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.

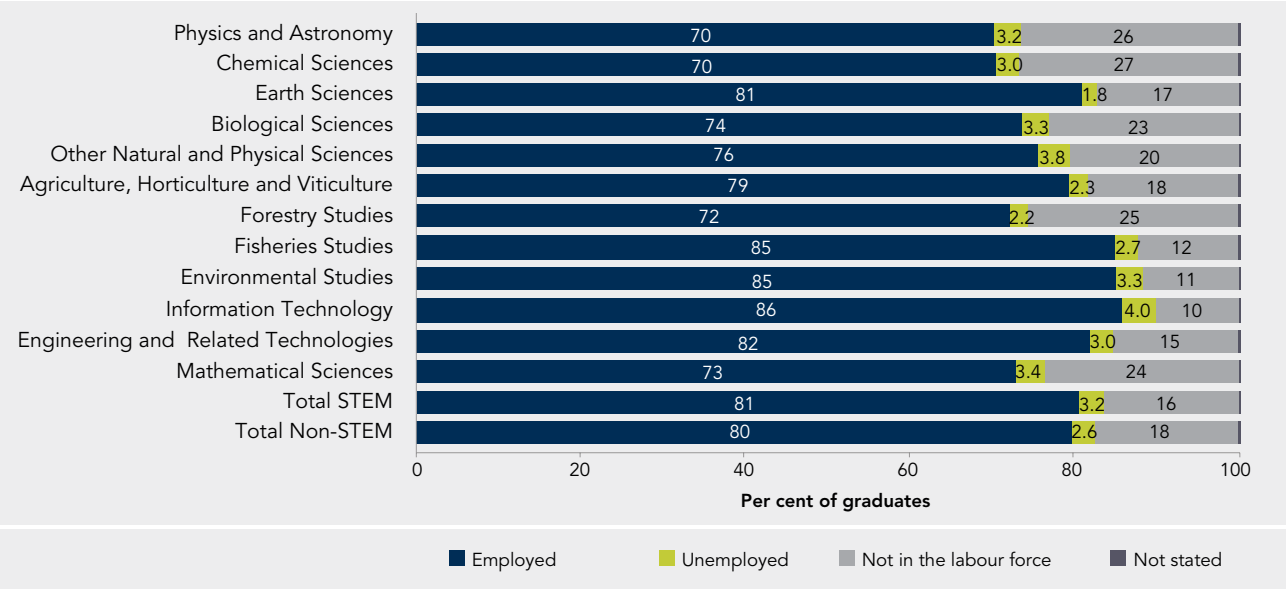
Table 4.1: Number of individuals with qualifications at the bachelor level and above, by highest level of qualification and field

	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

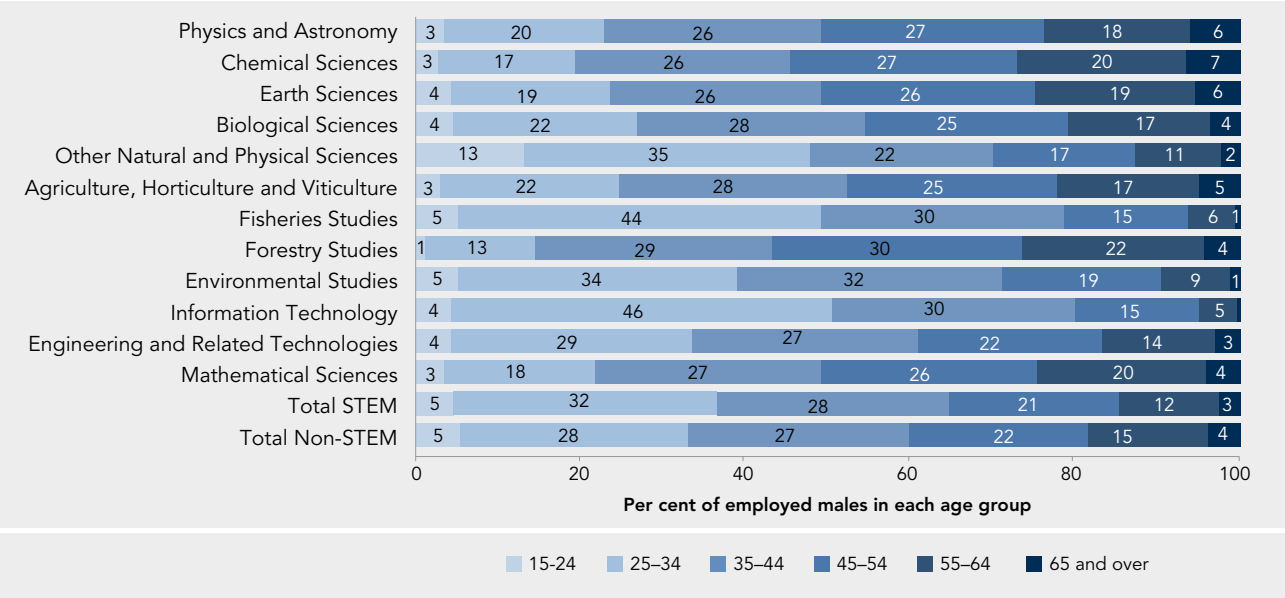


Figure 4.3: Age distribution of employed female graduates, by field

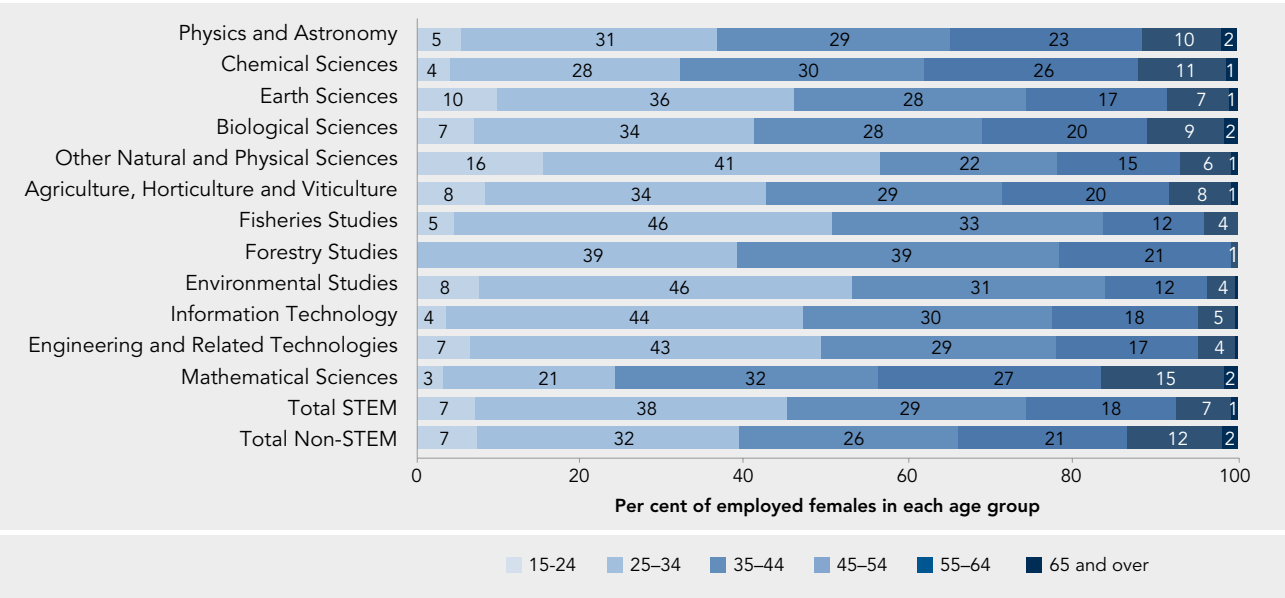


Figure 4.4: Skewness of the age distribution pattern of male STEM graduates, by field

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

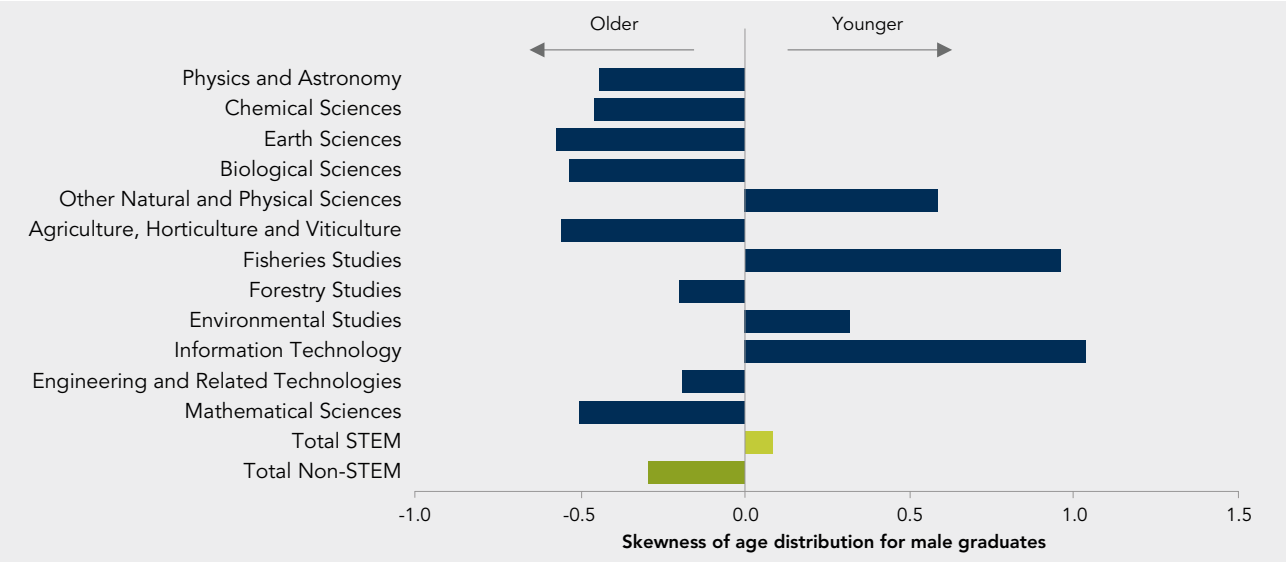
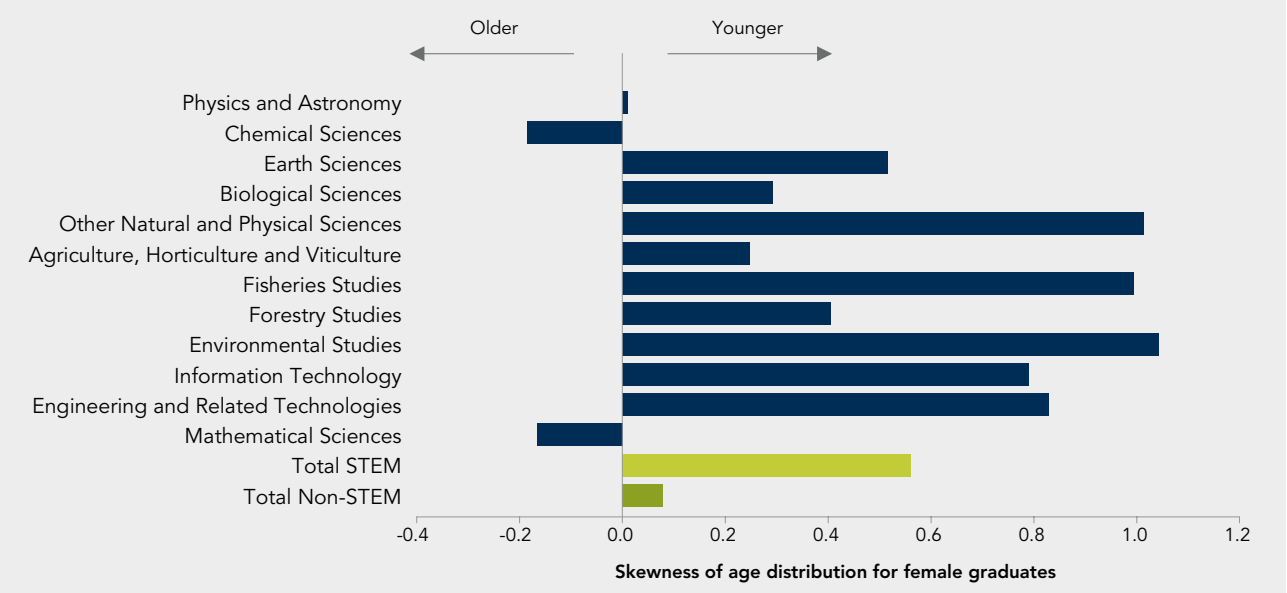


Figure 4.5: Skewness of the age distribution pattern of female STEM graduates, by field

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).

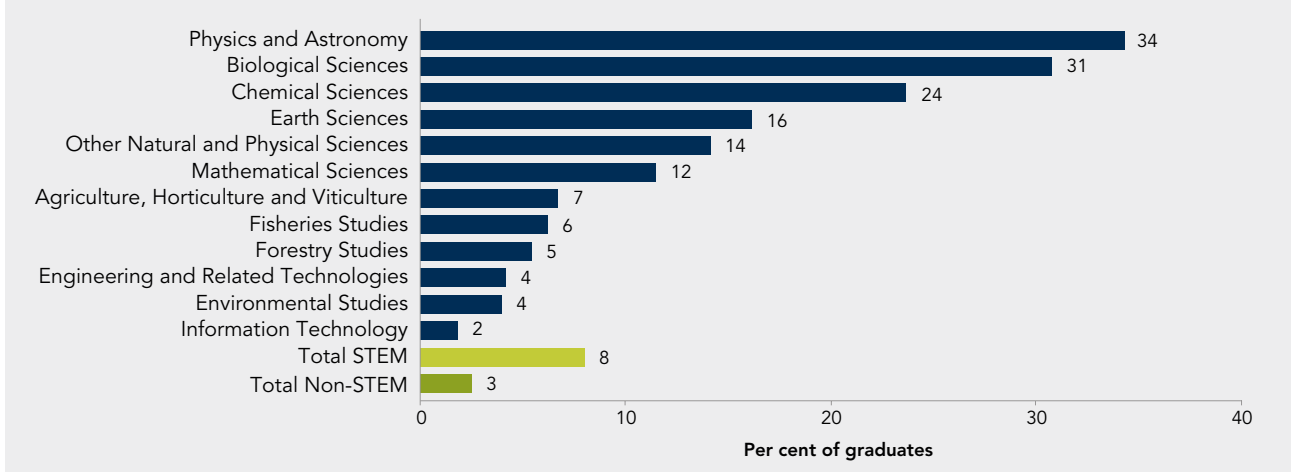
Generally, graduates in the workforce with qualifications in the Sciences fields were more likely to have doctorates than those in the other STEM fields; particularly in Physics and Astronomy, Biological Sciences and Chemical Sciences graduates (34, 31 and 24 per cent, respectively). In contrast, only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

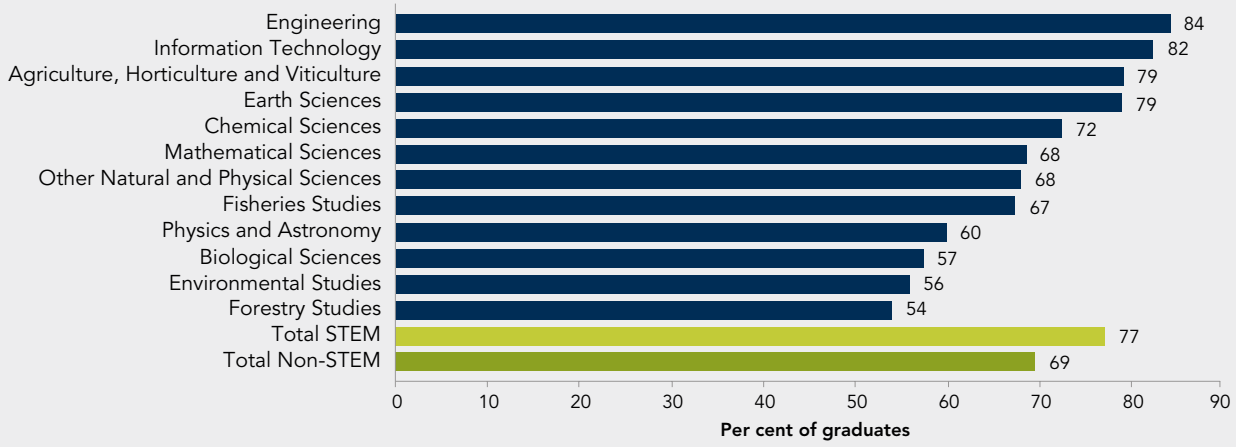


Figure 4.8: Percentage of doctorates employed in the private sector, by field

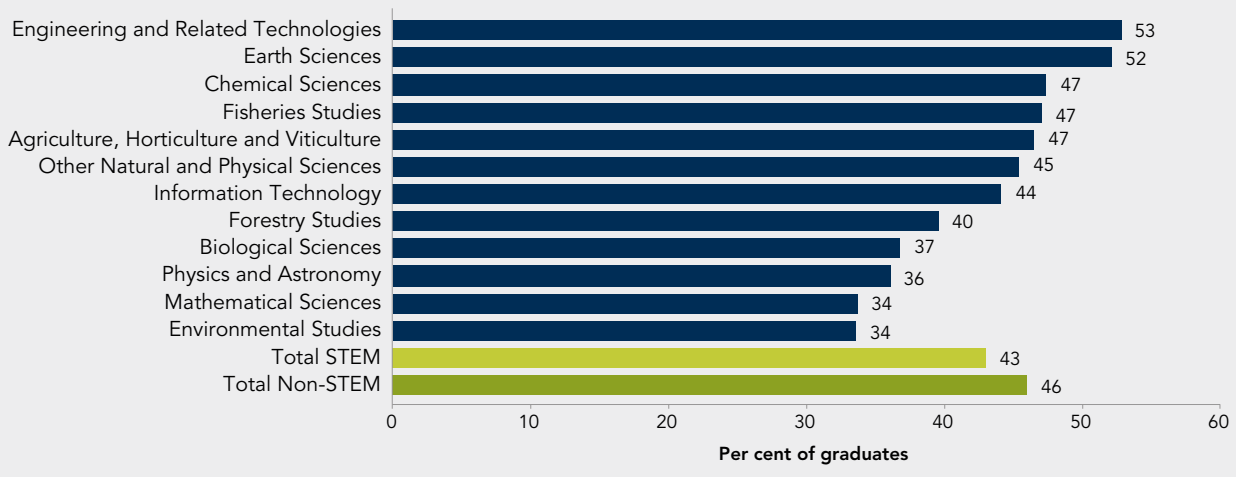
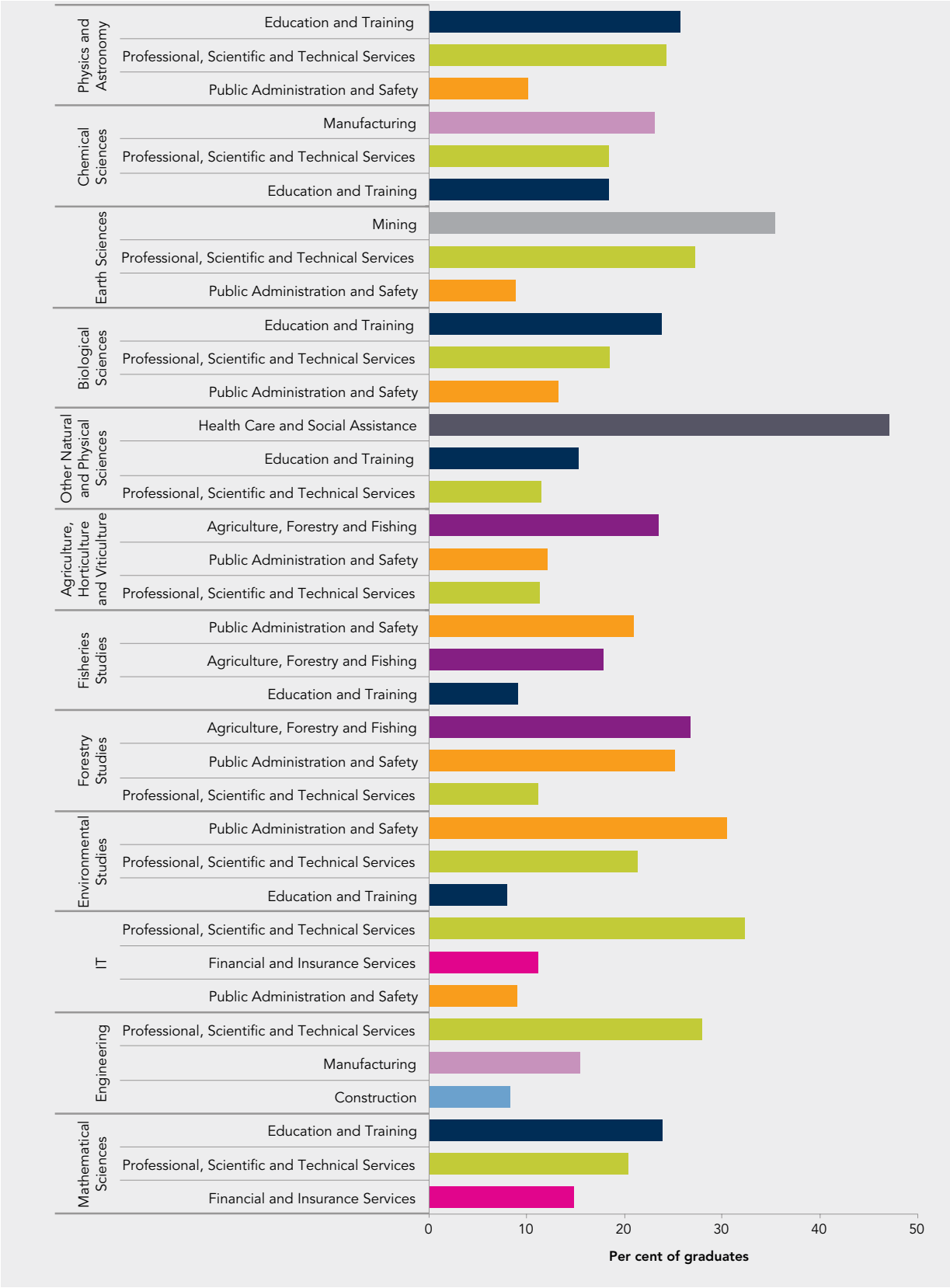


Figure 4.9: Top three industry divisions for graduate employment, by field



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

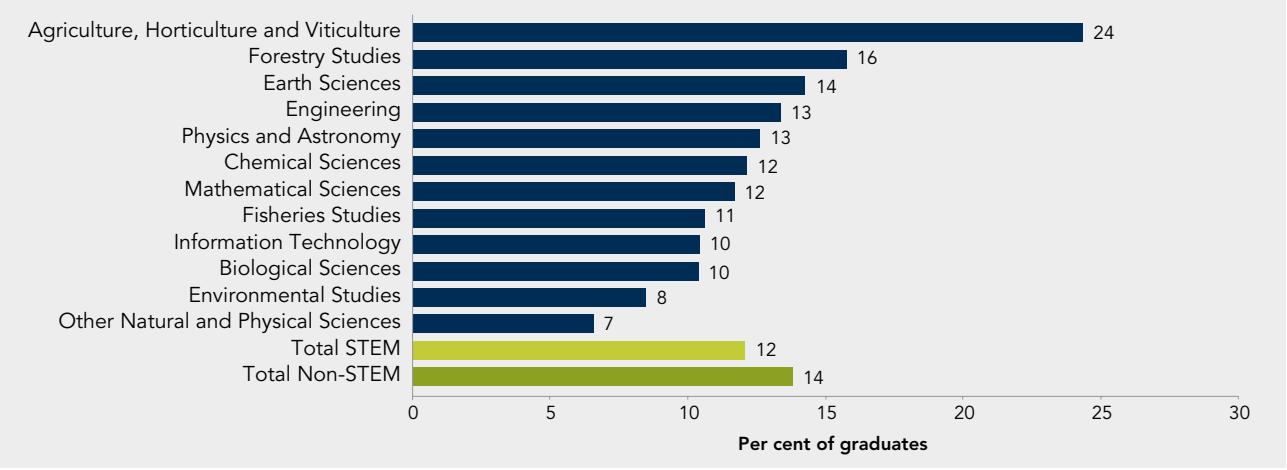


Figure 4.13: Percentage of graduates who were business owners employing more than 20 individuals, by field

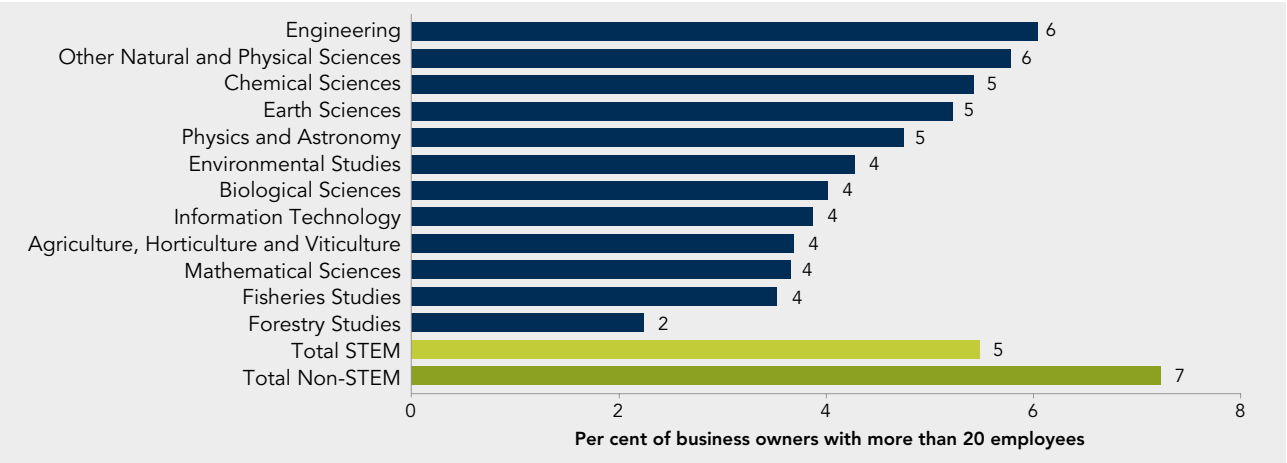


Figure 4.14: Top three unit group level occupations, by field

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%

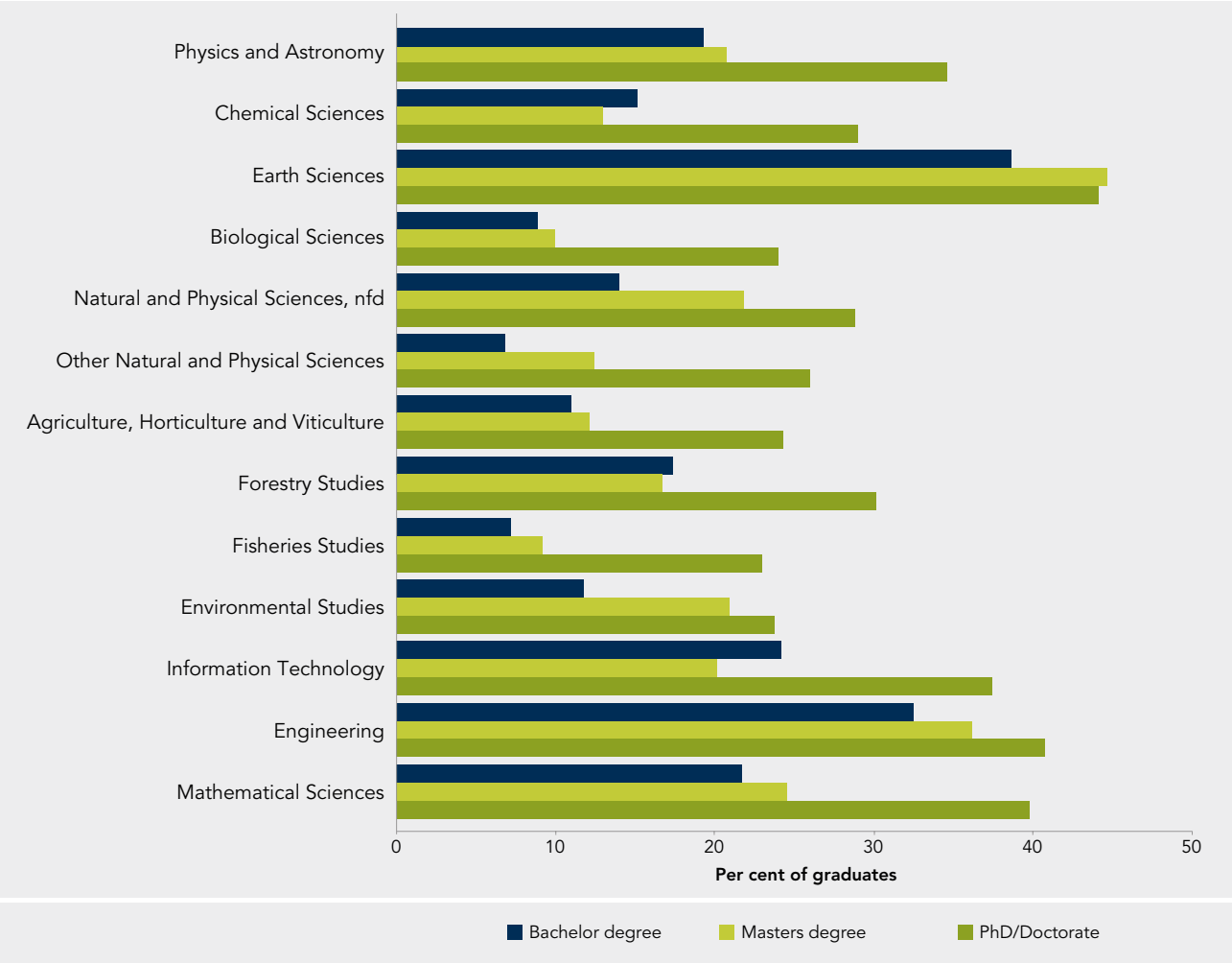
of Non-STEM graduates who owned a business, owned a large business. Only Engineering and Other Natural and Physical Sciences exceeded the average, at 6.0 and 5.8 per cent, respectively.

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



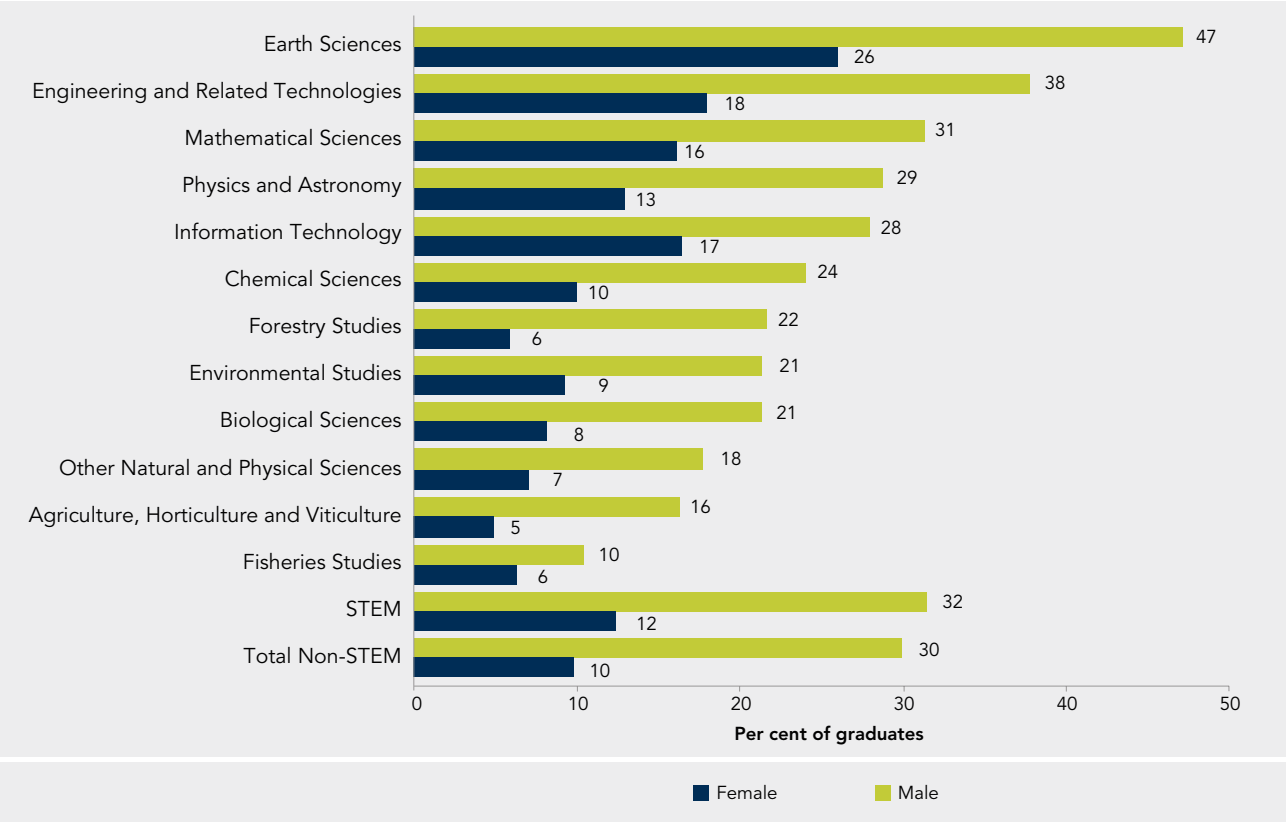
Occupations are classified in five levels (ABS, 2013):

- 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

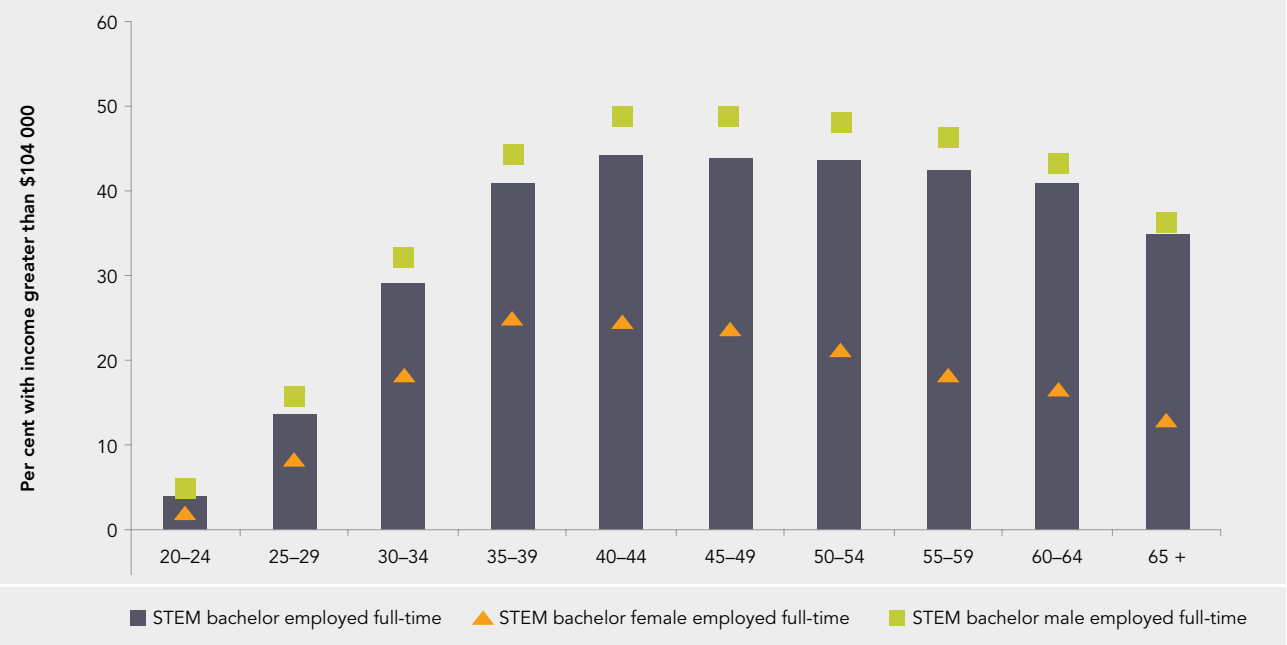


Figure 4.18: Percentage of doctorate level STEM graduates working full-time who earned greater than $104 000 annually, by age group and gender

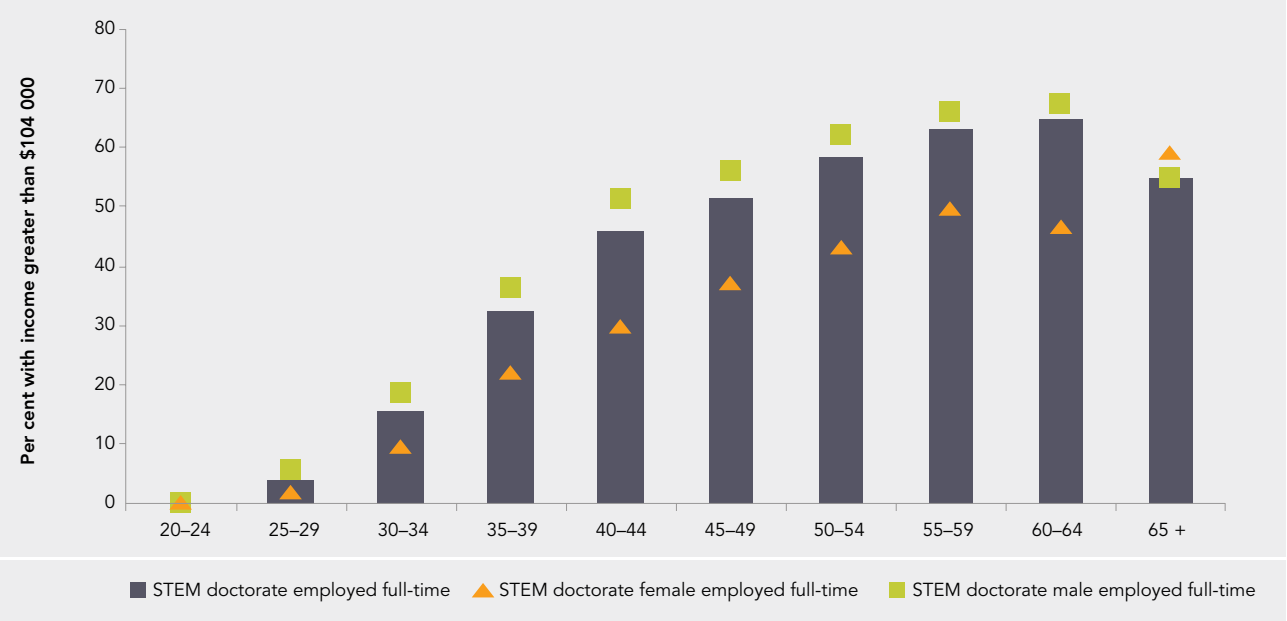


Figure 4.19: Percentage of bachelor level STEM graduates working part-time who earned greater than $104 000 annually, by age group and gender

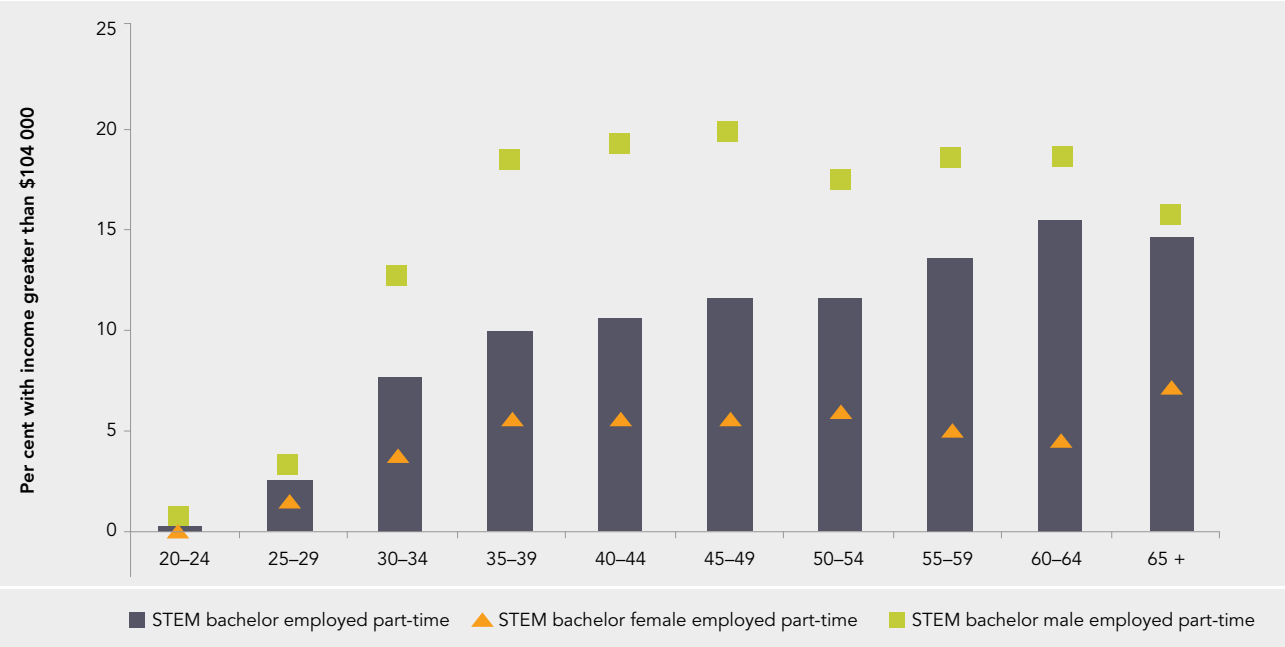
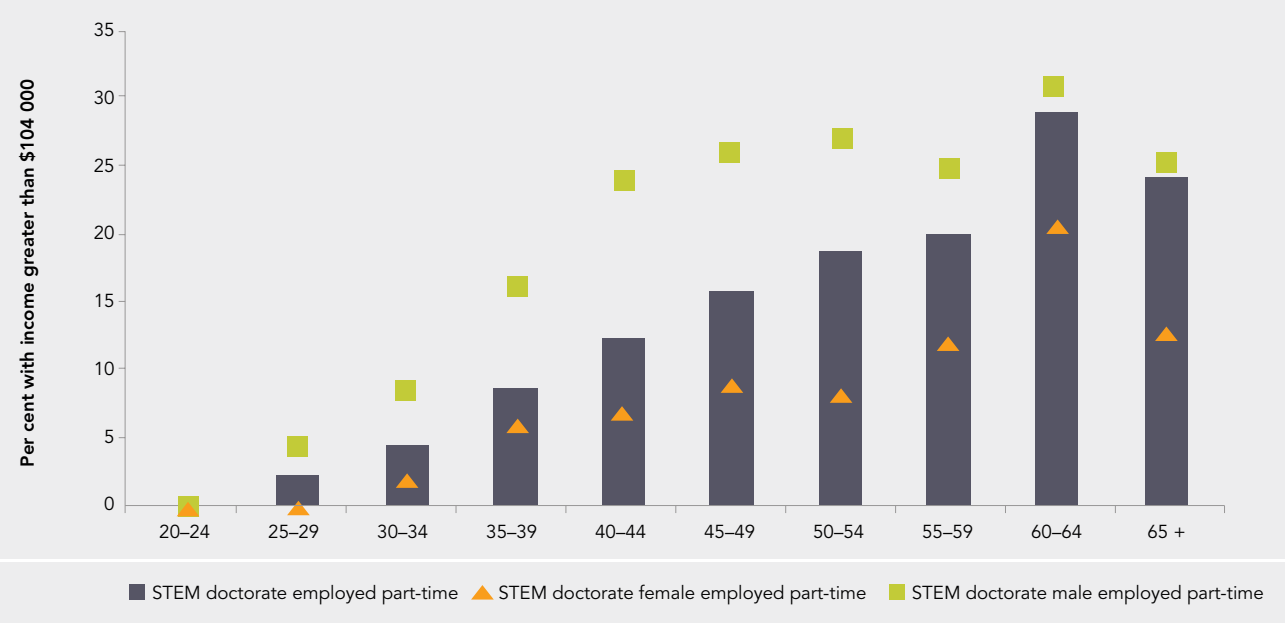


Figure 4.20: Percentage of doctorate level STEM graduates working part-time who earned greater than $104 000 annually, by age group and gender



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.

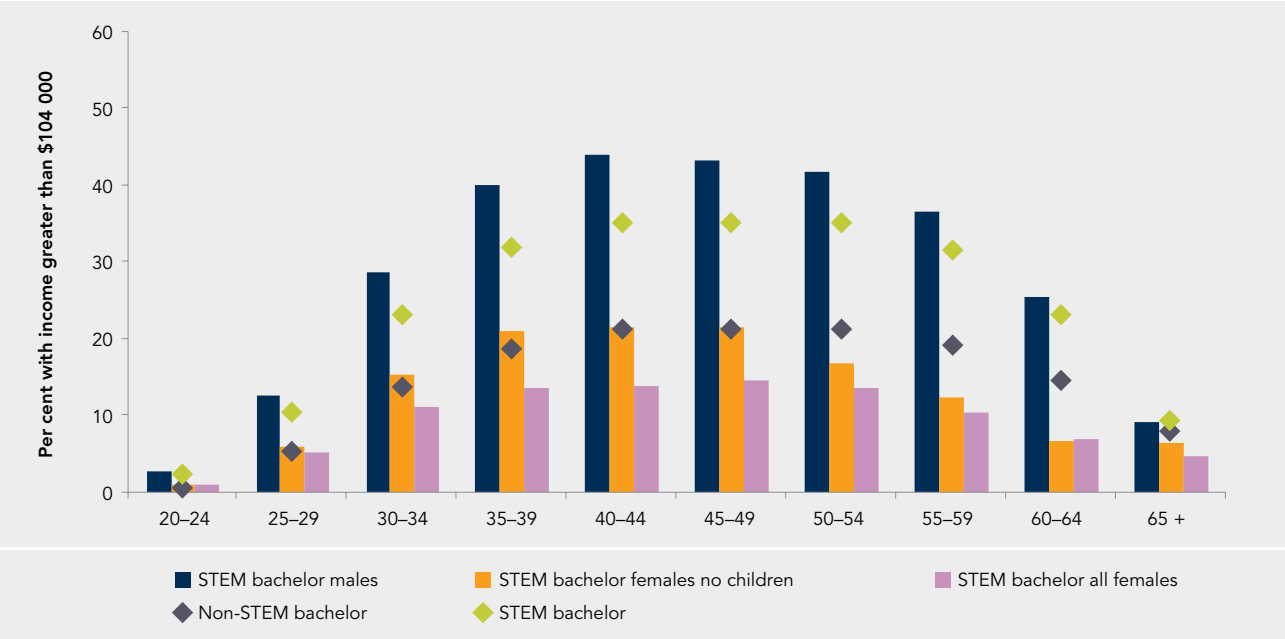
Data was not available to compare the incomes of male graduates with and without children. For the ease of discussion in this report, females who have never given birth to a live child are termed 'females with no children'

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.

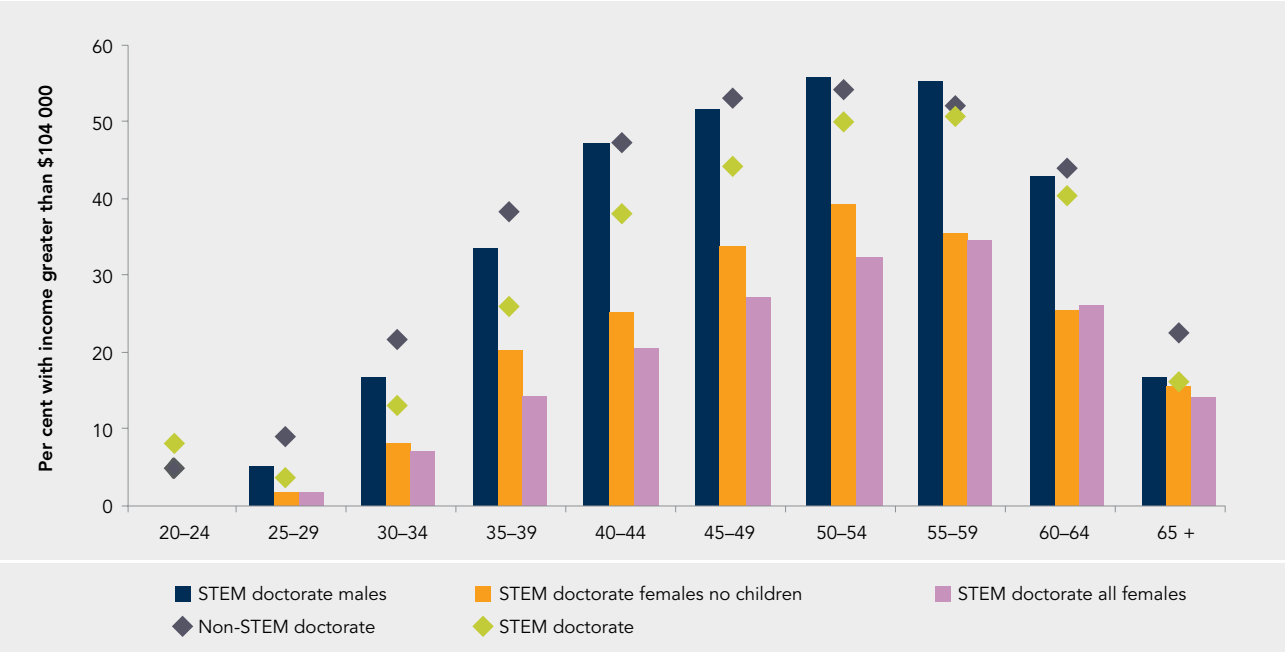
Amongst female graduates with no children, the percentage in the top income bracket was slightly higher than for females as a whole (with the exception of the 60 to 64 age group) but still much lower than for males.

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.