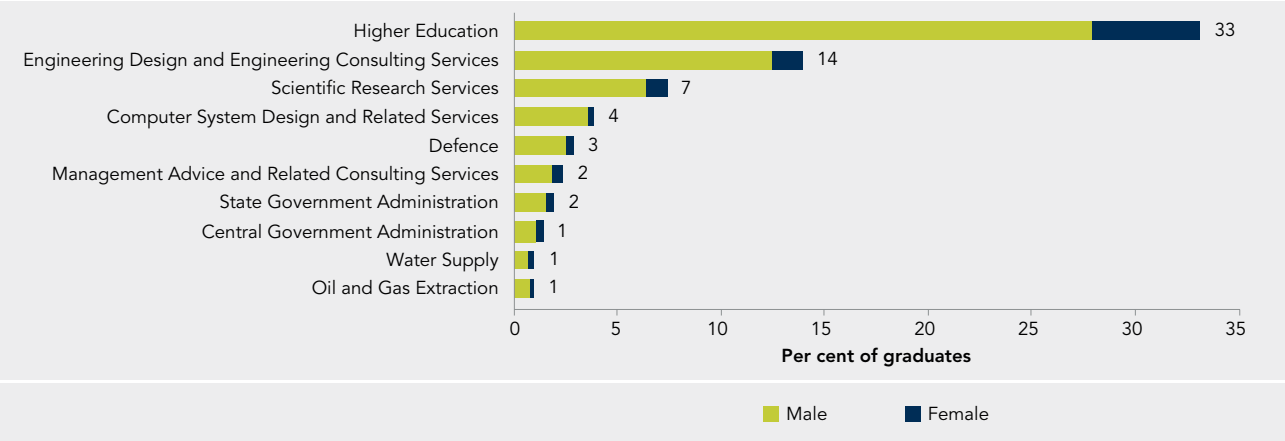


Figure 12.5: Top ten industry classes of employment for Engineering and Related Technologies doctoral graduates, by gender



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

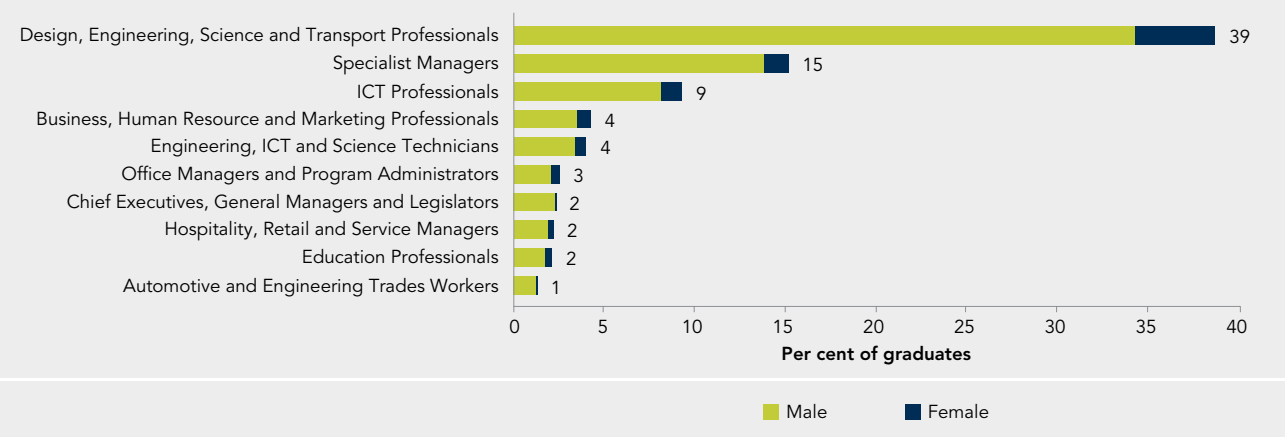
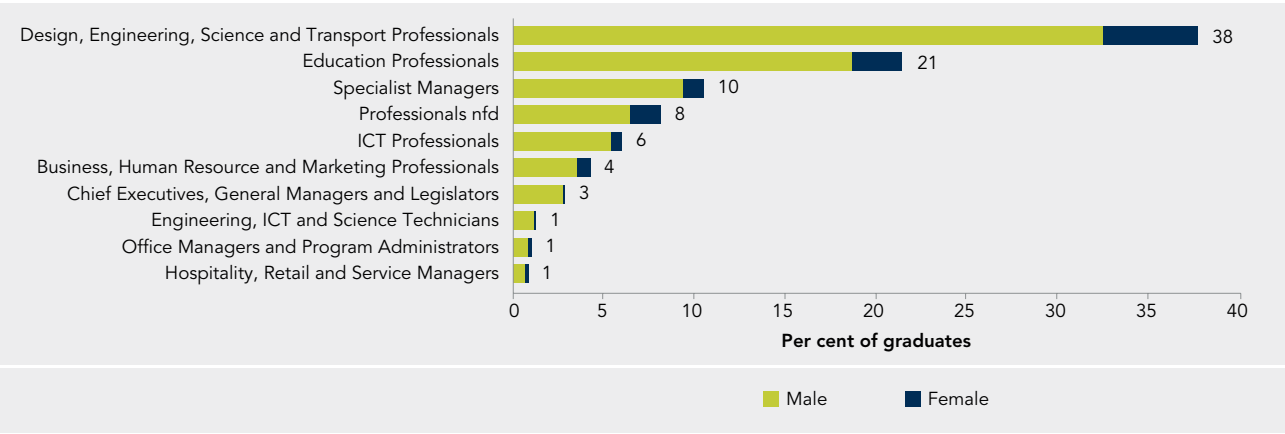


Figure 12.7: Top ten sub-major group occupations for Engineering and Related Technologies doctoral graduates, by gender



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, with1 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

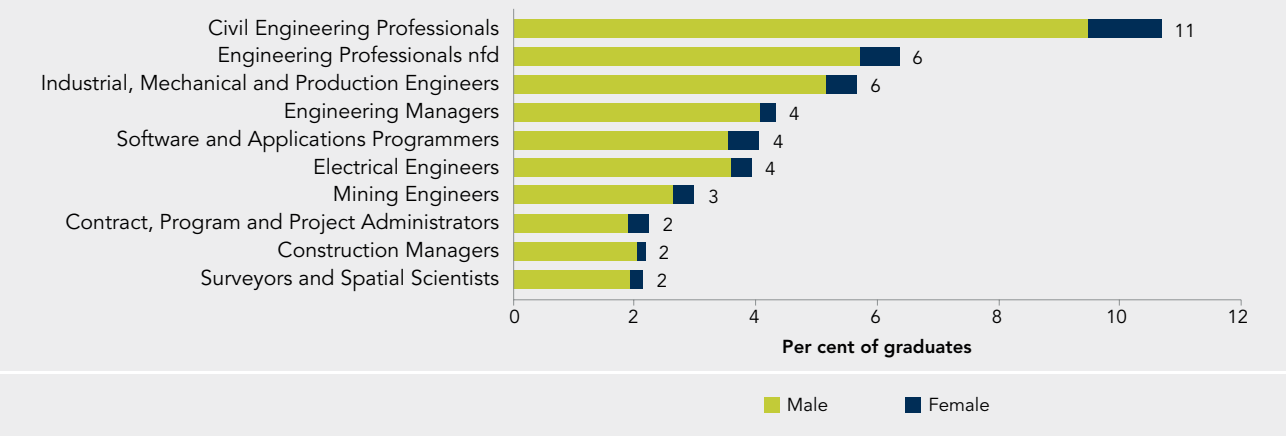
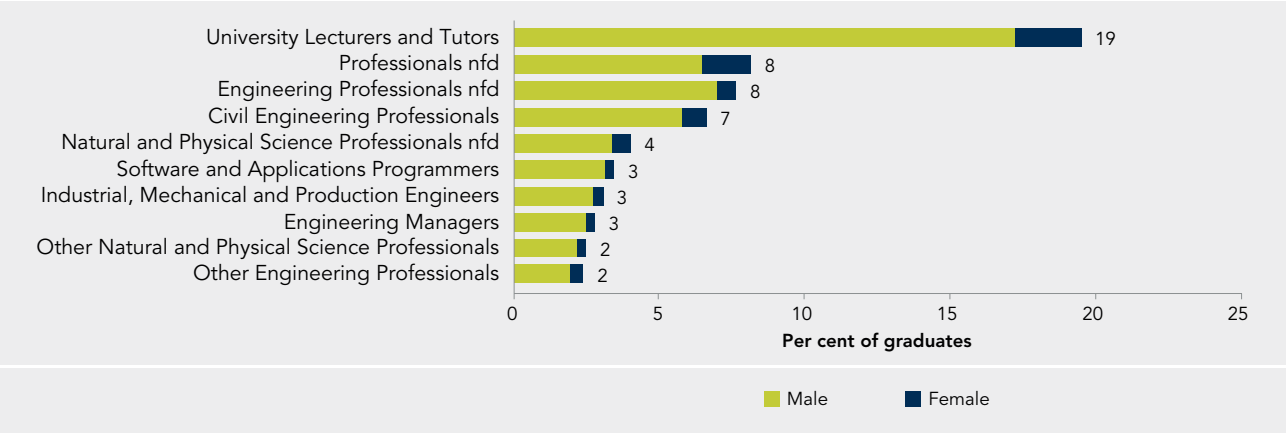


Figure 12.9: Top ten unit group level occupations for Engineering and Related Technologies doctorate graduates, by gender



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

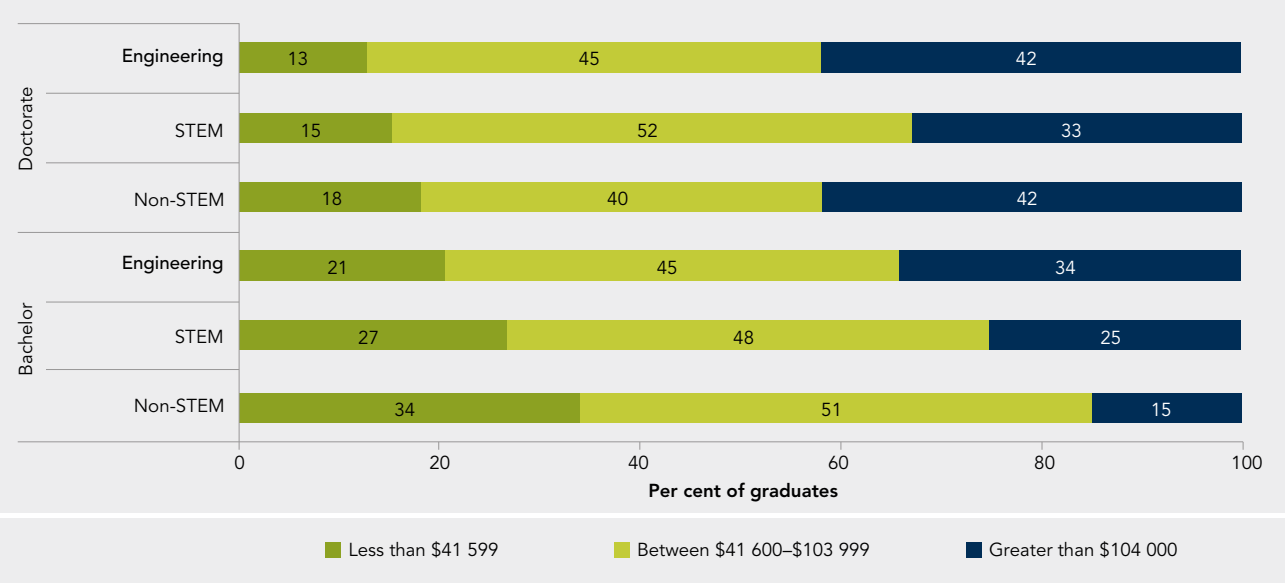
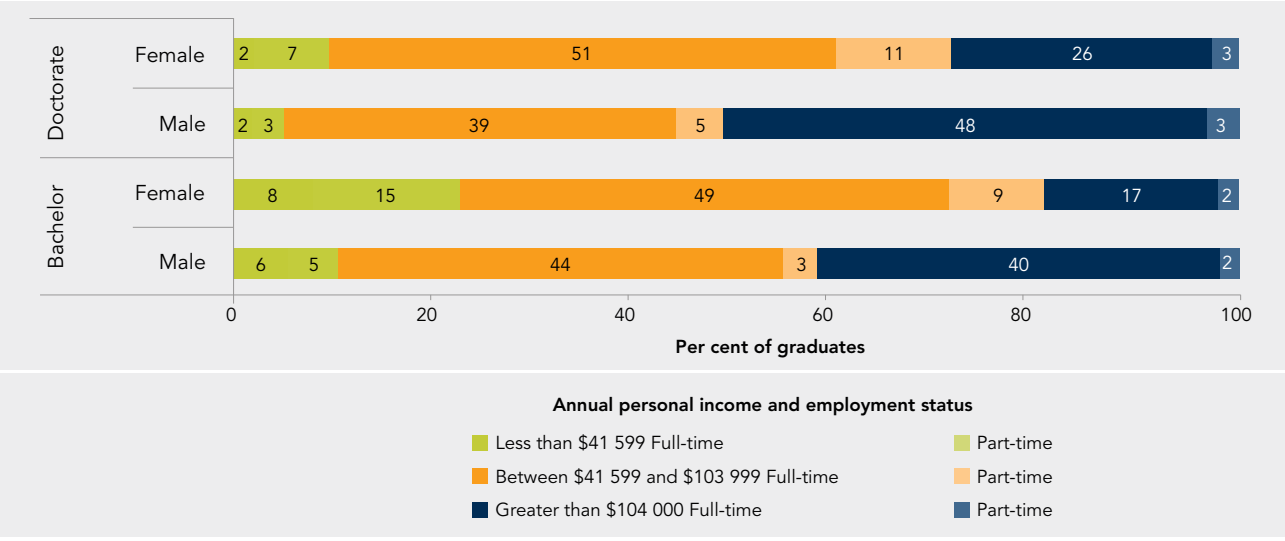


Figure 12.11: Personal annual income of Engineering and Related Technologies graduates working full-time and part-time, by gender and level of qualification



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

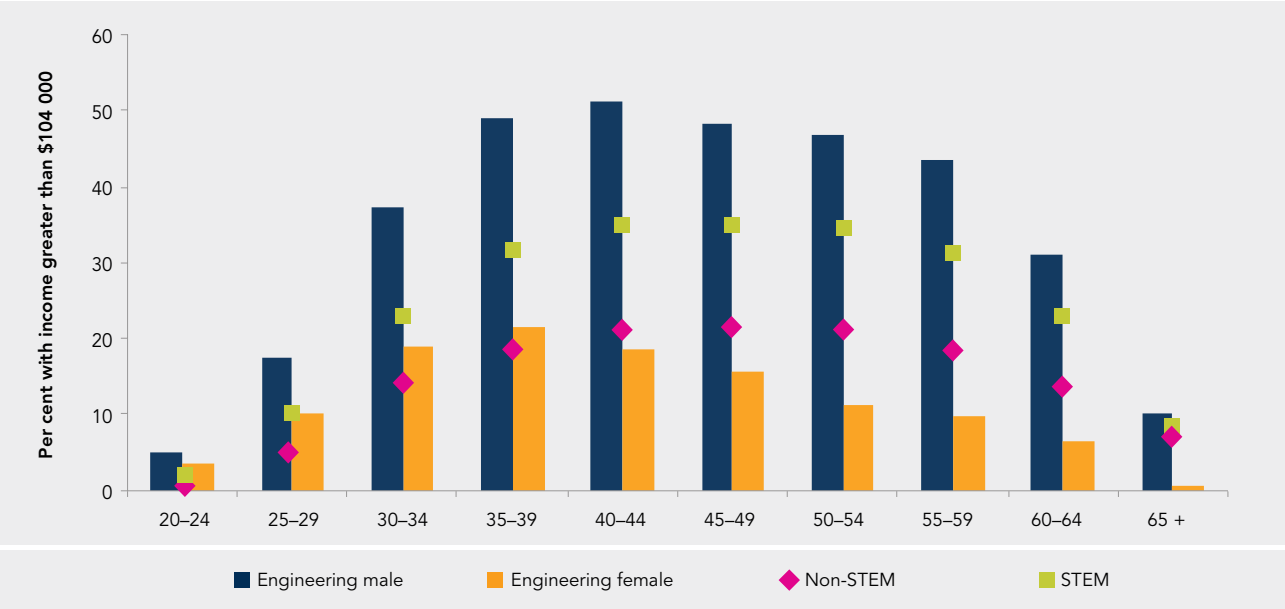
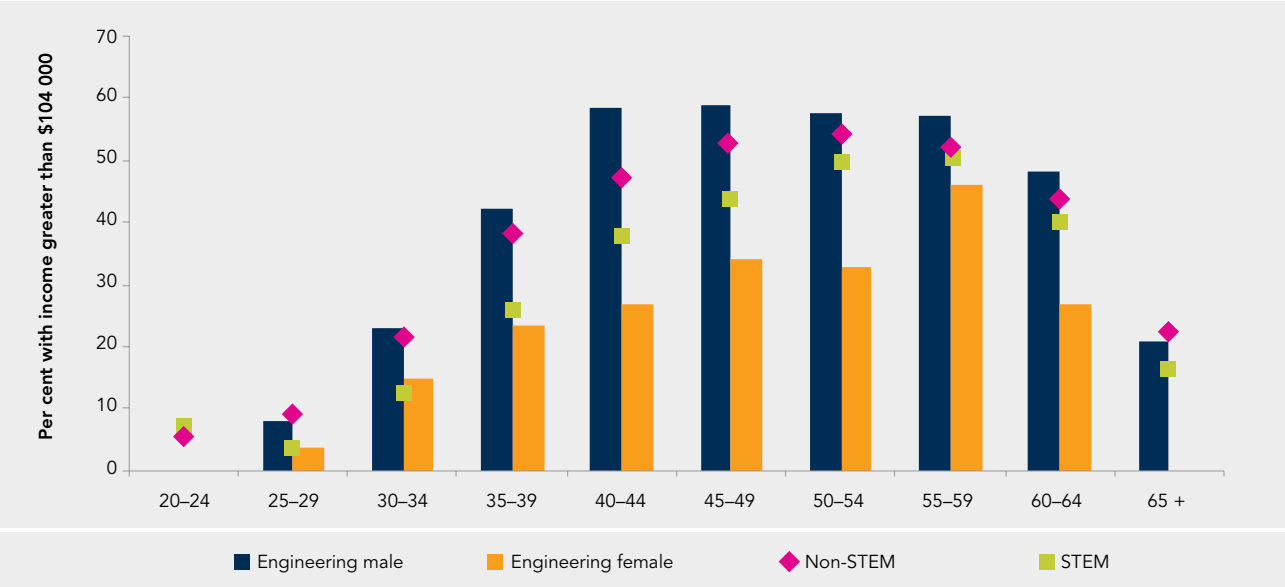


Figure 12.13: Percentage of doctoral level graduates earning greater than $104 000 annually, by field, gender and age group

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CHAPTER 13

STEM PATHWAYS: MATHEMATICAL SCIENCES

WHAT ARE MATHEMATICAL SCIENCES?

The main purpose of studying and working in Mathematical Sciences is to understand and apply knowledge of symbolic language and logic, mathematical theories and their deductive systems, techniques and modelling. It also involves developing an understanding of random processes and the ability to apply mathematical methods and modelling techniques to practical problems. Mathematical Sciences is comprised of Mathematics, Statistics and Mathematical Sciences, n.e.c. (not elsewhere classified) (ABS, 2001).

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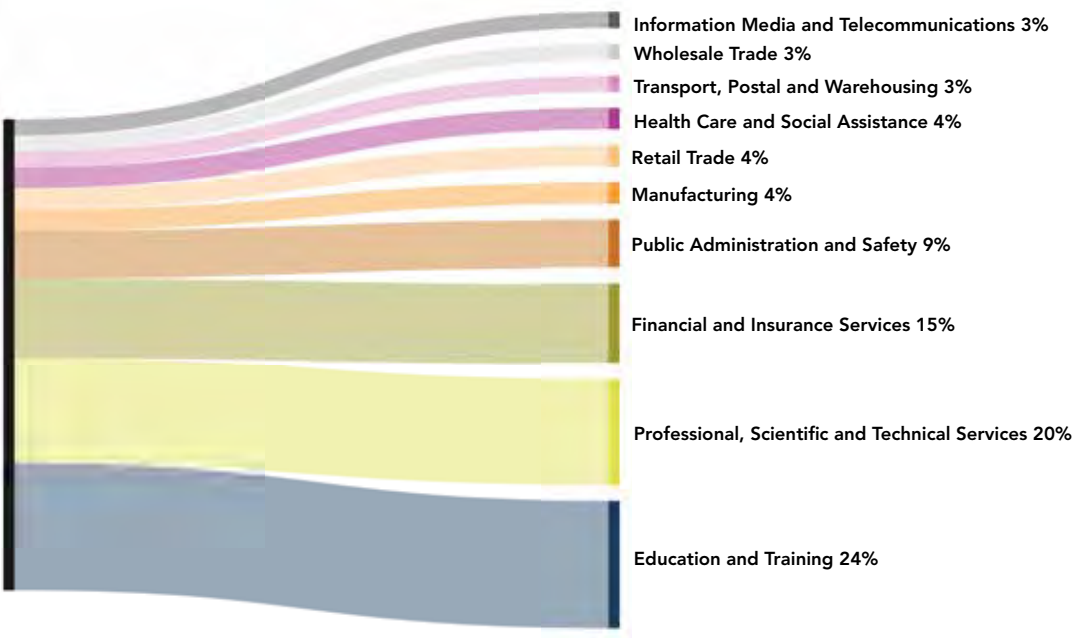
STEM PATHWAYS: MATHEMATICAL SCIENCES

KEY FACTS

1. In 2011, there were 25 688 Mathematical Sciences graduates, and the majority were male (61 per cent).
2. Half of male and 44 per cent of female graduates were aged 45 and over.
3. Sixty eight per cent of all graduates were employed in the private sector—varying from 75 per cent of bachelors to 34 per cent of doctorates.
4. Approximately 44 per cent of all Mathematical Sciences graduates worked in two industries—Education (24 per cent) and Professional, Scientific and Technical Services (20 per cent) divisions.
5. The majority of graduates worked as Professionals (60 per cent) and 15 per cent as Managers.
6. At a more detailed level, graduates worked in a wide variety of occupations—the top four were: Software and Applications Programmers; Secondary School Teachers; University Lecturers and Tutors; and Actuaries, Mathematicians and Statisticians.
7. Forty one per cent of graduates with doctorates earned over $104 000 per year, almost double that of bachelors (23 per cent).

Top ten industry sectors of employment for Mathematical Sciences graduates



HOW MANY MATHEMATICAL SCIENCES GRADUATES ARE THERE IN AUSTRALIA?

In 2011, there were 25 667 Mathematical Sciences graduates (bachelor and above) in Australia. The top sub-field of study was Mathematics, with 80 per cent of graduates. Eleven per cent of graduates held a doctorate degree, compared to 8 per cent of STEM graduates and 3 per cent of Non-STEM graduates.

Over one quarter of graduates (6913, 27 per cent) were either not in the labour force or were unemployed (24 and 3 per cent, respectively).

The majority of graduates were males (61 per cent). The gender difference was higher amongst Mathematical Sciences doctorate holders (80 per cent male).

HOW OLD IS THE MATHEMATICAL SCIENCES GRADUATE WORKFORCE?

Mathematical Sciences graduates in the workforce were comparatively older than the Non-STEM graduates (Figure 13.1). This difference was most pronounced for males compared to females.

Twenty two per cent of the female Mathematical Sciences qualified workforce was aged 34 or under. In comparison, 39 per cent of females were in the same age group for the Non-STEM qualified workforce.

In comparison, 24 per cent of the male Mathematical Sciences qualified workforce was aged 34 or under, compared to 33 per cent for Non-STEM.

WHERE DO MATHEMATICAL SCIENCES GRADUATES WORK?

The private sector employed 68 per cent of all Mathematical Sciences graduates; however the proportion varied depending on level of qualification as follows:

- Bachelor level: 75 per cent
- Postgraduate level: 52 per cent
  - Masters: 66 per cent
  - Doctorate: 34 per cent

Figure 13.1: Age distribution of employed Mathematical Sciences graduates at bachelor level and above, by field and gender

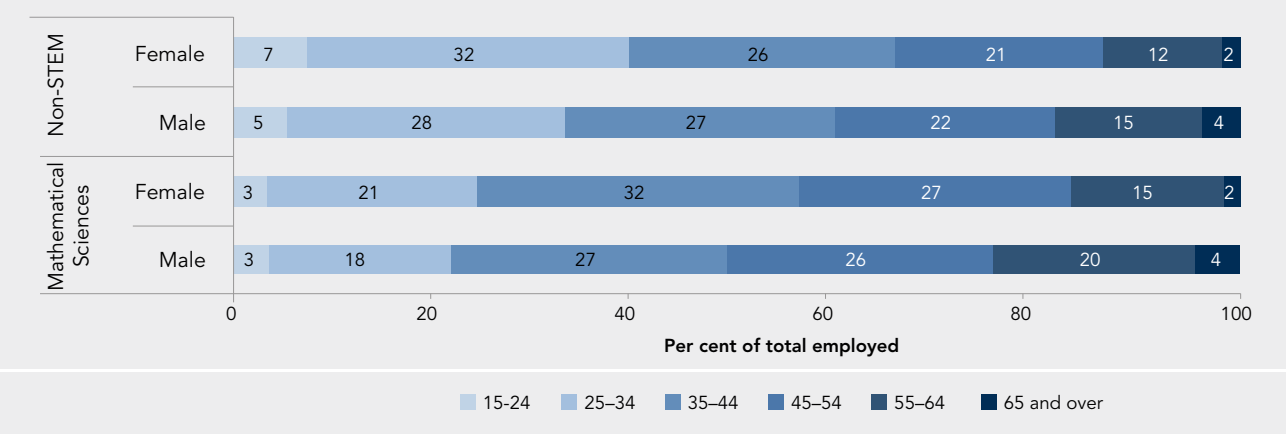


Figure 13.2: Top ten industry divisions of employment for Mathematical Sciences graduates with qualifications at bachelor level and above, by gender

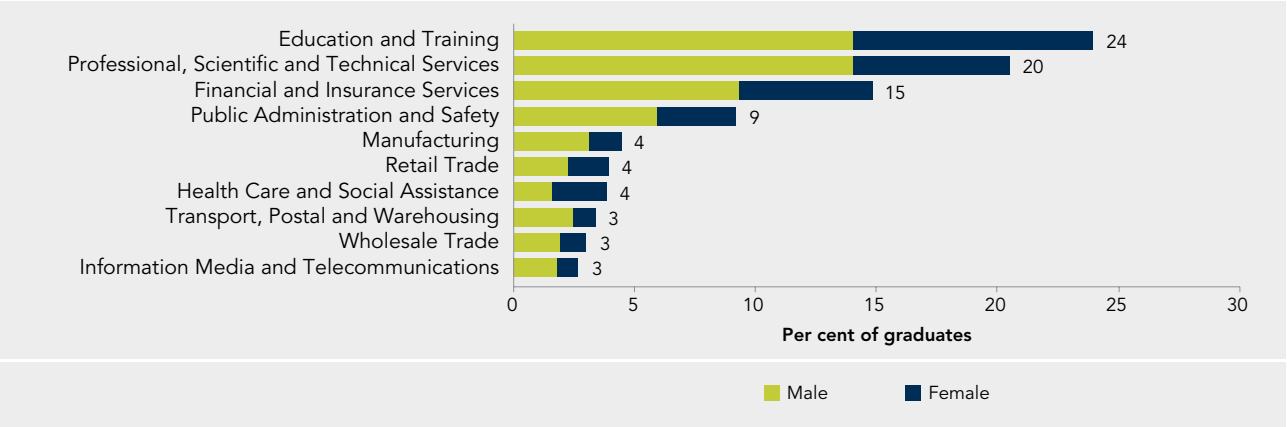
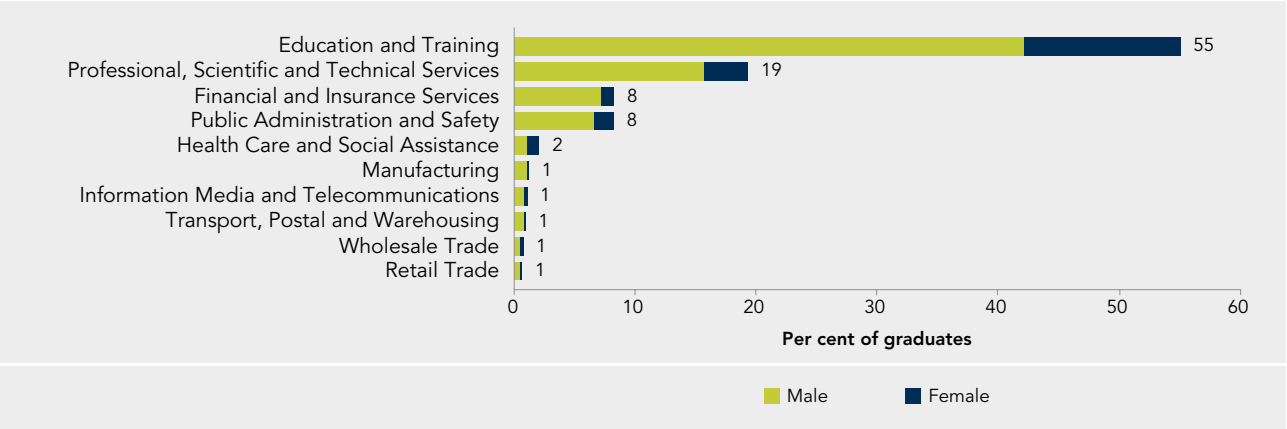


Figure 13.3: Top ten industry divisions of employment for Mathematical Sciences doctoral graduates, by gender



INDUSTRY SECTORS OF EMPLOYMENT

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.

The top three industry divisions that employed Mathematical Sciences graduates were Education and Training, Professional, Scientific and Technical Services, and Financial Services (24, 20 and 15 per cent, respectively) (Figure 13.2). There were more males compared to females employed in all industries of employment except Healthcare and Social Assistance.

For individuals with a doctorate degree in Mathematical Sciences, the top employment industries were Education and Training and Professional, Scientific and Technical Services (55 and 19 per cent, respectively) (Figure 13.3).

Among the top destinations of employment at the industry class level, Higher Education employed 11 per cent of all graduates and 50 per cent of doctorate degree holders (Figure 13.4 and Figure 13.5). For all graduates, the second highest industry class for employment was Computer System Design and Related Services (9 per cent). However, for doctorate holders the second most popular industry was Scientific Research Services (7 per cent).

Figure 13.4: Top ten industry classes of employment for Mathematical Sciences graduates with qualifications at bachelor level and above, by gender

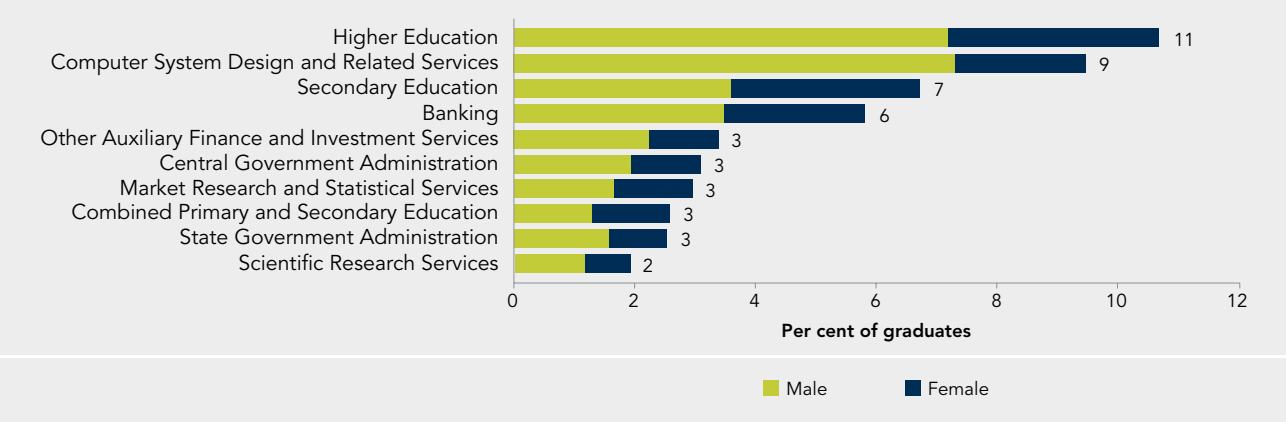


Figure 13.5: Top ten industry classes of employment for Mathematical Sciences doctoral graduates, by gender

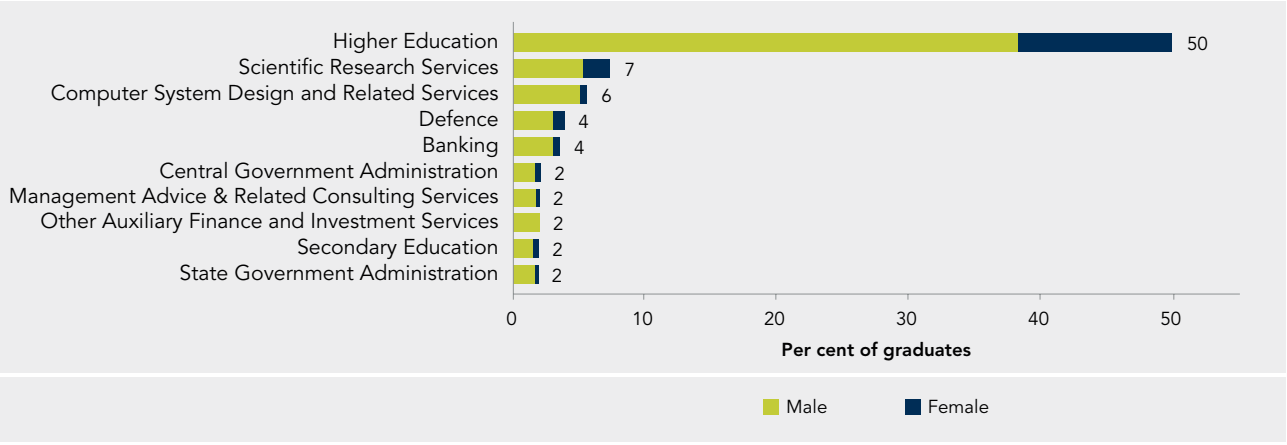


Figure 13.6: Top ten unit group level occupations for Mathematical Sciences graduates with qualifications at bachelor level and above, by gender

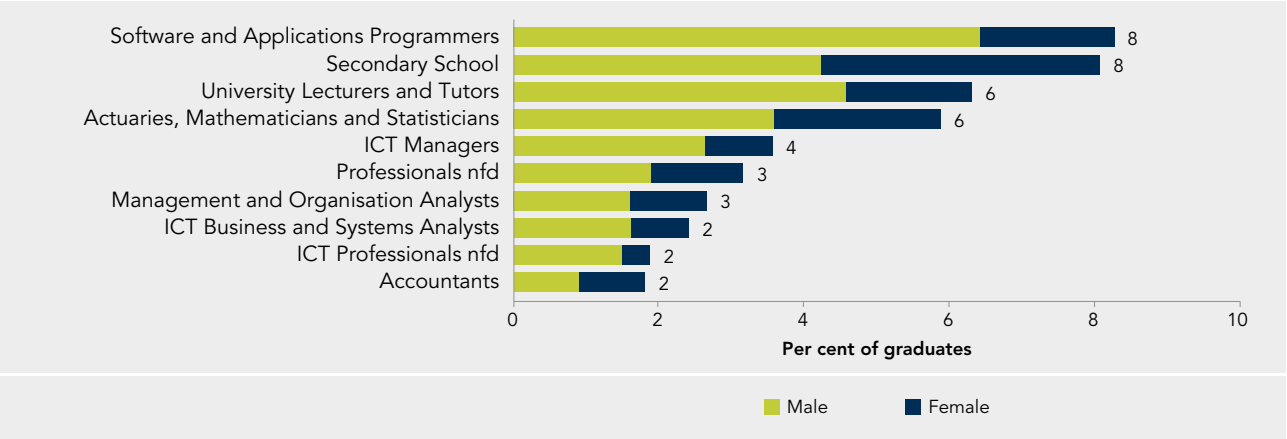
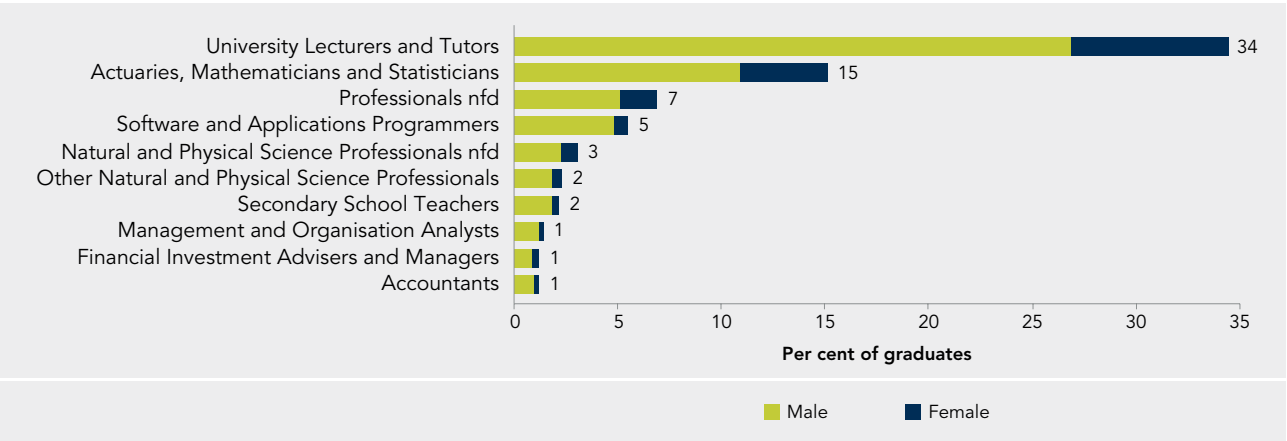


Figure 13.7: Top ten unit group level occupations for Mathematical Sciences doctorate graduates, by gender



WHAT ARE THE OCCUPATIONS OF MATHEMATICAL SCIENCES GRADUATES?

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

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

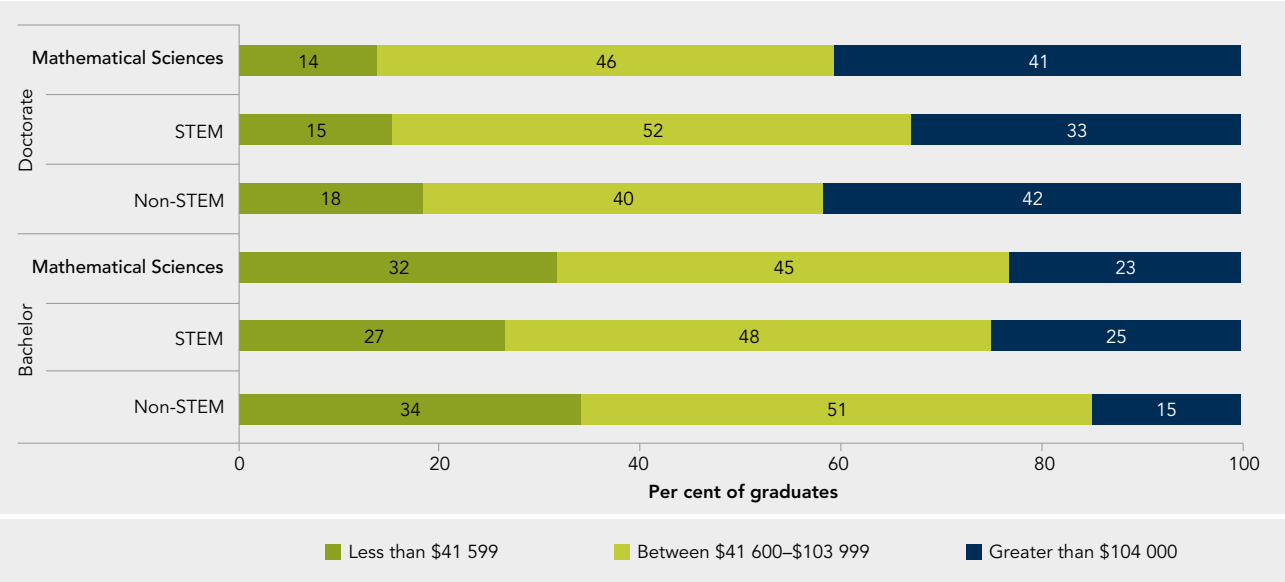
See Appendix C for a detailed list.

The majority of graduates in the Mathematical Sciences field were engaged as Professionals (60 per cent) and Managers (60 and 15 per cent, respectively). Within the graduates employed as Professionals, the most common occupation sub-groups were:

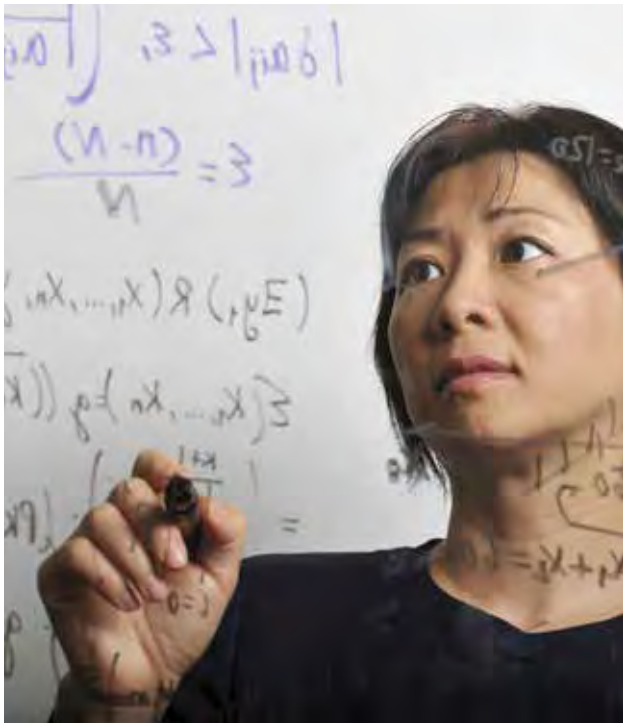
- Business, Human Resource and Marketing Professionals (30 per cent),
- Education Professionals (29 per cent), and
- ICT Professionals (27 per cent).

At the finer unit level of detail of occupation, Software and Application Programmers and Secondary School Teachers were the most common occupations, with 8 per cent of Mathematical Sciences graduates working in each (Figure 13.6).

Figure 13.8: Personal annual income of graduates, by field and level of qualification



The gender distribution in Mathematical Sciences graduates was highly skewed towards males, who made up the majority in all occupations. The difference was least prominent in Secondary School Teachers where there were 47 per cent females.

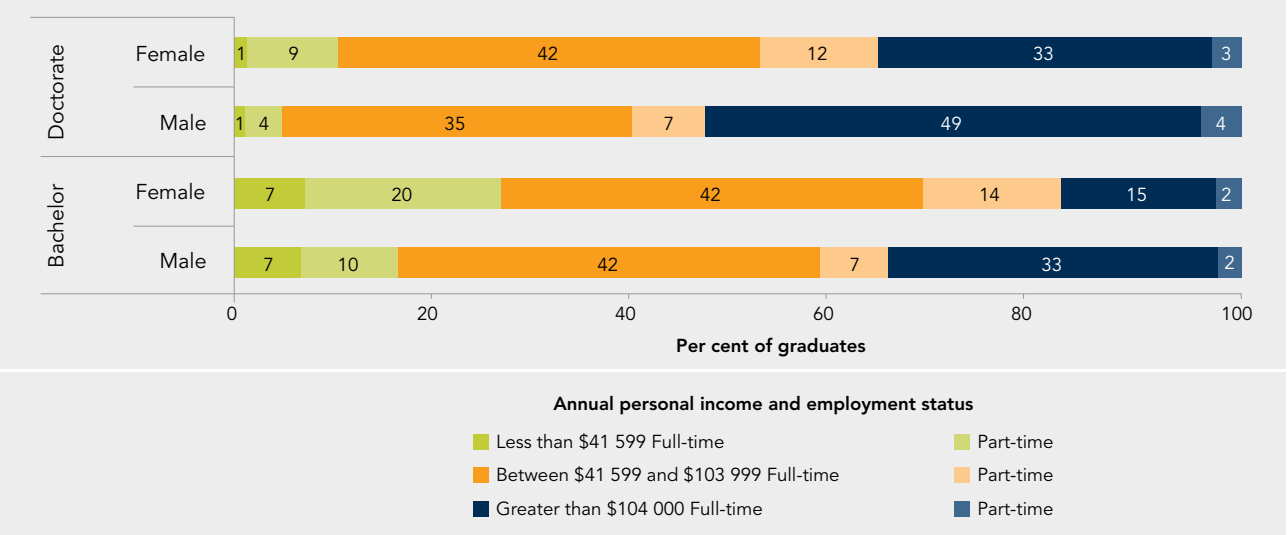


ARE THE OCCUPATIONS FOR MATHEMATICAL SCIENCES DOCTORATE HOLDERS DIFFERENT FROM BACHELOR DEGREE HOLDERS?

Almost 87 per cent of Mathematical Sciences doctorate holders were employed as Professionals and 8 per cent were employed as Managers. Of the Professionals, 29 per cent were employed in the private sector.

The most common occupations at the unit level for Mathematical Sciences doctorate holders were University Lecturers and Tutors, and Actuaries, Mathematicians and Statisticians (34 and 15 per cent, respectively) (Figure 13.7). There were more male than female doctorate holders across all occupations.

Figure 13.9: Personal annual income of Mathematical Sciences graduates working full-time and part-time, gender and level of qualification



ARE MATHEMATICAL SCIENCES GRADUATES HIGH EARNERS?

Mathematical Sciences graduates had a similar pattern of income distribution to the total STEM graduate population. Almost one quarter of Mathematical Sciences bachelor graduates were in the highest income bracket (more than $104 000) (Figure 13.8). Completing a doctorate can be financially rewarding, with the proportion of doctoral graduates earning in the highest bracket increasing to 41 per cent. In comparison, 15 per cent of bachelor and 42 per cent of doctorate level graduates from Non-STEM fields had incomes in the highest bracket.

Graduate income levels were dependent on both gender and full-time or part-time employment, with fewer females and fewer part-time workers reporting an income in higher brackets (Figure 13.9). More women were employed in a part-time role compared to men in all income brackets except those earning more than $104 000 per year.

Graduates with a bachelor degree were more likely to work part-time compared to those with a doctorate degree. Over one third of employed females with bachelor degrees worked part-time female compared to 19 per cent of males.

At the doctorate level, 24 per cent of females and 15 per cent of males were employed on a part-time basis.

Compared to the total STEM and Non-STEM graduate cohorts, a larger proportion of male graduates in Mathematical Sciences reached the highest income bracket for most age groups at both the bachelor and doctorate level of qualification (Figure 13.10 and Figure 13.11). The percentage of male graduates reaching the highest income at both the bachelor and doctorate levels was larger than for females at all age groups, and for the bachelor level was at least twice that of females between the ages of 30 and 59.

The proportion of Mathematical Sciences graduates who reached the highest income bracket peaked for male bachelor graduates in the 45 to 49 age group at 43 per cent, and for females the peak was for the 50 to 54 age group at 19 per cent. At the doctorate level, the peak in income was at the 55 to 59 age group for both males and females at 59 and 54 per cent, respectively.

Figure 13.10: Percentage of bachelor level graduates earning greater than $104 000 annually, by field, gender and age group

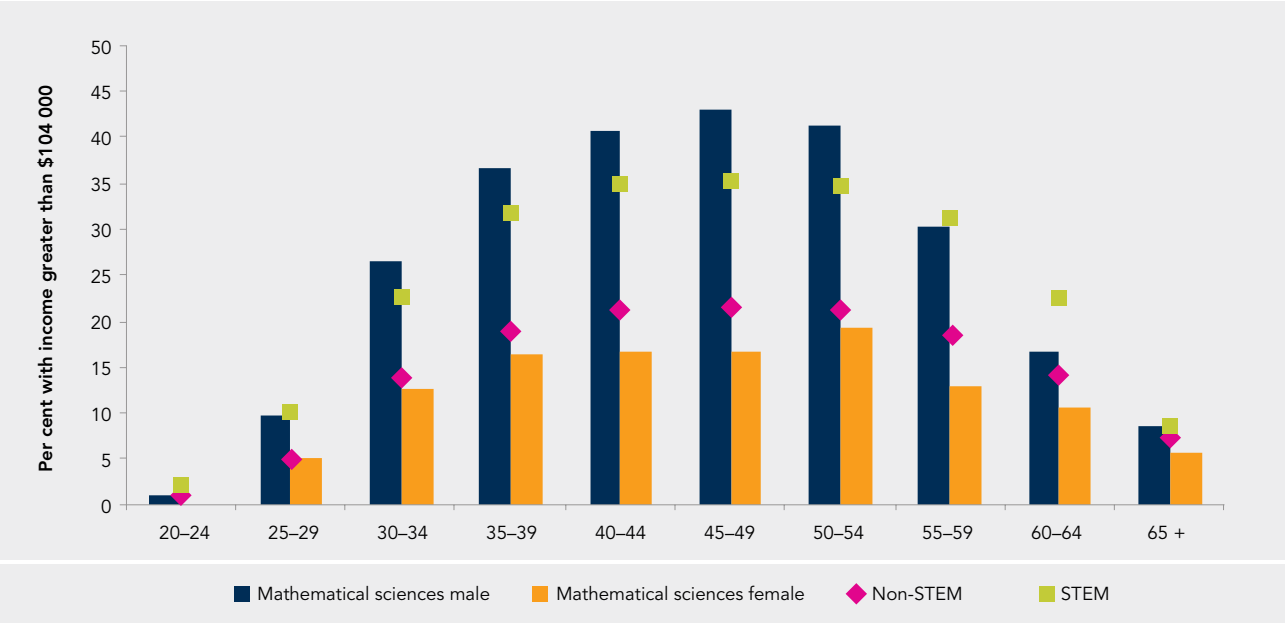
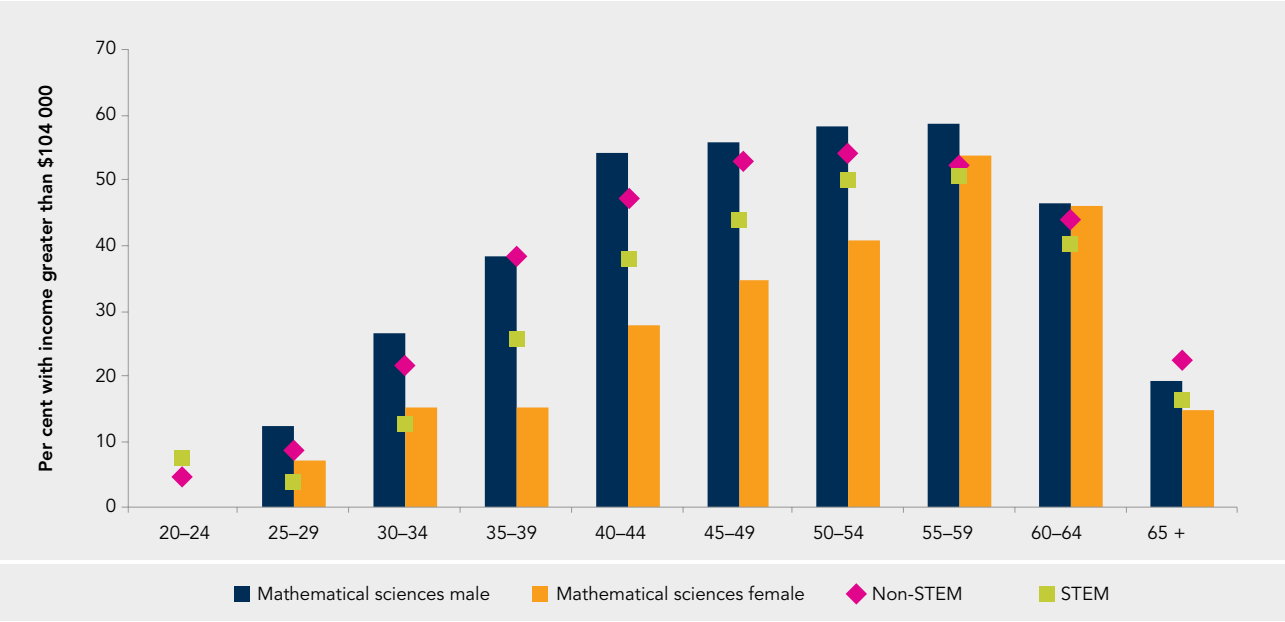


Figure 13.11: Percentage of doctoral level graduates earning greater than $104 000 annually, by field, gender and age groups



CHAPTER 14

FUTURE DIRECTIONS

14

FUTURE DIRECTIONS

This report is a snapshot of Australia's STEM workforce in 2011. In presenting that picture it inevitably opens the question: what should that workforce be tomorrow? We know that STEM skills are critical to Australia's future prosperity.

How can we progress from where we are to where we need to be, in line with our national goals?

It is a challenge with many facets, which will continue to be pursued as a priority by many investigators.

Some of the key emerging themes are highlighted below.

1 Doctorate holders working in the private sector

This report shows that a significantly lower proportion of doctorate holders work in the private sector than do graduates with bachelor qualifications. Should research training play a greater role in preparing doctoral students to seek positions—and succeed—in the private sector?

2 The gender pay gap

The pay gap between men and women across the STEM workforce remains substantial. Why does the gap remain, and what measures are needed to address it?

3 STEM skills in Vocational Education and Training

The VET sector makes a critical contribution to Australia's STEM skills base, a contribution yet to be fully reflected in the evidence base for policy development. What is known of the employment outcomes of VET graduates across STEM disciplines, and how can this knowledge be integrated with this report's analysis of outcomes from the university sector?

4 Business ownership in STEM

The data in Chapter 4 shows that STEM-qualified graduates, particularly doctorates, had low rates of business ownership compared to Non-STEM-qualified graduates. How can graduates be encouraged to harness their skills in building or leading businesses, particularly high-tech start-ups with global potential? The Office of the Chief Scientist has been investigating the ways in which universities can encourage STEM students to become entrepreneurs (Boosting High-Impact Entrepreneurship in Australia—A role for universities, Spike Innovation, 2015).

5 Education and employability

- How can the data be used to better align education and training with the skills and capabilities demanded by employers in a range of industry sectors?
- What are "STEM skills" and in particular what STEM skills are used in the workforce? A recent paper by the Office of the Chief Scientist "STEM skills in the workforce: what do employers want?" identifies a set of higher order STEM skills that employers seek (Office of the Chief Scientist, 2015).
- What is the difference between STEM-skilled and STEM-qualified?
- Is there a useful concept of "STEM understanding" that indicates skills to understand/manage/utilise/integrate STEM without being an expert practitioner?

6 STEM skills in "non-STEM" courses

In a technology-led economy the distinction between 'STEM' and 'non-STEM' jobs is increasingly blurred. More and more workers will be expected to have some degree of technological literacy, as well as the capacity to work effectively with STEM specialists. We can expect growing demand for STEM components in non-STEM courses as a consequence. How can we take account of the STEM skills of non-STEM graduates, as defined in this report; and should that definition be revisited?

7 What should our STEM workforce look like?

- How can we use this data to help in predicting and preparing the future Australian STEM workforce—particularly with regard to changing workforce needs
- Research by the ABS has shown that STEM jobs have grown at 1.5 times the rate of Non-STEM jobs (ABS, 2014) however, results in this report show that the STEM qualified population has grown at 15 per cent compared to 26 per cent of Non-STEM. Is this the right balance?
- How do the STEM workforce characteristics in Australia compare to similarly qualified workforces internationally?
- To what extent do STEM-qualified people engage with and contribute to Australia's industry growth sectors? This is being investigated by the Office of the Chief Scientist and will be published in a forthcoming report.

8 The direction of change

This report presents a largely static snapshot of the STEM workforce as at 2011, the latest year for which the necessary data exists. New datasets, including the 2016 Census, will allow important analysis of trends over time.

APPENDIXES

A

APPENDIX A: FIELDS OF EDUCATION

SCIENCE
01 NATURAL AND PHYSICAL SCIENCES
0103 Physics and Astronomy
010301 Physics
010303 Astronomy
0105 Chemical Sciences
010501 Organic Chemistry
010503 Inorganic Chemistry
010599 Chemical Sciences, n.e.c.
0107 Earth Sciences
010701 Atmospheric Sciences
010703 Geology
010705 Geophysics
010707 Geochemistry
010709 Soil Science
010711 Hydrology
010713 Oceanography
010799 Earth Sciences, n.e.c.
0109 Biological Sciences
010901 Biochemistry and Cell Biology
010903 Botany
010905 Ecology and Evolution
010907 Marine Science
010909 Genetics
010911 Microbiology
010913 Human Biology
010915 Zoology
010999 Biological Sciences, n.e.c.
0199 Other Natural and Physical Sciences
019901 Medical Science
019903 Forensic Science
019905 Food Science and Biotechnology
019907 Pharmacology
019909 Laboratory Technology
019999 Natural and Physical Sciences, n.e.c.

AGRICULTURE AND ENVIRONMENTAL SCIENCE
05 AGRICULTURE, ENVIRONMENTAL AND RELATED STUDIES
0501 Agriculture
050101 Agricultural Science
050103 Wool Science
050105 Animal Husbandry
050199 Agriculture, n.e.c.
0503 Horticulture and Viticulture
050301 Horticulture
050303 Viticulture
0505 Forestry Studies
050501 Forestry Studies
0507 Fisheries Studies
050701 Aquaculture
050799 Fisheries Studies, n.e.c.
0509 Environmental Studies
050901 Land, Parks and Wildlife Management
050999 Environmental Studies, n.e.c.
0599 Other Agriculture, Environmental and Related Studies
059901 Pest and Weed Control
059999 Agriculture, Environmental and Related Studies, n.e.c.

TECHNOLOGY
02 INFORMATION TECHNOLOGY
0201 Computer Science
020101 Formal Language Theory
020103 Programming
020105 Computational Theory
020107 Compiler Construction
020109 Algorithms
020111 Data Structures
020113 Networks and Communications
020115 Computer Graphics
020117 Operating Systems
020119 Artificial Intelligence
020199 Computer Science, n.e.c.
0203 Information Systems
020301 Conceptual Modelling
020303 Database Management
020305 Systems Analysis and Design
020307 Decision Support Systems
020399 Information Systems, n.e.c.

0299 Other Information Technology
029901 Security Science
029999 Information Technology, n.e.c.
ENGINEERING
03 ENGINEERING AND RELATED TECHNOLOGIES
0301 Manufacturing Engineering and Technology
030101 Manufacturing Engineering
030103 Printing
030105 Textile Making
030107 Garment Making
030109 Footwear Making
030111 Wood Machining and Turning
030113 Cabinet Making
030115 Furniture Upholstery and Renovation
030117 Furniture Polishing
030199 Manufacturing Engineering and Technology, n.e.c.
0303 Process and Resources Engineering
030301 Chemical Engineering
030303 Mining Engineering
030305 Materials Engineering
030307 Food Processing Technology
030399 Process and Resources Engineering, n.e.c.
0305 Automotive Engineering and Technology
030501 Automotive Engineering
030503 Vehicle Mechanics
030505 Automotive Electrics and Electronics
030507 Automotive Vehicle Refinishing
030509 Automotive Body Construction
030511 Panel Beating
030513 Upholstery and Vehicle Trimming
030515 Automotive Vehicle Operations
030599 Automotive Engineering and Technology, n.e.c.
0307 Mechanical and Industrial Engineering and Technology
030701 Mechanical Engineering
030703 Industrial Engineering
030705 Toolmaking
030707 Metal Fitting, Turning and Machining
030709 Sheetmetal Working
030711 Boilermaking and Welding
030713 Metal Casting and Patternmaking

030715 Precision Metalworking
030717 Plant and Machine Operations
030799 Mechanical and Industrial Engineering and Technology, n.e.c.
0309 Civil Engineering
030901 Construction Engineering
030903 Structural Engineering
030905 Building Services Engineering
030907 Water and Sanitary Engineering
030909 Transport Engineering
030911 Geotechnical Engineering
030913 Ocean Engineering
030999 Civil Engineering, n.e.c.
0311 Geomatic Engineering
031101 Surveying
031103 Mapping Science
031199 Geomatic Engineering, n.e.c.
0313 Electrical and Electronic Engineering and Technology
031301 Electrical Engineering
031303 Electronic Engineering
031305 Computer Engineering
031307 Communications Technologies
031309 Communications Equipment Installation and Maintenance
031311 Powerline Installation and Maintenance
031313 Electrical Fitting, Electrical Mechanics
031315 Refrigeration and Air Conditioning Mechanics
031317 Electronic Equipment Servicing
031399 Electrical and Electronic Engineering and Technology, n.e.c.
0315 Aerospace Engineering and Technology
031501 Aerospace Engineering
031503 Aircraft Maintenance Engineering
031505 Aircraft Operation
031507 Air Traffic Control
031599 Aerospace Engineering and Technology, n.e.c.
0317 Maritime Engineering and Technology
031701 Maritime Engineering
031703 Marine Construction
031705 Marine Craft Operation
031799 Maritime Engineering and Technology, n.e.c.
0399 Other Engineering and Related Technologies
039901 Environmental Engineering
039903 Biomedical Engineering

039905 Fire Technology
039907 Rail Operations
039909 Cleaning
039999 Engineering and Related Technologies, n.e.c.

MATHEMATICS
01 NATURAL AND PHYSICAL SCIENCES
0101 Mathematical Sciences
010101 Mathematics
010103 Statistics
010199 Mathematical Sciences, n.e.c.

B

APPENDIX B: INDUSTRY DIVISIONS AND SUBDIVISIONS

A AGRICULTURE, FORESTRY AND FISHING
01 AGRICULTURE
011 Nursery and Floriculture Production
0111 Nursery Production (Under Cover)
0112 Nursery Production (Outdoors)
0113 Turf Growing
0114 Floriculture Production (Under Cover)
0115 Floriculture Production (Outdoors)
012 Mushroom and Vegetable Growing
0121 Mushroom Growing
0122 Vegetable Growing (Under Cover)
0123 Vegetable Growing (Outdoors)
013 Fruit and Tree Nut Growing
0131 Grape Growing
0132 Kiwifruit Growing
0133 Berry Fruit Growing
0134 Apple and Pear Growing
0135 Stone Fruit Growing
0136 Citrus Fruit Growing
0137 Olive Growing
0139 Other Fruit and Tree Nut Growing
014 Sheep, Beef Cattle and Grain Farming
0141 Sheep Farming (Specialised)
0142 Beef Cattle Farming (Specialised)
0143 Beef Cattle Feedlots (Specialised)
0144 Sheep-Beef Cattle Farming
0145 Grain-Sheep or Grain-Beef Cattle Farming
0146 Rice Growing
0149 Other Grain Growing
015 Other Crop Growing
0151 Sugar Cane Growing
0152 Cotton Growing
0159 Other Crop Growing n.e.c.
016 Dairy Cattle Farming
0160 Dairy Cattle Farming

017 Poultry Farming
0171 Poultry Farming (Meat)
0172 Poultry Farming (Eggs)
018 Deer Farming
0180 Deer Farming
019 Other Livestock Farming
0191 Horse Farming
0192 Pig Farming
0193 Beekeeping
0199 Other Livestock Farming n.e.c.
02 AQUACULTURE
020 Aquaculture
0201 Offshore Longline and Rack Aquaculture
0202 Offshore Caged Aquaculture
0203 Onshore Aquaculture
03 FORESTRY AND LOGGING
030 Forestry and Logging
0301 Forestry
0302 Logging
04 FISHING, HUNTING AND TRAPPING
041 Fishing
0411 Rock Lobster and Crab Potting
0412 Prawn Fishing
0413 Line Fishing
0414 Fish Trawling, Seining and Netting
0419 Other Fishing
042 Hunting and Trapping
0420 Hunting and Trapping
05 AGRICULTURE, FORESTRY AND FISHING SUPPORT SERVICES
051 Forestry Support Services
0510 Forestry Support Services
052 Agriculture and Fishing Support Services
0521 Cotton Ginning
0522 Shearing Services
0529 Other Agriculture and Fishing Support Services

B MINING
06 COAL MINING
060 Coal Mining
0600 Coal Mining
07 OIL AND GAS EXTRACTION
070 Oil and Gas Extraction
0700 Oil and Gas Extraction
08 METAL ORE MINING
080 Metal Ore Mining
0801 Iron Ore Mining
0802 Bauxite Mining
0803 Copper Ore Mining
0804 Gold Ore Mining
0805 Mineral Sand Mining
0806 Nickel Ore Mining
0807 Silver-Lead-Zinc Ore Mining
0809 Other Metal Ore Mining
09 NON-METALLIC MINERAL MINING AND QUARRYING
091 Construction Material Mining
0911 Gravel and Sand Quarrying
0919 Other Construction Material Mining
099 Other Non-Metallic Mineral Mining and Quarrying
0990 Other Non-Metallic Mineral Mining and Quarrying
10 EXPLORATION AND OTHER MINING SUPPORT SERVICES
101 Exploration
1011 Petroleum Exploration
1012 Mineral Exploration
109 Other Mining Support Services
1090 Other Mining Support Services
C MANUFACTURING
11 FOOD PRODUCT MANUFACTURING
111 Meat and Meat Product Manufacturing
1111 Meat Processing
1112 Poultry Processing
1113 Cured Meat and Smallgoods Manufacturing
112 Seafood Processing
1120 Seafood Processing
113 Dairy Product Manufacturing
1131 Milk and Cream Processing
1132 Ice Cream Manufacturing
1133 Cheese and Other Dairy Product Manufacturing

114 Fruit and Vegetable Processing
1140 Fruit and Vegetable Processing
115 Oil and Fat Manufacturing
1150 Oil and Fat Manufacturing
116 Grain Mill and Cereal Product Manufacturing
1161 Grain Mill Product Manufacturing
1162 Cereal, Pasta and Baking Mix Manufacturing
117 Bakery Product Manufacturing
1171 Bread Manufacturing (Factory based)
1172 Cake and Pastry Manufacturing (Factory based)
1173 Biscuit Manufacturing (Factory based)
1174 Bakery Product Manufacturing (Non-factory based)
118 Sugar and Confectionery Manufacturing
1181 Sugar Manufacturing
1182 Confectionery Manufacturing
119 Other Food Product Manufacturing
1191 Potato, Corn and Other Crisp Manufacturing
1192 Prepared Animal and Bird Feed Manufacturing
1199 Other Food Product Manufacturing n.e.c.
12 BEVERAGE AND TOBACCO PRODUCT MANUFACTURING
121 Beverage Manufacturing
1211 Soft Drink, Cordial and Syrup Manufacturing
1212 Beer Manufacturing
1213 Spirit Manufacturing
1214 Wine and Other Alcoholic Beverage Manufacturing
122 Cigarette and Tobacco Product Manufacturing
1220 Cigarette and Tobacco Product Manufacturing
13 TEXTILE, LEATHER, CLOTHING AND FOOTWEAR MANUFACTURING
131 Textile Manufacturing
1311 Wool Scouring
1312 Natural Textile Manufacturing
1313 Synthetic Textile Manufacturing
132 Leather Tanning, Fur Dressing and Leather Product Manufacturing
1320 Leather Tanning, Fur Dressing and Leather Product Manufacturing
133 Textile Product Manufacturing
1331 Textile Floor Covering Manufacturing
1332 Rope, Cordage and Twine Manufacturing
1333 Cut and Sewn Textile Product Manufacturing
1334 Textile Finishing and Other Textile Product Manufacturing

134 Knitted Product Manufacturing
1340 Knitted Product Manufacturing
135 Clothing and Footwear Manufacturing
1351 Clothing Manufacturing
1352 Footwear Manufacturing
14 WOOD PRODUCT MANUFACTURING
141 Log Sawmilling and Timber Dressing
1411 Log Sawmilling
1412 Wood Chipping
1413 Timber Resawing and Dressing
149 Other Wood Product Manufacturing
1491 Prefabricated Wooden Building Manufacturing
1492 Wooden Structural Fitting and Component Manufacturing
1493 Veneer and Plywood Manufacturing
1494 Reconstituted Wood Product Manufacturing
1499 Other Wood Product Manufacturing n.e.c.
15 PULP, PAPER AND CONVERTED PAPER PRODUCT MANUFACTURING
151 Pulp, Paper and Paperboard Manufacturing
1510 Pulp, Paper and Paperboard Manufacturing
152 Converted Paper Product Manufacturing
1521 Corrugated Paperboard and Paperboard Container Manufacturing
1522 Paper Bag Manufacturing
1523 Paper Stationery Manufacturing
1524 Sanitary Paper Product Manufacturing
1529 Other Converted Paper Product Manufacturing
16 PRINTING (INCLUDING THE REPRODUCTION OF RECORDED MEDIA)
161 Printing and Printing Support Services
1611 Printing
1612 Printing Support Services
162 Reproduction of Recorded Media
1620 Reproduction of Recorded Media
17 PETROLEUM AND COAL PRODUCT MANUFACTURING
170 Petroleum and Coal Product Manufacturing
1701 Petroleum Refining and Petroleum Fuel Manufacturing
1709 Other Petroleum and Coal Product Manufacturing
18 BASIC CHEMICAL AND CHEMICAL PRODUCT MANUFACTURING
181 Basic Chemical Manufacturing
1811 Industrial Gas Manufacturing
1812 Basic Organic Chemical Manufacturing
1813 Basic Inorganic Chemical Manufacturing

182 Basic Polymer Manufacturing
1821 Synthetic Resin and Synthetic Rubber Manufacturing
1829 Other Basic Polymer Manufacturing
183 Fertiliser and Pesticide Manufacturing
1831 Fertiliser Manufacturing
1832 Pesticide Manufacturing
184 Pharmaceutical and Medicinal Product Manufacturing
1841 Human Pharmaceutical and Medicinal Product Manufacturing
1842 Veterinary Pharmaceutical and Medicinal Product Manufacturing
185 Cleaning Compound and Toiletry Preparation Manufacturing
1851 Cleaning Compound Manufacturing
1852 Cosmetic and Toiletry Preparation Manufacturing
189 Other Basic Chemical Product Manufacturing
1891 Photographic Chemical Product Manufacturing
1892 Explosive Manufacturing
1899 Other Basic Chemical Product Manufacturing n.e.c.
19 POLYMER PRODUCT AND RUBBER PRODUCT MANUFACTURING
191 Polymer Product Manufacturing
1911 Polymer Film and Sheet Packaging Material Manufacturing
1912 Rigid and Semi-Rigid Polymer Product Manufacturing
1913 Polymer Foam Product Manufacturing
1914 Tyre Manufacturing
1915 Adhesive Manufacturing
1916 Paint and Coatings Manufacturing
1919 Other Polymer Product Manufacturing
192 Natural Rubber Product Manufacturing
1920 Natural Rubber Product Manufacturing
20 NON-METALLIC MINERAL PRODUCT MANUFACTURING
201 Glass and Glass Product Manufacturing
2010 Glass and Glass Product Manufacturing
202 Ceramic Product Manufacturing
2021 Clay Brick Manufacturing
2029 Other Ceramic Product Manufacturing
203 Cement, Lime, Plaster and Concrete Product Manufacturing
2031 Cement and Lime Manufacturing
2032 Plaster Product Manufacturing
2033 Ready-Mixed Concrete Manufacturing
2034 Concrete Product Manufacturing
209 Other Non-Metallic Mineral Product Manufacturing
2090 Other Non-Metallic Mineral Product Manufacturing

21 PRIMARY METAL AND METAL PRODUCT MANUFACTURING
211 Basic Ferrous Metal Manufacturing
2110 Iron Smelting and Steel Manufacturing
212 Basic Ferrous Metal Product Manufacturing
2121 Iron and Steel Casting
2122 Steel Pipe and Tube Manufacturing
213 Basic Non-Ferrous Metal Manufacturing
2131 Alumina Production
2132 Aluminium Smelting
2133 Copper, Silver, Lead and Zinc Smelting and Refining
2139 Other Basic Non-Ferrous Metal Manufacturing
214 Basic Non-Ferrous Metal Product Manufacturing
2141 Non-Ferrous Metal Casting
2142 Aluminium Rolling, Drawing, Extruding
2149 Other Basic Non-Ferrous Metal Product Manufacturing
22 FABRICATED METAL PRODUCT MANUFACTURING
221 Iron and Steel Forging
2210 Iron and Steel Forging
222 Structural Metal Product Manufacturing
2221 Structural Steel Fabricating
2222 Prefabricated Metal Building Manufacturing
2223 Architectural Aluminium Product Manufacturing
2224 Metal Roof and Guttering Manufacturing (except Aluminium)
2229 Other Structural Metal Product Manufacturing
223 Metal Container Manufacturing
2231 Boiler, Tank and Other Heavy Gauge Metal Container Manufacturing
2239 Other Metal Container Manufacturing
224 Sheet Metal Product Manufacturing (except Metal Structural and Container Products)
2240 Sheet Metal Product Manufacturing (except Metal Structural and Container Products)
229 Other Fabricated Metal Product Manufacturing
2291 Spring and Wire Product Manufacturing
2292 Nut, Bolt, Screw and Rivet Manufacturing
2293 Metal Coating and Finishing
2299 Other Fabricated Metal Product Manufacturing n.e.c.
23 TRANSPORT EQUIPMENT MANUFACTURING
231 Motor Vehicle and Motor Vehicle Part Manufacturing
2311 Motor Vehicle Manufacturing
2312 Motor Vehicle Body and Trailer Manufacturing
2313 Automotive Electrical Component Manufacturing
2319 Other Motor Vehicle Parts Manufacturing

239 Other Transport Equipment Manufacturing
2391 Shipbuilding and Repair Services
2392 Boatbuilding and Repair Services
2393 Railway Rolling Stock Manufacturing and Repair Services
2394 Aircraft Manufacturing and Repair Services
2399 Other Transport Equipment Manufacturing n.e.c.
24 MACHINERY AND EQUIPMENT MANUFACTURING
241 Professional and Scientific Equipment Manufacturing
2411 Photographic, Optical and Ophthalmic Equipment Manufacturing
2412 Medical and Surgical Equipment Manufacturing
2419 Other Professional and Scientific Equipment Manufacturing
242 Computer and Electronic Equipment Manufacturing
2421 Computer and Electronic Office Equipment Manufacturing
2422 Communication Equipment Manufacturing
2429 Other Electronic Equipment Manufacturing
243 Electrical Equipment Manufacturing
2431 Electric Cable and Wire Manufacturing
2432 Electric Lighting Equipment Manufacturing
2439 Other Electrical Equipment Manufacturing
244 Domestic Appliance Manufacturing
2441 Whiteware Appliance Manufacturing
2449 Other Domestic Appliance Manufacturing
245 Pump, Compressor, Heating and Ventilation Equipment Manufacturing
2451 Pump and Compressor Manufacturing
2452 Fixed Space Heating, Cooling and Ventilation Equipment Manufacturing
246 Specialised Machinery and Equipment Manufacturing
2461 Agricultural Machinery and Equipment Manufacturing
2462 Mining and Construction Machinery Manufacturing
2463 Machine Tool and Parts Manufacturing
2469 Other Specialised Machinery and Equipment Manufacturing
249 Other Machinery and Equipment Manufacturing
2491 Lifting and Material Handling Equipment Manufacturing
2499 Other Machinery and Equipment Manufacturing n.e.c.
25 FURNITURE AND OTHER MANUFACTURING
251 Furniture Manufacturing
2511 Wooden Furniture and Upholstered Seat Manufacturing
2512 Metal Furniture Manufacturing
2513 Mattress Manufacturing
2519 Other Furniture Manufacturing
259 Other Manufacturing
2591 Jewellery and Silverware Manufacturing

2592 Toy, Sporting and Recreational Product Manufacturing
2599 Other Manufacturing n.e.c.
D ELECTRICITY, GAS, WATER AND WASTE SERVICES
26 ELECTRICITY SUPPLY
261 Electricity Generation
2611 Fossil Fuel Electricity Generation
2612 Hydro-Electricity Generation
2619 Other Electricity Generation
262 Electricity Transmission
2620 Electricity Transmission
263 Electricity Distribution
2630 Electricity Distribution
264 On Selling Electricity and Electricity Market Operation
2640 On Selling Electricity and Electricity Market Operation
27 GAS SUPPLY
270 Gas Supply
2700 Gas Supply
28 WATER SUPPLY, SEWERAGE AND DRAINAGE SERVICES
281 Water Supply, Sewerage and Drainage Services
2811 Water Supply
2812 Sewerage and Drainage Services
29 WASTE COLLECTION, TREATMENT AND DISPOSAL SERVICES
291 Waste Collection Services
2911 Solid Waste Collection Services
2919 Other Waste Collection Services
292 Waste Treatment, Disposal and Remediation Services
2921 Waste Treatment and Disposal Services
2922 Waste Remediation and Materials Recovery Services
E CONSTRUCTION
30 BUILDING CONSTRUCTION
301 Residential Building Construction
3011 House Construction
3019 Other Residential Building Construction
302 Non-Residential Building Construction
3020 Non-Residential Building Construction
31 HEAVY AND CIVIL ENGINEERING CONSTRUCTION
310 Heavy and Civil Engineering Construction
3101 Road and Bridge Construction
3109 Other Heavy and Civil Engineering Construction

32 CONSTRUCTION SERVICES
321 Land Development and Site Preparation Services
3211 Land Development and Subdivision
3212 Site Preparation Services
322 Building Structure Services
3221 Concreting Services
3222 Bricklaying Services
3223 Roofing Services
3224 Structural Steel Erection Services
323 Building Installation Services
3231 Plumbing Services
3232 Electrical Services
3233 Air Conditioning and Heating Services
3234 Fire and Security Alarm Installation Services
3239 Other Building Installation Services
324 Building Completion Services
3241 Plastering and Ceiling Services
3242 Carpentry Services
3243 Tiling and Carpeting Services
3244 Painting and Decorating Services
3245 Glazing Services
329 Other Construction Services
3291 Landscape Construction Services
3292 Hire of Construction Machinery with Operator
3299 Other Construction Services n.e.c.
F WHOLESALE TRADE
33 BASIC MATERIAL WHOLESALING
331 Agricultural Product Wholesaling
3311 Wool Wholesaling
3312 Cereal Grain Wholesaling
3319 Other Agricultural Product Wholesaling
332 Mineral, Metal and Chemical Wholesaling
3321 Petroleum Product Wholesaling
3322 Metal and Mineral Wholesaling
3323 Industrial and Agricultural Chemical Product Wholesaling
333 Timber and Hardware Goods Wholesaling
3331 Timber Wholesaling
3332 Plumbing Goods Wholesaling
3339 Other Hardware Goods Wholesaling

34 MACHINERY AND EQUIPMENT WHOLESALING
341 Specialised Industrial Machinery and Equipment Wholesaling
3411 Agricultural and Construction Machinery Wholesaling
3419 Other Specialised Industrial Machinery and Equipment Wholesaling
349 Other Machinery and Equipment Wholesaling
3491 Professional and Scientific Goods Wholesaling
3492 Computer and Computer Peripheral Wholesaling
3493 Telecommunication Goods Wholesaling
3494 Other Electrical and Electronic Goods Wholesaling
3499 Other Machinery and Equipment Wholesaling n.e.c.
35 MOTOR VEHICLE AND MOTOR VEHICLE PARTS WHOLESALING
350 Motor Vehicle and Motor Vehicle Parts Wholesaling
3501 Car Wholesaling
3502 Commercial Vehicle Wholesaling
3503 Trailer and Other Motor Vehicle Wholesaling
3504 Motor Vehicle New Parts Wholesaling
3505 Motor Vehicle Dismantling and Used Parts Wholesaling
36 GROCERY, LIQUOR AND TOBACCO PRODUCT WHOLESALING
360 Grocery, Liquor and Tobacco Product Wholesaling
3601 General Line Grocery Wholesaling
3602 Meat, Poultry and Smallgoods Wholesaling
3603 Dairy Produce Wholesaling
3604 Fish and Seafood Wholesaling
3605 Fruit and Vegetable Wholesaling
3606 Liquor and Tobacco Product Wholesaling
3609 Other Grocery Wholesaling
37 OTHER GOODS WHOLESALING
371 Textile, Clothing and Footwear Wholesaling
3711 Textile Product Wholesaling
3712 Clothing and Footwear Wholesaling
372 Pharmaceutical and Toiletry Goods Wholesaling
3720 Pharmaceutical and Toiletry Goods Wholesaling
373 Furniture, Floor Covering and Other Goods Wholesaling
3731 Furniture and Floor Covering Wholesaling
3732 Jewellery and Watch Wholesaling
3733 Kitchen and Diningware Wholesaling
3734 Toy and Sporting Goods Wholesaling
3735 Book and Magazine Wholesaling
3736 Paper Product Wholesaling
3739 Other Goods Wholesaling n.e.c.

38 COMMISSION-BASED WHOLESALING
380 Commission-Based Wholesaling
3800 Commission-Based Wholesaling
G RETAIL TRADE
39 MOTOR VEHICLE AND MOTOR VEHICLE PARTS RETAILING
391 Motor Vehicle Retailing
3911 Car Retailing
3912 Motor Cycle Retailing
3913 Trailer and Other Motor Vehicle Retailing
392 Motor Vehicle Parts and Tyre Retailing
3921 Motor Vehicle Parts Retailing
3922 Tyre Retailing
40 FUEL RETAILING
400 Fuel Retailing
4000 Fuel Retailing
41 FOOD RETAILING
411 Supermarket and Grocery Stores
4110 Supermarket and Grocery Stores
412 Specialised Food Retailing
4121 Fresh Meat, Fish and Poultry Retailing
4122 Fruit and Vegetable Retailing
4123 Liquor Retailing
4129 Other Specialised Food Retailing
42 OTHER STORE-BASED RETAILING
421 Furniture, Floor Coverings, Houseware and Textile Goods Retailing
4211 Furniture Retailing
4212 Floor Coverings Retailing
4213 Houseware Retailing
4214 Manchester and Other Textile Goods Retailing
422 Electrical and Electronic Goods Retailing
4221 Electrical, Electronic and Gas Appliance Retailing
4222 Computer and Computer Peripheral Retailing
4229 Other Electrical and Electronic Goods Retailing
423 Hardware, Building and Garden Supplies Retailing
4231 Hardware and Building Supplies Retailing
4232 Garden Supplies Retailing
424 Recreational Goods Retailing
4241 Sport and Camping Equipment Retailing
4242 Entertainment Media Retailing
4243 Toy and Game Retailing

4244 Newspaper and Book Retailing
4245 Marine Equipment Retailing
425 Clothing, Footwear and Personal Accessory Retailing
4251 Clothing Retailing
4252 Footwear Retailing
4253 Watch and Jewellery Retailing
4259 Other Personal Accessory Retailing
426 Department Stores
4260 Department Stores
427 Pharmaceutical and Other Store-Based Retailing
4271 Pharmaceutical, Cosmetic and Toiletry Goods Retailing
4272 Stationery Goods Retailing
4273 Antique and Used Goods Retailing
4274 Flower Retailing
4279 Other Store-Based Retailing n.e.c.
43 NON-STORE RETAILING AND RETAIL COMMISSION BASED BUYING AND/OR SELLING
431 Non-Store Retailing
4310 Non-Store Retailing
432 Retail Commission-Based Buying and/or Selling
4320 Retail Commission-Based Buying and/or Selling
H ACCOMMODATION
44 ACCOMMODATION
440 Accommodation
4400 Accommodation
45 FOOD AND BEVERAGE SERVICES
451 Cafes, Restaurants and Takeaway Food Services
4511 Cafes and Restaurants
4512 Takeaway Food Services
4513 Catering Services
452 Pubs, Taverns and Bars
4520 Pubs, Taverns and Bars
453 Clubs (Hospitality)
4530 Clubs (Hospitality)
I TRANSPORT, POSTAL AND WAREHOUSING
46 ROAD TRANSPORT
461 Road Freight Transport
4610 Road Freight Transport
462 Road Passenger Transport
4621 Interurban and Rural Bus Transport

4622 Urban Bus Transport (Including Tramway)
4623 Taxi and Other Road Transport
47 RAIL TRANSPORT
471 Rail Freight Transport
4710 Rail Freight Transport
472 Rail Passenger Transport
4720 Rail Passenger Transport
48 WATER TRANSPORT
481 Water Freight Transport
4810 Water Freight Transport
482 Water Passenger Transport
4820 Water Passenger Transport
49 AIR AND SPACE TRANSPORT
490 Air and Space Transport
4900 Air and Space Transport
50 OTHER TRANSPORT
501 Scenic and Sightseeing Transport
5010 Scenic and Sightseeing Transport
502 Pipeline and Other Transport
5021 Pipeline Transport
5029 Other Transport n.e.c.
51 POSTAL AND COURIER PICK-UP AND DELIVERY SERVICES
510 Postal and Courier Pick-up and Delivery Services
5101 Postal Services
5102 Courier Pick-up and Delivery Services
52 TRANSPORT SUPPORT SERVICES
521 Water Transport Support Services
5211 Stevedoring Services
5212 Port and Water Transport Terminal Operations
5219 Other Water Transport Support Services
522 Airport Operations and Other Air Transport Support Services
5220 Airport Operations and Other Air Transport Support Services
529 Other Transport Support Services
5291 Customs Agency Services
5292 Freight Forwarding Services
5299 Other Transport Support Services n.e.c.
53 WAREHOUSING AND STORAGE SERVICES
530 Warehousing and Storage Services
5301 Grain Storage Services
5309 Other Warehousing and Storage Services

J INFORMATION MEDIA AND TELECOMMUNICATIONS
54 PUBLISHING (EXCEPT INTERNET AND MUSIC PUBLISHING)
541 Newspaper, Periodical, Book and Directory Publishing
5411 Newspaper Publishing
5412 Magazine and Other Periodical Publishing
5413 Book Publishing
5414 Directory and Mailing List Publishing
5419 Other Publishing (except Software, Music and Internet)
542 Software Publishing
5420 Software Publishing
55 MOTION PICTURE AND SOUND RECORDING ACTIVITIES
551 Motion Picture and Video Activities
5511 Motion Picture and Video Production
5512 Motion Picture and Video Distribution
5513 Motion Picture Exhibition
5514 Post-production Services and Other Motion Picture and Video Activities
552 Sound Recording and Music Publishing
5521 Music Publishing
5522 Music and Other Sound Recording Activities
56 BROADCASTING (EXCEPT INTERNET)
561 Radio Broadcasting
5610 Radio Broadcasting
562 Television Broadcasting
5621 Free-to-Air Television Broadcasting
5622 Cable and Other Subscription Broadcasting
57 INTERNET PUBLISHING AND BROADCASTING
570 Internet Publishing and Broadcasting
5700 Internet Publishing and Broadcasting
58 TELECOMMUNICATIONS SERVICES
580 Telecommunications Services
5801 Wired Telecommunications Network Operation
5802 Other Telecommunications Network Operation
5809 Other Telecommunications Services
59 INTERNET SERVICE PROVIDERS, WEB SEARCH PORTALS AND DATA PROCESSING SERVICES
591 Internet Service Providers and Web Search Portals
5910 Internet Service Providers and Web Search Portals
592 Data Processing, Web Hosting and Electronic Information Storage Services
5921 Data Processing and Web Hosting Services
5922 Electronic Information Storage Services

60 LIBRARY AND OTHER INFORMATION SERVICES
601 Libraries and Archives
6010 Libraries and Archives
602 Other Information Services
6020 Other Information Services
K FINANCIAL AND INSURANCE SERVICES
62 FINANCE
621 Central Banking
6210 Central Banking
622 Depository Financial Intermediation
6221 Banking
6222 Building Society Operation
6223 Credit Union Operation
6229 Other Depository Financial Intermediation
623 Non-Depository Financing
6230 Non-Depository Financing
624 Financial Asset Investing
6240 Financial Asset Investing
63 INSURANCE AND SUPERANNUATION FUNDS
631 Life Insurance
6310 Life Insurance
632 Health and General Insurance
6321 Health Insurance
6322 General Insurance
633 Superannuation Funds
6330 Superannuation Funds
64 AUXILIARY FINANCE AND INSURANCE SERVICES
641 Auxiliary Finance and Investment Services
6411 Financial Asset Broking Services
6419 Other Auxiliary Finance and Investment Services
642 Auxiliary Insurance Services
6420 Auxiliary Insurance Services
L RENTAL, HIRING AND REAL ESTATE SERVICES
66 RENTAL AND HIRING SERVICES (EXCEPT REAL ESTATE)
661 Motor Vehicle and Transport Equipment Rental and Hiring
6611 Passenger Car Rental and Hiring
6619 Other Motor Vehicle and Transport Equipment Rental and Hiring
662 Farm Animal and Bloodstock Leasing
6620 Farm Animal and Bloodstock Leasing

663 Other Goods and Equipment Rental and Hiring
6631 Heavy Machinery and Scaffolding Rental and Hiring
6632 Video and Other Electronic Media Rental and Hiring
6639 Other Goods and Equipment Rental and Hiring n.e.c.
664 Non-Financial Intangible Assets (Except Copyrights) Leasing
6640 Non-Financial Intangible Assets (Except Copyrights) Leasing
67 PROPERTY OPERATORS AND REAL ESTATE SERVICES
671 Property Operators
6711 Residential Property Operators
6712 Non-Residential Property Operators
672 Real Estate Services
6720 Real Estate Services
M PROFESSIONAL, SCIENTIFIC AND TECHNICAL SERVICES
69 PROFESSIONAL, SCIENTIFIC AND TECHNICAL SERVICES (EXCEPT COMPUTER SYSTEM DESIGN AND RELATED SERVICES)
691 Scientific Research Services
6910 Scientific Research Services
692 Architectural, Engineering and Technical Services
6921 Architectural Services
6922 Surveying and Mapping Services
6923 Engineering Design and Engineering Consulting Services
6924 Other Specialised Design Services
6925 Scientific Testing and Analysis Services
693 Legal and Accounting Services
6931 Legal Services
6932 Accounting Services
694 Advertising Services
6940 Advertising Services
695 Market Research and Statistical Services
6950 Market Research and Statistical Services
696 Management and Related Consulting Services
6961 Corporate Head Office Management Services
6962 Management Advice and Related Consulting Services
697 Veterinary Services
6970 Veterinary Services
699 Other Professional, Scientific and Technical Services
6991 Professional Photographic Services
6999 Other Professional, Scientific and Technical Services n.e.c.

70 COMPUTER SYSTEM DESIGN AND RELATED SERVICES
700 Computer System Design and Related Services
7000 Computer System Design and Related Services
N ADMINISTRATIVE AND SUPPORT SERVICES
72 ADMINISTRATIVE SERVICES
721 Employment Services
7211 Employment Placement and Recruitment Services
7212 Labour Supply Services
722 Travel Agency and Tour Arrangement Services
7220 Travel Agency and Tour Arrangement Services
729 Other Administrative Services
7291 Office Administrative Services
7292 Document Preparation Services
7293 Credit Reporting and Debt Collection Services
7294 Call Centre Operation
7299 Other Administrative Services n.e.c.
73 BUILDING CLEANING, PEST CONTROL AND OTHER SUPPORT SERVICES
731 Building Cleaning, Pest Control and Gardening Services
7311 Building and Other Industrial Cleaning Services
7312 Building Pest Control Services
7313 Gardening Services
732 Packaging Services
7320 Packaging Services
O PUBLIC ADMINISTRATION AND SAFETY
75 PUBLIC ADMINISTRATION
751 Central Government Administration
7510 Central Government Administration
752 State Government Administration
7520 State Government Administration
753 Local Government Administration
7530 Local Government Administration
754 Justice
7540 Justice
755 Government Representation
7551 Domestic Government Representation
7552 Foreign Government Representation
76 DEFENCE
760 Defence
7600 Defence

77 PUBLIC ORDER, SAFETY AND REGULATORY SERVICES
771 Public Order and Safety Services
7711 Police Services
7712 Investigation and Security Services
7713 Fire Protection and Other Emergency Services
7714 Correctional and Detention Services
7719 Other Public Order and Safety Services
772 Regulatory Services
7720 Regulatory Services
P EDUCATION AND TRAINING
80 PRESCHOOL AND SCHOOL EDUCATION
801 Preschool Education
8010 Preschool Education
802 School Education
8021 Primary Education
8022 Secondary Education
8023 Combined Primary and Secondary Education
8024 Special School Education
81 TERTIARY EDUCATION
810 Tertiary Education
8101 Technical and Vocational Education and Training
8102 Higher Education
82 ADULT, COMMUNITY AND OTHER EDUCATION
821 Adult, Community and Other Education
8211 Sports and Physical Recreation Instruction
8212 Arts Education
8219 Adult, Community and Other Education n.e.c.
822 Educational Support Services
8220 Educational Support Services
Q HEALTH CARE AND SOCIAL ASSISTANCE
84 HOSPITALS
840 Hospitals
8401 Hospitals (Except Psychiatric Hospitals)
8402 Psychiatric Hospitals
85 MEDICAL AND OTHER HEALTH CARE SERVICES
851 Medical Services
8511 General Practice Medical Services
8512 Specialist Medical Services
852 Pathology and Diagnostic Imaging Services
8520 Pathology and Diagnostic Imaging Services

853 Allied Health Services
8531 Dental Services
8532 Optometry and Optical Dispensing
8533 Physiotherapy Services
8534 Chiropractic and Osteopathic Services
8539 Other Allied Health Services
859 Other Health Care Services
8591 Ambulance Services
8599 Other Health Care Services n.e.c.
86 RESIDENTIAL CARE SERVICES
860 Residential Care Services
8601 Aged Care Residential Services
8609 Other Residential Care Services
87 SOCIAL ASSISTANCE SERVICES
871 Child Care Services
8710 Child Care Services
879 Other Social Assistance Services
8790 Other Social Assistance Services
R ARTS AND RECREATION SERVICES
89 HERITAGE ACTIVITIES
891 Museum Operation
8910 Museum Operation
892 Parks and Gardens Operations
8921 Zoological and Botanical Gardens Operation
8922 Nature Reserves and Conservation Parks Operation
90 CREATIVE AND PERFORMING ARTS ACTIVITIES
900 Creative and Performing Arts Activities
9001 Performing Arts Operation
9002 Creative Artists, Musicians, Writers and Performers
9003 Performing Arts Venue Operation
91 SPORTS AND RECREATION ACTIVITIES
911 Sports and Physical Recreation Activities
9111 Health and Fitness Centres and Gymnasia Operation
9112 Sports and Physical Recreation Clubs and Sports Professionals
9113 Sports and Physical Recreation Venues, Grounds and Facilities Operation
9114 Sports and Physical Recreation Administrative Service
912 Horse and Dog Racing Activities
9121 Horse and Dog Racing Administration and Track Operation
9129 Other Horse and Dog Racing Activities

913 Amusement and Other Recreation Activities
9131 Amusement Parks and Centres Operation
9139 Amusement and Other Recreational Activities n.e.c.
92 GAMBLING ACTIVITIES
920 Gambling Activities
9201 Casino Operation
9202 Lottery Operation
9209 Other Gambling Activities
S OTHER SERVICES
94 REPAIR AND MAINTENANCE
941 Automotive Repair and Maintenance
9411 Automotive Electrical Services
9412 Automotive Body, Paint and Interior Repair
9419 Other Automotive Repair and Maintenance
942 Machinery and Equipment Repair and Maintenance
9421 Domestic Appliance Repair and Maintenance
9422 Electronic (except Domestic Appliance) and Precision Equipment Repair and Maintenance
9429 Other Machinery and Equipment Repair and Maintenance
949 Other Repair and Maintenance
9491 Clothing and Footwear Repair
9499 Other Repair and Maintenance n.e.c.
95 PERSONAL AND OTHER SERVICES
951 Personal Care Services
9511 Hairdressing and Beauty Services
9512 Diet and Weight Reduction Centre Operation
952 Funeral, Crematorium and Cemetery Services
9520 Funeral, Crematorium and Cemetery Services
953 Other Personal Services
9531 Laundry and Dry-Cleaning Services
9532 Photographic Film Processing
9533 Parking Services
9534 Brothel Keeping and Prostitution Services
9539 Other Personal Services n.e.c.
954 Religious Services
9540 Religious Services
955 Civic, Professional and Other Interest Group Services
9551 Business and Professional Association Services
9552 Labour Association Services
9559 Other Interest Group Services n.e.c.

96 PRIVATE HOUSEHOLDS EMPLOYING STAFF AND UNDIFFERENTIATED GOODS- AND SERVICE-PRODUCING ACTIVITIES OF HOUSEHOLDS FOR OWN USE
960 Private Households Employing Staff and Undifferentiated Goods- and Service-Producing Activities of Households for Own Use
9601 Private Households Employing Staff
9602 Undifferentiated Goods-Producing Activities of Private Households for Own Use
9603 Undifferentiated Service-Producing Activities of Private Households for Own Use

APPENDIX C: OCCUPATION: MAJOR, SUB-MAJOR, MINOR AND UNIT GROUPS

1 MANAGERS
11 CHIEF EXECUTIVES, GENERAL MANAGERS AND LEGISLATORS
111 Chief Executives, General Managers and Legislators
1111 Chief Executives and Managing Directors
1112 General Managers
1113 Legislators
12 FARMERS AND FARM MANAGERS
121 Farmers and Farm Managers
1211 Aquaculture Farmers
1212 Crop Farmers
1213 Livestock Farmers
1214 Mixed Crop and Livestock Farmers
13 SPECIALIST MANAGERS
131 Advertising, Public Relations and Sales Managers
1311 Advertising, Public Relations and Sales Managers
132 Business Administration Managers
1321 Corporate Services Managers
1322 Finance Managers
1323 Human Resource Managers
1324 Policy and Planning Managers
1325 Research and Development Managers
133 Construction, Distribution and Production Managers
1331 Construction Managers
1332 Engineering Managers
1333 Importers, Exporters and Wholesalers
1334 Manufacturers
1335 Production Managers
1336 Supply and Distribution Managers
134 Education, Health and Welfare Services Managers
1341 Child Care Centre Managers
1342 Health and Welfare Services Managers
1343School Principals
1344Other Education Managers
135 ICT Managers
1351 ICT Managers

139 Miscellaneous Specialist Managers
1391 Commissioned Officers (Management)
1392 Senior Non-commissioned Defence Force Members
1399 Other Specialist Managers
14 HOSPITALITY, RETAIL AND SERVICE MANAGERS
141 Accommodation and Hospitality Managers
1411 Cafe and Restaurant Managers
1412 Caravan Park and Camping Ground Managers
1413 Hotel and Motel Managers
1414 Licensed Club Managers
1419 Other Accommodation and Hospitality Managers
142 Retail Managers
1421 Retail Managers
149 Miscellaneous Hospitality, Retail and Service Managers
1491 Amusement, Fitness and Sports Centre Managers
1492 Call or Contact Centre and Customer Service Managers
1493 Conference and Event Organisers
1494 Transport Services Managers
1499 Other Hospitality, Retail and Service Managers
11 CHIEF EXECUTIVES, GENERAL MANAGERS AND LEGISLATORS
111 Chief Executives, General Managers and Legislators
1111 Chief Executives and Managing Directors
1112 General Managers
1113 Legislators
12 FARMERS AND FARM MANAGERS
121 Farmers and Farm Managers
1211Aquaculture Farmers
1212 Crop Farmers
1213 Livestock Farmers
1214 Mixed Crop and Livestock Farmers
13 SPECIALIST MANAGERS
131 Advertising, Public Relations and Sales Managers
1311 Advertising, Public Relations and Sales Managers
132 Business Administration Managers
1321 Corporate Services Managers
1322 Finance Managers
1323 Human Resource Managers
1324 Policy and Planning Managers
1325 Research and Development Managers

133 Construction, Distribution and Production Managers
1331 Construction Managers
1332 Engineering Managers
1333 Importers, Exporters and Wholesalers
1334 Manufacturers
1335 Production Managers
1336 Supply and Distribution Managers
134 Education, Health and Welfare Services Managers
1341 Child Care Centre Managers
1342 Health and Welfare Services Managers
1343 School Principals
1344 Other Education Managers
135 ICT Managers
1351 ICT Managers
139 Miscellaneous Specialist Managers
1391 Commissioned Officers (Management)
1392 Senior Non-commissioned Defence Force Members
1399 Other Specialist Managers
14 HOSPITALITY, RETAIL AND SERVICE MANAGERS
141 Accommodation and Hospitality Managers
1411 Cafe and Restaurant Managers
1412 Caravan Park and Camping Ground Managers
1413 Hotel and Motel Managers
1414 Licensed Club Managers
1419 Other Accommodation and Hospitality Managers
142 Retail Managers
1421 Retail Managers
149 Miscellaneous Hospitality, Retail and Service Managers
1491 Amusement, Fitness and Sports Centre Managers
1492 Call or Contact Centre and Customer Service Managers
1493 Conference and Event Organisers
1494 Transport Services Managers
1499 Other Hospitality, Retail and Service Managers
2 PROFESSIONALS
21 ARTS AND MEDIA PROFESSIONALS
211 Arts Professionals
2111 Actors, Dancers and Other Entertainers
2112 Music Professionals
2113 Photographers
2114 Visual Arts and Crafts Professionals

212 Media Professionals
2121 Artistic Directors, and Media Producers and Presenters
2122 Authors, and Book and Script Editors
2123 Film, Television, Radio and Stage Directors
2124 Journalists and Other Writers
22 BUSINESS, HUMAN RESOURCE AND MARKETING PROFESSIONALS
221 Accountants, Auditors and Company Secretaries
2211 Accountants
2212 Auditors, Company Secretaries and Corporate Treasurers
222 Financial Brokers and Dealers, and Investment Advisers
2221 Financial Brokers
2222 Financial Dealers
2223 Financial Investment Advisers and Managers
223 Human Resource and Training Professionals
2231 Human Resource Professionals
2232 ICT Trainers
2233 Training and Development Professionals
224 Information and Organisation Professionals
2241Actuaries, Mathematicians and Statisticians
2242 Archivists, Curators and Records Managers
2243 Economists
2244 Intelligence and Policy Analysts
2245 Land Economists and Valuers
2246 Librarians
2247 Management and Organisation Analysts
2249 Other Information and Organisation Professionals
225 Sales, Marketing and Public Relations Professionals
2251 Advertising and Marketing Professionals
2252 ICT Sales Professionals
2253 Public Relations Professionals
2254 Technical Sales Representatives
23 DESIGN, ENGINEERING, SCIENCE AND TRANSPORT PROFESSIONALS
231 Air and Marine Transport Professionals
2311 Air Transport Professionals
2312 Marine Transport Professionals
232 Architects, Designers, Planners and Surveyors
2321 Architects and Landscape Architects
2322 Surveyors and Spatial Scientists
2323 Fashion, Industrial and Jewellery Designers
2324 Graphic and Web Designers, and Illustrators
2325 Interior Designers
2326 Urban and Regional Planners

233 Engineering Professionals
2331 Chemical and Materials Engineers
2332 Civil Engineering Professionals
2333 Electrical Engineers
2334 Electronics Engineers
2335 Industrial, Mechanical and Production Engineers
2336 Mining Engineers
2339 Other Engineering Professionals
234 Natural and Physical Science Professionals
2341 Agricultural and Forestry Scientists
2342 Chemists, and Food and Wine Scientists
2343 Environmental Scientists
2344 Geologists and Geophysicists
2345 Life Scientists
2346 Medical Laboratory Scientists
2347 Veterinarians
2349 Other Natural and Physical Science Professionals
24 EDUCATION PROFESSIONALS
241 School Teachers
2411 Early Childhood (Pre-primary School) Teachers
2412 Primary School Teachers
2413 Middle School Teachers (Aus) / Intermediate School Teachers (NZ)
2414 Secondary School Teachers
2415 Special Education Teachers
242 Tertiary Education Teachers
2421 University Lecturers and Tutors
2422 Vocational Education Teachers (Aus) / Polytechnic Teachers (NZ)
249 Miscellaneous Education Professionals
2491 Education Advisers and Reviewers
2492 Private Tutors and Teachers
2493 Teachers of English to Speakers of Other Languages
25 HEALTH PROFESSIONALS
251 Health Diagnostic and Promotion Professionals
2511 Dietitians
2512 Medical Imaging Professionals
2513 Occupational and Environmental Health Professionals
2514 Optometrists and Orthoptists
2515 Pharmacists
2519 Other Health Diagnostic and Promotion Professionals
252 Health Therapy Professionals
2521 Chiropractors and Osteopaths

2522 Complementary Health Therapists
2523 Dental Practitioners
2524 Occupational Therapists
2525 Physiotherapists
2526 Podiatrists
2527 Speech Professionals and Audiologists
253 Medical Practitioners
2531 Generalist Medical Practitioners
2532 Anaesthetists
2533 Specialist Physicians
2534 Psychiatrists
2535 Surgeons
2539 Other Medical Practitioners
254 Midwifery and Nursing Professionals
2541 Midwives
2542 Nurse Educators and Researchers
2543 Nurse Managers
2544 Registered Nurses
26 ICT PROFESSIONALS
261 Business and Systems Analysts, and Programmers
2611 ICT Business and Systems Analysts
2612 Multimedia Specialists and Web Developers
2613 Software and Applications Programmers
262 Database and Systems Administrators, and ICT Security Specialists
2621 Database and Systems Administrators, and ICT Security Specialists
263 ICT Network and Support Professionals
2631 Computer Network Professionals
2632 ICT Support and Test Engineers
2633 Telecommunications Engineering Professionals
27 LEGAL, SOCIAL AND WELFARE PROFESSIONALS
271 Legal Professionals
2711 Barristers
2712 Judicial and Other Legal Professionals
2713 Solicitors
272 Social and Welfare Professionals
2721 Counsellors
2722 Ministers of Religion
2723 Psychologists
2724 Social Professionals
2725 Social Workers
2726 Welfare, Recreation and Community Arts Workers

3 TECHNICIANS AND TRADES WORKERS
31 ENGINEERING, ICT AND SCIENCE TECHNICIANS
311 Agricultural, Medical and Science Technicians
3111 Agricultural Technicians
3112 Medical Technicians
3113 Primary Products Inspectors
3114 Science Technicians
312 Building and Engineering Technicians
3121 Architectural, Building and Surveying Technicians
3122 Civil Engineering Draftspersons and Technicians
3123 Electrical Engineering Draftspersons and Technicians
3124 Electronic Engineering Draftspersons and Technicians
3125 Mechanical Engineering Draftspersons and Technicians
3126 Safety Inspectors
3129 Other Building and Engineering Technicians
313 ICT and Telecommunications Technicians
3131 ICT Support Technicians
3132 Telecommunications Technical Specialists
32 AUTOMOTIVE AND ENGINEERING TRADES WORKERS
321 Automotive Electricians and Mechanics
3211 Automotive Electricians
3212 Motor Mechanics
322 Fabrication Engineering Trades Workers
3221 Metal Casting, Forging and Finishing Trades Workers
3222 Sheetmetal Trades Workers
3223 Structural Steel and Welding Trades Workers
323 Mechanical Engineering Trades Workers
3231 Aircraft Maintenance Engineers
3232 Metal Fitters and Machinists
3233 Precision Metal Trades Workers
3234 Toolmakers and Engineering Patternmakers
324 Panelbeaters, and Vehicle Body Builders, Trimmers and Painters
3241 Panelbeaters
3242 Vehicle Body Builders and Trimmers
3243 Vehicle Painters
33 CONSTRUCTION TRADES WORKERS
331 Bricklayers, and Carpenters and Joiners
3311 Bricklayers and Stonemasons
3312 Carpenters and Joiners
332 Floor Finishers and Painting Trades Workers
3321 Floor Finishers
3322 Painting Trades Workers

333 Glaziers, Plasterers and Tilers
3331 Glaziers
3332 Plasterers
3333 Roof Tilers
3334 Wall and Floor Tilers
334 Plumbers
3341 Plumbers
34 ELECTROTECHNOLOGY AND TELECOMMUNICATIONS TRADES WORKERS
341 Electricians
3411 Electricians
342 Electronics and Telecommunications Trades Workers
3421 Airconditioning and Refrigeration Mechanics
3422 Electrical Distribution Trades Workers
3423 Electronics Trades Workers
3424 Telecommunications Trades Workers
35 FOOD TRADES WORKERS
351 Food Trades Workers
3511 Bakers and Pastrycooks
3512 Butchers and Smallgoods Makers
3513 Chefs
3514 Cooks
36 SKILLED ANIMAL AND HORTICULTURAL WORKERS
361 Animal Attendants and Trainers, and Shearers
3611 Animal Attendants and Trainers
3612 Shearers
3613 Veterinary Nurses
362 Horticultural Trades Workers
3621 Florists
3622 Gardeners
3623 Greenkeepers
3624 Nurserypersons
39 OTHER TECHNICIANS AND TRADES WORKERS
391 Hairdressers
3911 Hairdressers
392 Printing Trades Workers
3921 Print Finishers and Screen Printers
3922 Graphic Pre-press Trades Workers
3923 Printers
393 Textile, Clothing and Footwear Trades Workers
3931 Canvas and Leather Goods Makers
3932 Clothing Trades Workers
3933 Upholsterers

394 Wood Trades Workers
3941 Cabinetmakers
3942 Wood Machinists and Other Wood Trades Workers
399 Miscellaneous Technicians and Trades Workers
3991 Boat Builders and Shipwrights
3992 Chemical, Gas, Petroleum and Power Generation Plant Operators
3993 Gallery, Library and Museum Technicians
3994 Jewellers
3995 Performing Arts Technicians
3996 Signwriters
3999 Other Miscellaneous Technicians and Trades Workers
4 COMMUNITY AND PERSONAL SERVICE WORKERS
41 HEALTH AND WELFARE SUPPORT WORKERS
411 Health and Welfare Support Workers
4111 Ambulance Officers and Paramedics
4112 Dental Hygienists, Technicians and Therapists
4113 Diversional Therapists
4114 Enrolled and Mothercraft Nurses
4115 Indigenous Health Workers
4116 Massage Therapists
4117 Welfare Support Workers
42 CARERS AND AIDES
421 Child Carers
4211 Child Carers
422 Education Aides
4221 Education Aides
423 Personal Carers and Assistants
4231 Aged and Disabled Carers
4232 Dental Assistants
4233 Nursing Support and Personal Care Workers
4234 Special Care Workers
43 HOSPITALITY WORKERS
431 Hospitality Workers
4311 Bar Attendants and Baristas
4312 Cafe Workers
4313 Gaming Workers
4314 Hotel Service Managers
4315 Waiters
4319 Other Hospitality Workers

44 PROTECTIVE SERVICE WORKERS
441 Defence Force Members, Fire Fighters and Police
4411 Defence Force Members - Other Ranks
4412 Fire and Emergency Workers
4413 Police
442 Prison and Security Officers
4421 Prison Officers
4422 Security Officers and Guards
45 SPORTS AND PERSONAL SERVICE WORKERS
451 Personal Service and Travel Workers
4511 Beauty Therapists
4512 Driving Instructors
4513 Funeral Workers
4514 Gallery, Museum and Tour Guides
4515 Personal Care Consultants
4516 Tourism and Travel Advisers
4517 Travel Attendants
4518 Other Personal Service Workers
452 Sports and Fitness Workers
4521 Fitness Instructors
4522 Outdoor Adventure Guides
4523 Sports Coaches, Instructors and Officials
4524 Sportspersons
5 CLERICAL AND ADMINISTRATIVE WORKERS
51 OFFICE MANAGERS AND PROGRAM ADMINISTRATORS
511 Contract, Program and Project Administrators
5111 Contract, Program and Project Administrators
512 Office and Practice Managers
5121 Office Managers
5122 Practice Managers
52 PERSONAL ASSISTANTS AND SECRETARIES
521 Personal Assistants and Secretaries
5211 Personal Assistants
5212 Secretaries
53 GENERAL CLERICAL WORKERS
531 General Clerks
5311 General Clerks

532 Keyboard Operators
5321 Keyboard Operators
54 INQUIRY CLERKS AND RECEPTIONISTS
541 Call or Contact Centre Information Clerks
5411 Call or Contact Centre Workers
5412 Inquiry Clerks
542 Receptionists
5421 Receptionists
55 NUMERICAL CLERKS
551 Accounting Clerks and Bookkeepers
5511 Accounting Clerks
5512 Bookkeepers
5513 Payroll Clerks
552 Financial and Insurance Clerks
5521 Bank Workers
5522 Credit and Loans Officers (Aus) / Finance Clerks (NZ)
5523 Insurance, Money Market and Statistical Clerks
56 CLERICAL AND OFFICE SUPPORT WORKERS
561 Clerical and Office Support Workers
5611 Betting Clerks
5612 Couriers and Postal Deliverers
5613 Filing and Registry Clerks
5614 Mail Sorters
5615 Survey Interviewers
5616 Switchboard Operators
5619 Other Clerical and Office Support Workers
59 OTHER CLERICAL AND ADMINISTRATIVE WORKERS
591 Logistics Clerks
5911 Purchasing and Supply Logistics Clerks
5912 Transport and Despatch Clerks
599 Miscellaneous Clerical and Administrative Workers
5991 Conveyancers and Legal Executives
5992 Court and Legal Clerks
5993 Debt Collectors
5994 Human Resource Clerks
5995 Inspectors and Regulatory Officers
5996 Insurance Investigators, Loss Adjusters and Risk Surveyors
5997 Library Assistants
5999 Other Miscellaneous Clerical and Administrative Workers

6 SALES WORKERS
61 SALES REPRESENTATIVES AND AGENTS
611 Insurance Agents and Sales Representatives
6111 Auctioneers, and Stock and Station Agents
6112 Insurance Agents
6113 Sales Representatives
612 Real Estate Sales Agents
6121 Real Estate Sales Agents
62 SALES ASSISTANTS AND SALESPERSONS
621 Sales Assistants and Salespersons
6211 Sales Assistants (General)
6212 ICT Sales Assistants
6213 Motor Vehicle and Vehicle Parts Salespersons
6214 Pharmacy Sales Assistants
6215 Retail Supervisors
6216 Service Station Attendants
6217 Street Vendors and Related Salespersons
6219 Other Sales Assistants and Salespersons
63 SALES SUPPORT WORKERS
631 Checkout Operators and Office Cashiers
6311 Checkout Operators and Office Cashiers
639 Miscellaneous Sales Support Workers
6391 Models and Sales Demonstrators
6392 Retail and Wool Buyers
6393 Telemarketers
6394 Ticket Salespersons
6395 Visual Merchandisers
6399 Other Sales Support Workers

7 MACHINERY OPERATORS AND DRIVERS
71 MACHINE AND STATIONARY PLANT OPERATORS
711 Machine Operators
7111 Clay, Concrete, Glass and Stone Processing Machine Operators
7112 Industrial Spraypainters
7113 Paper and Wood Processing Machine Operators
7114 Photographic Developers and Printers
7115 Plastics and Rubber Production Machine Operators
7116 Sewing Machinists
7117 Textile and Footwear Production Machine Operators
7119 Other Machine Operators
712 Stationary Plant Operators
7121 Crane, Hoist and Lift Operators

7122 Drillers, Miners and Shot Firers
7123 Engineering Production Workers
7129 Other Stationary Plant Operators
72 MOBILE PLANT OPERATORS
721 Mobile Plant Operators
7211 Agricultural, Forestry and Horticultural Plant Operators
7212 Earthmoving Plant Operators
7213 Forklift Drivers
7219 Other Mobile Plant Operators
73 ROAD AND RAIL DRIVERS
731 Automobile, Bus and Rail Drivers
7311 Automobile Drivers
7312 Bus and Coach Drivers
7313 Train and Tram Drivers
732 Delivery Drivers
7321 Delivery Drivers
733 Truck Drivers
7331 Truck Drivers
74 STOREPERSONS
741 Storepersons
7411 Storepersons
8 LABOURERS
81 CLEANERS AND LAUNDRY WORKERS
811 Cleaners and Laundry Workers
8111 Car Detailers
8112 Commercial Cleaners
8113 Domestic Cleaners
8114 Housekeepers
8115 Laundry Workers
8116 Other Cleaners
82 CONSTRUCTION AND MINING LABOURERS
821 Construction and Mining Labourers
8211 Building and Plumbing Labourers
8212 Concreters
8213 Fencers
8214 Insulation and Home Improvement Installers
8215 Paving and Surfacing Labourers
8216 Railway Track Workers
8217 Structural Steel Construction Workers
8219 Other Construction and Mining Labourers

83 FACTORY PROCESS WORKERS
831 Food Process Workers
8311 Food and Drink Factory Workers
8312 Meat Boners and Slicers, and Slaughterers
8313 Meat, Poultry and Seafood Process Workers
832 Packers and Product Assemblers
8321 Packers
8322 Product Assemblers
839 Miscellaneous Factory Process Workers
8391 Metal Engineering Process Workers
8392 Plastics and Rubber Factory Workers
8393 Product Quality Controllers
8394 Timber and Wood Process Workers
8399 Other Factory Process Workers
84 FARM, FORESTRY AND GARDEN WORKERS
841 Farm, Forestry and Garden Workers
8411 Aquaculture Workers
8412 Crop Farm Workers
8413 Forestry and Logging Workers
8414 Garden and Nursery Labourers
8415 Livestock Farm Workers
8416 Mixed Crop and Livestock Farm Workers
8419 Other Farm, Forestry and Garden Workers
85 FOOD PREPARATION ASSISTANTS
851 Food Preparation Assistants
8511 Fast Food Cooks
8512 Food Trades Assistants
8513 Kitchenhands
89 OTHER LABOURERS
891 Freight Handlers and Shelf Fillers
8911 Freight and Furniture Handlers
8912 Shelf Fillers
899 Miscellaneous Labourers
8991 Caretakers
8992 Deck and Fishing Hands
8993 Handypersons
8994 Motor Vehicle Parts and Accessories Fitters
8995 Printing Assistants and Table Workers
8996 Recycling and Rubbish Collectors
8997 Vending Machine Attendants
8999 Other Miscellaneous Labourers

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