

University IT graduates for ICT occupations in Victoria 2008 to 2022

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Executive summary

This report assesses supply and demand for people in information and communication technology (ICT) occupations¹ in Victoria from 2008 to 2022. In particular, it estimates the shortfall or surplus of people with university information technology (IT) qualifications for these occupations.

Context

Victoria's employment is projected to grow almost 14 per cent from 2.53 million in 2007 to 2.88 million by 2022.

As the state competes in the global economy, the industrial structure of its economy has been transforming from a manufacturing base to services and to activities emphasising innovation. ICT skills of the workforce will be critical in this new phase.

This is causing a shift in the occupational structure of Victoria's workforce. Employment in ICT occupations is projected to increase from 103,000 in 2007 to 135,000 in 2022, a rise of 30 per cent.

Employment is increasing faster in occupations requiring people with qualifications, particularly at the higher level. In many occupations, there is evidence of *skills deepening*, meaning the growth in the number of people with qualifications is faster than employment growth.

Enrolments in IT courses in Victorian universities fell 20 per cent from 2001 to 2006. Course completions, which lag behind enrolments, increased until 2003 but fell each year after that.

Had it not been for international students the decline in enrolments would be even sharper.² Nearly 60 per cent of all enrolments in IT courses were by international students in 2006. Changes in Australia's skilled migration programmes, including temporary migration, are probably partly responsible for the increase in international student enrolments.

Requirements in ICT occupations of people with qualifications from 2008 to 2022

If the trend in skills deepening continues, more than 90 per cent of employed people in ICT occupations in Victoria will have qualifications in 2022, compared to about 80 per cent in 2007. Two out of every three of them will have the qualification at the higher education level.

To meet the requirements for people with qualifications in these occupations resulting from employment growth, turnover in jobs and skills deepening, an estimated 71,000 will need to acquire qualifications from 2008 to 2022—43,000 with higher education and 28,000 with VET qualifications.

Note that new entrants and existing workers will additionally acquire skills that are not formally accredited, or are at a level lower or the same as that of their current highest qualification. In the ICT sector, because of rapid advances in technology, a high level of skill development activity of this type can be expected.

¹ The list of ICT occupations and their ANZSCO codes are included in Appendix 1.

² There is some evidence that enrolments may be stabilising though.

Projections of university IT course completions from 2008 to 2022

If commencements in higher education IT courses remain at current levels, then Victoria will produce about 61,200 IT graduates from 2008 to 2022—37 per cent with postgraduate qualifications, 61 per cent with bachelor degrees and a small proportion with graduate diplomas and graduate certificates. Overall, about two-thirds of all completions will be by international students. At the postgraduate level, international students will make up 80 per cent of all completions.

Which university graduates are employed in ICT occupations?

Graduates employed in ICT occupations have qualifications in a range of fields, not just in IT. In 2006, ICT occupations employed about 2,900 people who had graduated from Victorian universities in 2005. Of these:

- about 1,100 (37 per cent) were international students
 - about 1,800 (63 per cent) were employed in Victoria—1,400 domestic and 400 international graduates
 - most were employed in a managerial or professional capacity, but about 10 per cent were employed in technician or trade occupations
 - about 1,400 (49 per cent) had qualifications in IT. The qualifications of the rest were mostly in engineering, management and commerce or humanities (some of which might have included some IT skills).
-

Where do IT graduates from higher education go?

The labour market destinations of IT graduates are varied. More than 6,300 people with a main qualification in IT graduated from Victorian universities in 2005. Of these:

- about 3,900 (62 per cent) were employed in 2006—2,700 in Victoria
 - about 1,400 (36 per cent) were employed in ICT occupations in 2006—900 in Victoria
 - about 2,400 (39 per cent) were domestic students—79 per cent were working (32 per cent in ICT occupations and 47 per cent in other occupations) and 21 per cent were not working (8 per cent studying and 13 per cent not studying)
 - about 3,900 (61 per cent) were international students—48 per cent were working (11 per cent in ICT occupations and 37 per cent in other occupations) and 52 per cent were not working.³
-

Of the IT graduates from Australian universities, how many are potentially available for ICT occupations in Victoria?

The sources of supply of IT graduates for ICT occupations in Victoria are (domestic and international) graduates from Victorian and interstate universities and Australia's various migration programmes.

Excluding migration programmes, two scenarios for potential supply are outlined below.

³ Among domestic graduates not working, 39 per cent were engaged in further study, compared to 52 per cent among international graduates.

Base scenario

ICT occupations in Victoria employed 900 people who graduated with IT qualifications from Victorian universities in 2005 together with another 100 from interstate universities.

Part of the 2005 cohort of IT graduates, from both Victorian and interstate universities, resident in Victoria were neither working nor studying in 2006. While some of them may have left the labour force altogether, others could be looking for jobs in ICT occupations. Adding those looking for jobs to the 900 already working in ICT occupations provides an indication of the potential supply of IT graduates for these occupations in Victoria.

Assuming 80 per cent of domestic and 25 per cent of international graduates neither working nor studying are available for ICT occupations, the potential supply is then estimated to be about 1,300.

Alternative scenario

A significant part of the 2005 cohort of IT graduates found employment in non-ICT occupations in 2006. Many of these jobs were in low-skill occupations.⁴ Some graduates are probably in these jobs only temporarily while they search for jobs in ICT occupations. It can therefore be argued that they should be part of the potential supply for ICT occupations.

Assuming a fraction (50 per cent domestic and 40 per cent international) of IT graduates working in non-ICT occupations in Victoria are still actively searching for ICT jobs, the potential supply for ICT occupations then increases from 1,300 (base scenario) to about 2,000.

Shortfall/surplus in IT qualifications for ICT occupations from 2008 to 2022

In assessing whether there will be a shortfall or surplus in the number of IT graduates available for ICT occupations in Victoria from 2008 to 2022, the following assumptions were made:

- the current pattern of demand for IT graduates in ICT occupations will continue
- the current pattern of labour force and occupational destinations of IT graduates from Australian universities will continue
- commencements in IT courses in Australian universities will stabilise at levels recorded recently
- the net gain to Victoria of people with IT qualifications from Australia's migration programmes will continue at levels recorded recently.

Base scenario

If the supply of IT graduates for ICT occupations in Victoria continues as estimated in the base scenario, shortfall of 3,700 graduates is projected for Victoria from 2008 to 2022.

Alternative scenario

On the other hand, if supply continues as estimated in the alternative scenario, surplus of 3,100 graduates is projected.

⁴ Among domestic graduates from Victorian universities working in non-ICT occupations in Victoria, 49 per cent were not in a managerial, professional, technician or trade occupation. The proportion was 68 per cent among international graduates.

Final remarks

The labour market for IT workers is dynamic, which makes assessing imbalances in the supply and demand problematic. The assessments made in this report are, therefore, tentative. They assume relative salaries in ICT occupations compared to other occupations remaining at current levels.

The projections in this report are based on Victoria's employment growing at 0.9 per cent year to 2022. If labour force participation rate increases above that assumed in this report, then overall employment growth is likely to be higher. This could mean higher requirements in ICT occupations and, hence, under the base scenario, a bigger shortfall in the number of people with IT qualifications.

Some international IT graduates find it difficult to secure jobs in ICT occupations in Victoria. The reasons for this need investigation with the aim of developing policies to help them adjust to the local labour market. The success of such programmes has the potential to improve labour supply of IT skills.

The fall in domestic student enrolments in IT courses in Victoria since 2001 has been quite significant. The flight of domestic students from IT courses partly reflects the conditions of the ICT labour market, and the media attention it received following the collapse of the dotcom bubble at the beginning of the decade. Employment in ICT occupations remained largely unchanged from 2001 to 2007 and earnings for computing professionals increased by less than in other professional occupations. At the same time, international student enrolments as a proportion of all enrolments in IT courses increased from 42 to 57 per cent from 2001 to 2006, although in the last two years there has been a slowing in the rate of growth. An increasing number of international students have been opting to work in Victoria after graduation and apply onshore for residency under the skilled migration or temporary migration programmes. Offshore applicants to these programmes add to the total supply of IT graduates available. The relationship between the fall in domestic students' interest in IT courses and these other factors need investigation.

1 Introduction

In 2007, *Industry demand for higher education graduates in Victoria 2008–2022* reported on the demand for, and supply of, higher education graduates aggregated across all occupations. This report's focus is on information and communication technology (ICT) occupations. It assesses the demand for, and supply of, people with higher education qualifications in these occupations in Victoria from 2008 to 2022.

More specifically, it provides for Victoria projections of:

- the qualification and occupation profile of the ICT workforce in 2022
- additional number of people with higher education qualifications who will be required in ICT occupations to achieve the 2022 qualification profile
- IT graduate numbers from Victorian and interstate universities for ICT occupations from 2008 to 2022
- shortfall or surplus of IT graduates for ICT occupations from 2008 to 2022.

OECD (2006) defines three categories of ICT-skilled employment:

1. ICT specialists, who have the ability to develop, operate and maintain ICT systems. ICT constitute the main part of their job.
2. Advanced users: who competently use advanced, and often sector-specific, software tools. ICTs are tools of their trade.
3. Basic users: competent users of generic tools (e.g. Microsoft Word™, Excel™, Outlook™, PowerPoint™) needed for the information society, e-government and working life. Here too, ICTs are tools, not the main job.

Thus, the first category covers those who supply ICT tools (hardware and software) and services, and the second and third categories those who use them. It appears that, increasingly, ICT specialists are expected to have ICT specialist as well as other skills, including “business” skills. Similarly, non-ICT related professions increasingly require at least basic ICT user skills.

ICT specialists' share of employment in most OECD countries, including Australia, is around 3 to 4 per cent and increasing. ICT-skilled workers' (the broader group that includes all three above categories) share of employment accounts for about 20–30 percent of total employment in most OECD countries. While most countries experienced an increase in the share of ICT-skilled employment from 1995 to 2004, some, including Australia, United States and Canada, experienced a slight decline (OECD 2006).

This report is about ICT specialists' workforce. It spans many occupations from the ICT managers to electrical and communications trades assistants. The range of skills required to practise in these occupations vary from highly specialised, high-level skills to basic vocational skills. Note that not all skills acquired by ICT workers are obtained from formal training as many are acquired outside the formal education and training system.

1.1 Background

ICT, including ICT skills and employment, has emerged as a major factor contributing to economic growth and increased productivity in the last 50 years. It has had significant influence on business restructuring. In Australia, the contribution of ICT investment to GDP growth increased from just over 0.5 per cent in the 1990–1995 period to over 0.9 per cent in the 1995–2002 period (OECD 2005). Furthermore, ICT now plays a central role in the innovation process across the whole economy (DCITA 2007).

The demand for ICT workers worldwide, including in Victoria grew significantly from 1997 to 2001. In many developed countries demand however declined from 2001 to 2003. In Victoria, demand declined after 2003 and only began to pick up after 2005 (ABS 1997-2007).

Since the late 1990s, offshoring of ICT-enabled activities from the developed countries to developing countries has grown, in particular to India, which has had a large supply of skilled, low-cost and English-speaking workforce. Just like in many English-speaking countries, this has probably had an impact on demand in Victoria.

The downturn in demand between 2001 and 2003, associated with the bursting of the dotcom bubble, has been a major factor in the recent decline in the numbers of people enrolling in and completing ICT courses in Victoria, particularly at universities. At the same time, potential students' perception of the industry, in terms of providing good career prospects, also changed. The inflow of temporary workers, who were prepared to work under different conditions to local employees, may also have had an impact on career choices of domestic students.

In the last couple of years, employment of ICT specialists in Victoria has picked up. Research undertaken by the Victorian Labour Economics Office of the Department of Employment, Education and Workplace Relations shows internet ICT Vacancy count for Victoria increased about 33 per cent from June 2006 to June 2007, thus indicating a strengthening in the market for ICT specialists in the state.

1.1.1 Demand factors for qualified ICT specialists

Future demand for qualified ICT specialists will be generated by overall economic activity in Victoria and the state's long-term, ongoing transformation of its economic base from manufacturing to that focussing on innovation. In particular, demand will be generated by Government spending on, and private sector investment in, particular ICT projects and the adoption of ICT by business and households. The 2007–08 Victorian State budget included funding for \$95.3 million in ICT-related projects.

Examples of ICT businesses expanding their operations in Victoria since the middle of 2006 include:

- EMC Corporation, a multi-billion dollar global information management and storage company with expanding operations in Melbourne (50 new software development jobs will be created).
- Cybertrust, a global ICT security specialist, will expand its Melbourne Asia-Pacific headquarters over the next five years (up to 120 new jobs will be created).
- Freshtel Holdings, a Melbourne based ICT company, will increase its workforce after signing partnership with UK supermarket giant Tesco to facilitate the development of the necessary hardware, software and network to commercialise future internet phone services
- Satyam Computer Services, one of India's largest IT companies, will build a new software development and training campus at Geelong, creating 2000 jobs.

Rollout of broadband across Australia, which has the strong backing of the Australian and Victorian Governments, will no doubt increase the demand for ICT specialists in Victoria.

The introduction of the next generation in mobile phone technology, including wireless internet, by the major telecommunication companies will also add demand for ICT specialists.

Need to replace the net numbers of ICT specialists who leave the workforce will be additional to demand due to growth. Future net turnover largely depends on the age structure of current ICT occupations. The number of workers retiring will rise in the coming years as the baby boomer generation ages.

The trend towards part-time employment also creates additional needs simply because it means a larger number of people must be trained for a given level of equivalent full-time jobs. The ageing of the workforce is also likely to increase this trend towards part-time work.

A major reason for increasing demand for workers with qualifications is *skills deepening*. This refers to the percentage increase in the number of workers with qualifications after allowing for employment growth. In Victoria, while employment increased 7 per cent from 2001 to 2006, the number of people with qualifications increased 16 per cent. Thus, skills deepening could add to the demand for qualified ICT specialists.

Removing skills gaps in ICT occupations (where workers are under-skilled for the jobs they are employed in) or reducing skills shortages (where skilled jobs remain unfilled due to lack of trained people) can also add to demand. The considerable numbers of people who do not hold what are considered relevant qualifications (even in high-skill occupations) indicates possible skills gaps, although many of these unqualified workers have acquired skills in other ways.

The desirable level of qualified people in an occupation is also not static. If more workers with qualifications become available, and new work specifications and technologies are introduced to utilise their higher skills, productivity improvements will follow.

1.1.2 Supply factors for qualified ICT specialists

Future supply of people with higher education qualifications for ICT occupations in Victoria depends on two main factors: relevant course completions at Victorian and interstate universities and international migration.

The numbers of people completing ICT courses in universities depend on the number of places universities allocate in ICT courses, the impact of specific Government policies and the number of students applying for entry into ICT courses.

Student demand for ICT courses depends not only on how interesting students find these courses but also on their assessment of the relative private net returns (young people are likely to use wages relative to those in other occupations as a proxy for relative net returns) from doing such courses. In their assessment, students also include working conditions in the industry and other non-pecuniary benefits.

The supply to ICT occupations is also affected by the relatively low representation of women in these occupations. Under-representation in the workforce affects the potential supply.

Australian Government policies on skilled permanent and temporary migration means migration generally adds to the domestic supply of ICT specialists. In 2005–06, 38.6 per cent of ICT specialists working in Australia were born overseas compared to 25 per cent of all employed people (ABS 2006). Migration, and in particular temporary migration, if not managed properly has the potential to reduce domestic supply of labour in a given sector. This can happen if migration depresses wages and reduces conditions of work in the sector. As domestic labour flees from the sector, a dependency on migrant labour develops within the sector. Consequently, the local training market can come under considerable stress (Weinstein 2002).

1.2 Scope of this report

Chapter 2 describes the trends in the ICT workforce in Victoria from 2001 to 2007 by qualification, occupation and other demographic variables.

Chapter 3 forecasts employment in ICT occupations by occupation and qualification for 2022. It also assesses the additional people with qualifications who will be needed between now and then to achieve Victoria's projected qualifications profile in ICT occupations.

Chapter 4 describes the current patterns of supply of people with higher education qualifications for ICT occupations in Victoria. It also describes the labour market destinations of IT graduates, domestic and international, and the trends in the commencements, enrolment and completions of IT courses in Australian, particularly Victorian, universities. Different scenarios of potential supply of IT graduates for ICT occupations are provided.

Chapter 5 assesses the imbalance in the supply and requirements for people with IT qualifications for different scenarios of supply investigated in chapter 4.

Chapter 6 contains some concluding comments.

2 ICT workforce trends in Victoria, 2001–2007

This chapter describes the trends in employment in ICT occupations in Victoria from 2001 to 2007. The analysis uses data from the ABS *Survey of Education and Work* (Cat. no. 6227.0). The survey is administered in May each year. Note that in some occupations employment in May can be higher than the average for the year.

The trends are examined in terms of occupation, gender, age, qualification and hours of work (full-time/part-time status).

The Appendix 1 includes the list of ICT specialist occupations under the Australian and New Zealand Standard Classification of Occupations (ANZSCO). The list was compiled by MMV.

Key findings

These key findings relate to people working in ICT occupations in Victoria from 2001 to 2007.

- Employment of ICT specialists in the state was about 100,000 from 2001 to 2007, with almost no growth over this period. In contrast, overall employment in the state grew 1.8 per cent per year.
- Relative to population, a higher proportion of Australia's ICT workforce was employed in Victoria in 2007.
- While most (55 per cent in 2007) worked in professional occupations, an increasing proportion (about a third in 2007) worked in technician or trade occupations.
- The proportion with qualifications averaged 77 per cent from 2001 to 2007, compared to 56 per cent in the rest of the workforce. As in many other occupations, this proportion increased over time.
- About 47 per cent had higher education qualifications, 30 per cent VET qualifications and 23 per cent had no qualifications.
- The most common field of education was engineering, followed by IT.
- Most people employed were male, although 70 per cent of ICT sales assistants were female.
- Relatively more people were aged 25–44 years compared to the rest of the Victorian workforce—70 per cent of professionals were in this age group but only 53 per cent of technicians and tradespeople.
- More than half of all ICT sales assistants were aged 15–24 years.
- Almost all worked full-time, except ICT sales assistants who worked mostly part-time.

2.1 Occupational composition

Table 1 shows the number of people employed as ICT specialists by occupation in Victoria from 2001 to 2007. It shows:

- Just over 100,000 people were employed each year with almost no change, on average, in their numbers from one to year to the next. In contrast, overall employment in the state increased 1.8 per cent per year.
- They represented between 4 and 5 per cent of the total number of people employed in Victoria.⁵

⁵ Of all people employed in Australia in 2005–2006, 3.5 per cent were in ICT occupations (ABS 2006). Thus, about a third of all ICT specialists in Australia work in Victoria.

- More than half worked in professional occupations. This proportion has however fallen from 61 per cent in 2001 to 55 per cent in 2007.
- The number employed in technician and trade occupations increased by more than a third from 2001 to 2007 to 34,000.

Table 1 Employment in ICT occupations, Victoria, 2001–2007 ('000)

Occupation group	2001	2002	2003	2004	2005	2006	2007	Average annual change (%)
ICT occupations	106	106	111	107	99	110	103	-0.3
<i>Managers</i>	12	11	9	10	14	14	8	-3.8
<i>Professionals</i>	64	65	68	65	54	62	57	-1.5
<i>Technicians/Trades</i>	25	25	29	28	26	29	34	5.3
<i>Sales assistants</i>	4	5	5	4	5	5	4	1.2
Others	2,175	2,198	2,232	2,228	2,337	2,331	2,435	1.9
All	2,281	2,303	2,343	2,335	2,436	2,441	2,537	1.8

Source: Unpublished ABS *Education and Work Survey*, 2001–07 (Cat. no. 6227.0). Scope: persons aged 15–64 years.

Note: Data for 2001 to 2006 were converted from ASCO (second edition) to ANZSCO using a concordance developed from Census 2006 data.

2.2 Qualifications profile

Tables 2 and 3 show the highest level of non-school qualification of people working in ICT occupations in Victoria from 2001 to 2007 and Table 4 shows their field of education. They show:

- The proportion with qualifications averaged 77 per cent from 2001 to 2007 compared to an average of 56 per cent in all other occupations (see Table 3). This proportion increased over time.
- About 47 per cent had higher education qualifications, 30 per cent VET qualifications and 23 per cent had no qualifications.
- Most people with higher education qualifications worked in a professional or managerial occupation. Among technicians and tradespersons, 18 per cent also had qualifications at this level.
- While only 17 per cent of professionals had no qualifications, 72 per cent of sales assistants had no qualifications.
- The most common field of education was engineering, followed by IT.

Table 2 Level of qualification, persons employed in ICT occupations, Victoria, 2001–2007 (%)

Level of highest non-school qualification	2001	2002	2003	2004	2005	2006	2007	Average 2001–07
With qualification	73	77	78	77	75	77	81	77
<i>Postgraduate degree</i>	10	4	8	8	7	9	10	8
<i>Grad dip/cert</i>	5	9	5	5	4	6	5	6
<i>Bachelor degree</i>	30	35	33	33	31	35	36	33
<i>Adv diploma/diploma</i>	9	7	12	10	11	7	13	10
<i>Certificate</i>	18	21	20	21	23	19	16	20
Without qualification	27	23	22	23	25	23	19	23
Total	100	100	100	100	100	100	100	100

Source: Unpublished ABS *Education and Work Survey*, 2001–07 (Cat. no. 6227.0). Scope: persons aged 15–64 years.

Note: Data for 2001 to 2006 were converted from ASCO (second edition) to ANZSCO using a concordance developed from 2006 Census data.

Table 3 Level of qualification by occupation, persons employed in ICT occupations, Victoria, average 2001–2007 (%)

Level of highest non-school qualification

Occupation group	Grad					With qualification	Without qualification	Total
	Postgrad	dip/cert	Bachelor	Adv dip/dip	Certificate			
ICT occupations	8	6	33	10	20	77	23	100
<i>Managers</i>	7	6	30	11	17	71	29	100
<i>Professionals</i>	11	8	45	10	9	83	17	100
<i>Technicians/Trades</i>	2	2	14	10	46	74	26	100
<i>Sales assistants</i>	1	0	6	5	15	28	72	100
Others	3	4	17	9	24	56	44	100
All	4	4	18	9	24	57	43	100

Source: Unpublished ABS *Education and Work Survey*, 2001–07 (Cat. no. 6227.0). Scope: persons aged 15–64 years.

Note. Data for 2001 to 2006 were converted from ASCO (second edition) to ANZSCO using a concordance developed from 2006 Census data.

Table 4 Field of education by occupation, persons employed in ICT occupations, Victoria, average 2001–2007 (%)

Occupation group	Field of education					With qualification	Without qualification	Total
	IT	Man &			Other ^b			
		Engineering	commerce	Humanities ^a				
ICT occupations	22	25	13	7	10	77	23	100
<i>Managers</i>	13	22	19	7	10	71	29	100
<i>Professionals</i>	32	18	13	8	11	83	17	100
<i>Technicians/Trades</i>	8	43	10	6	8	74	26	100
<i>Sales assistants</i>	2	3	9	9	5	28	72	100
Others	2	11	12	13	18	56	44	100
All	3	12	12	13	18	57	43	100

Source: Unpublished ABS *Education and Work Survey*, 2001–07 (Cat. no. 6227.0). Scope: persons aged 15–64 years.

Note. Data for 2001 to 2006 were converted from ASCO (second edition) to ANZSCO using a concordance developed from 2006 Census data.

a Includes society and culture and creative arts.

b Includes science, architecture & building, agriculture & environment, health, education, food, hospitality and personal services and mixed field programmes.

2.3 Gender profile

Table 5 shows the gender profile of people working in ICT occupations in Victoria from 2001 to 2007. It shows:

- Most were male, although 70 per cent of ICT sales assistants were female.

Table 5 Gender by occupation, persons employed in ICT occupations, Victoria, average 2001–2007 (%)

Occupation group	Males	Females	Total
ICT occupations	78	22	100
<i>Managers</i>	82	18	100
<i>Professionals</i>	79	21	100
<i>Technicians/Trades</i>	83	17	100
<i>Sales assistants</i>	31	69	100
Others	54	46	100
All	55	45	100

Source: Unpublished ABS *Education and Work Survey*, 2001–07 (Cat. no. 6227.0). Scope: persons aged 15–64 years.

Note. Data for 2001 to 2006 were converted from ASCO (second edition) to ANZSCO using a concordance developed from 2006 Census data.

2.4 Age profile

Tables 6 and 7 show the age profile of people working in ICT occupations in Victoria from 2001 to 2007. They show:

- They had a very different age profile to that of the rest of the workforce, in particular, a much higher proportion was aged 25–44 years.
- In general, high-skill occupations had fewer people aged 15–24 years than low-skill occupations.
- While 70 per cent of professionals were aged 25–44 years, only 53 per cent of technicians and tradespeople were in this age group.
- More than half of all sales assistants were aged 15–24 years. Such an age profile suggests high turnover of jobs in the occupation. The occupation probably provides an entry into the job market for many young people, particularly women. The eventual career destination of many who work in this occupation may be elsewhere and not necessarily in the ICT workforce. For many of them, these jobs provide income support while they complete their education in other fields.
- People aged 25–44 years were relatively more qualified than those aged 45–64 years. However, a higher proportion in the older age group had VET qualifications.

Table 6 Age by occupation, persons employed in ICT occupations, Victoria, average 2001–2007 (%)

Occupation group	Age group			Total
	15–24 years	25–44 years	45–64 years	
ICT occupations	11	63	26	100
<i>Managers</i>	4	61	35	100
<i>Professionals</i>	8	70	22	100
<i>Technicians/Trades</i>	15	53	31	100
<i>Sales assistants</i>	51	31	18	100
Others	18	48	34	100
All	18	49	33	100

Source: Unpublished ABS *Education and Work Survey*, 2001–07 (Cat. no. 6227.0). Scope: persons aged 15–64 years.

Note. Data for 2001 to 2006 were converted from ASCO (second edition) to ANZSCO using a concordance developed from 2006 Census data.

Any errors in the data used to construct the concordance may affect the change in the level of employment at the occupation level from 2006 to 2007.

Table 7 Level of qualification by age, persons employed in ICT occupations, Victoria, average 2001–2007 (%)

Level of highest non-school qualification	Age group			Total
	15–24 years	25–44 years	45–64 years	
With qualification	53	82	75	77
<i>Postgraduate degree</i>	1	9	8	8
<i>Grad certificate/diploma</i>	1	6	7	6
<i>Bachelor degree</i>	25	39	24	33
<i>Advanced diploma/diploma</i>	10	9	11	10
<i>Certificate</i>	15	18	25	20
Without qualification	47	18	25	23
Total	100	100	100	100

Source: Unpublished ABS *Education and Work Survey*, 2001–07 (Cat. no. 6227.0). Scope: persons aged 15–64 years.

Note. Data for 2001 to 2006 were converted from ASCO (second edition) to ANZSCO using a concordance developed from 2006 Census data.

Any errors in the data used to construct the concordance may affect the change in the level of employment at the occupation level from 2006 to 2007.

2.5 Hours of work

Table 8 shows the hours of work of people working in ICT occupations in Victoria from 2001 to 2007. It shows:

- Most of them, except sales assistants, worked full-time.

Table 8 Hours of work by occupation, persons employed in ICT occupations, Victoria, average 2001–2007 (%)

Occupation group	Full-time	Part-time	Total
ICT occupations	89	11	100
<i>Managers</i>	97	3	100
<i>Professionals</i>	91	9	100
<i>Technicians/Trades</i>	89	11	100
<i>Sales assistants</i>	36	64	100
Others	71	29	100
All	71	29	100

Source: Unpublished ABS *Education and Work Survey*, 2001–07 (Cat. no. 6227.0). Scope: persons aged 15–64 years.

Note. Data for 2001 to 2006 were converted from ASCO (second edition) to ANZSCO using a concordance developed from 2006 Census data.

Any errors in the data used to construct the concordance may affect the change in the level of employment at the occupation level from 2006 to 2007.

3 Forecasts of employment and required numbers with qualifications in ICT occupations

Forecasts of employment by occupation and qualification in Victoria from 2008 to 2022 were reported in Shah, Cooper and Burke (2007). The report also included estimates of the number of people with higher education qualifications required in the next 15 years to achieve the qualifications profile projected for 2022. The results showed that, in Victoria, more qualified people would be needed to meet future industry demand. These will include new entrants as well as existing workers who gain new qualifications or upgrade their qualifications. Demand estimates in aggregate for both groups from 2008 to 2022 were provided.

The focus of this chapter is the employment in ICT occupations in the state from 2008 to 2022. It uses the results derived in Shah, Cooper and Burke (2007) to provide forecasts of employment by occupation and qualification and the numbers of new entrants and existing workers who would need to be trained to achieve the qualification profile for the workforce in 2022.

Key findings

Forecasts of employment in ICT occupations in Victoria in 2022

- Employment is forecast to increase from 104,000 in 2007 to 135,000 in 2022, an increase of 30 per cent. Most growth in jobs will be at the managerial and professional level. In contrast, the state's total employment is forecast to increase by 13 per cent.
- Under Scenario II, which assumes continuing skills deepening, 128,000, or 94 per cent, will have qualifications in 2022. The proportion with qualifications in the employed workforce as a whole will be 78 per cent.
- While most of those working at the professional level will have higher education qualifications in 2022, less than half of those working in managerial positions will have higher education qualifications. A number of technicians and tradespersons will also have higher education qualifications.

Additional numbers with qualifications required in ICT occupations in Victoria from 2008 to 2022

- Of the 128,000 people with qualifications in ICT occupations in 2022, more than half (71,000) will be either new entrants (41,000) or existing workers (30,000) who will upgrade their qualification.
- Sixty per cent of the qualifications required will be at the higher education level and 40 per cent at the VET level.
- While postgraduate qualifications requirements will mostly be met through existing workers upgrading qualifications, the bachelor degree requirements will be through new entrants.
- Over half the new entrants to managerial occupations and about a third to technician and trade occupations will have higher education qualifications.

3.1 Forecasts of overall employment in ICT occupations

Employment in Victoria steadily increased from 2.09 million in 1997 to 2.55 million in 2007, an average annual increase of 2.2 per cent.

Forecasts produced using the MONASH model indicates employment growth in Victoria continuing at 0.9 per cent per year until 2014.⁶ This is significantly lower than the historical rate. In 2022, employment is forecast to be 2.88 million.⁷

If the labour force participation rate increases more than assumed in the MONASH model, then employment growth could be higher. The labour force participation rate has in fact increased in recent years, particularly in the older age group.

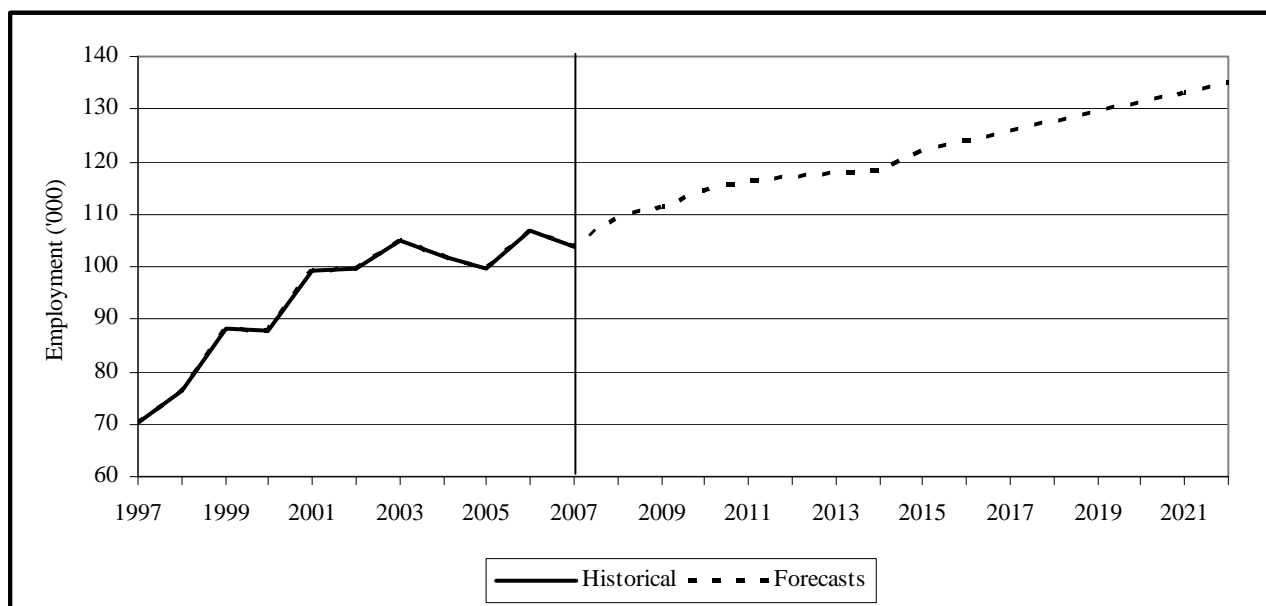
Similarly, if the trend towards part-time work increases above that assumed in the model, employment growth could again be higher. Note that in this report all results are in terms of head count, not equivalent full-time.

The following analysis of employment in ICT occupations is within the context of these state-level trends.

Figure 1 shows the actual employment in ICT occupations in Victoria from 1997 to 2007 and forecasts from 2008 to 2022. The rapid growth in employment ended in 2001. Since then the average growth rate has been very small.

Employment is however forecast to increase to 135,000 in 2022, an increase of 30 per cent from the level in 2007. In contrast, overall employment in the state is forecast to increase by 13 per cent over the same period.

Figure 1 Employment in ICT occupations, Victoria, 1997–2007 (historical) 2008–2022 (forecasts)



Source: *Labour Force* (ABS Cat. no. 6202.0); Monash Economic Forecasts (CoPS November 2007); and CEET. Scope: persons aged 15 years or older.

⁶ A brief description of the MONASH model is given in Appendix 1 of the report. The forecasts were produced in 2006.

⁷ The most recent outlook for Victoria by Access Economics, who provide the macro forecasts for input into the MONASH model, is for higher growth rate in output. This means the 0.9 per cent employment growth rate assumed for the analysis in this report may be on the conservative side.

Table 9 shows employment forecasts in the ICT occupations for 2022. It shows:

- Employment will increase at an above average rate in managerial and professional occupations. In 2022, 73 per cent of all ICT employment will be in these occupations, compared to the present 65 per cent.
- Employment of technicians and tradespeople is forecast to remain at about the same level as in 2007. This seems counter intuitive because high growth in employment in these occupations from 2001 to 2007 was reported in the previous chapter. Such a situation may arise if there is a declining trend in an occupation's share of employment in industries that employ people in these occupations. The MONASH model's sensitivity to alternative assumptions with respect to trends in occupational shares needs further investigation. Also, employment in most trade occupations is forecast to be relatively lower than in other occupations (Shah, Cooper and Burke 2007).

Table 9 Employment by occupation, persons employed in ICT occupations, Victoria, 2007 and 2022 (%)

Occupation group	Actual 2007		Forecast 2022		% change 2006–22
	'000	%	'000	%	
ICT occupations	104	100	135	100	30
Managers	12	12	20	15	61
Professionals	55	53	78	58	43
Technicians/Trades	32	31	32	24	0
Sales assistants	5	4	5	4	11

Source: *Labour Force Survey* (ABS Cat. no. 6202.0) and CEET.

Note: The calculation of the percentage change is based on unrounded numbers. The actual number of sales assistants employed in 2007 was just over 4,500. Over 5,000 were forecast in 2022. Thus the 11 per cent increase from 2007 to 2022.

3.2 Forecasts of employment in ICT occupations by qualification

The MONASH model does not include forecasts of employment by qualification and occupation. Shah, Cooper and Burke (2007) provide projections of them for 2022 under two scenarios:

Scenario I—'no skills deepening'

Assumes the 2007 distribution of qualifications within each occupation will remain unchanged to 2022 and that skills deepening cease to operate in the future. These projections provide a baseline for comparative purposes.

Scenario II—'skills deepening'

Chapter 2 showed an increasing proportion of people in employment in Victoria with qualifications. In some occupations, not only is the rate of increase of people with qualifications higher than the rate of increase in the total number employed in the occupation, but also the qualifications held are generally at higher levels. This phenomenon is termed *skills deepening*. For example, while the employment of professionals in Victoria increased by 13 per cent from 2001 to 2007, the number among them with qualifications increased by 16 per cent and those with higher education qualifications by 22 per cent. Under scenario II, it is assumed the trends in skills deepening continuing to 2022.

3.2.1 Scenario I—'no skills deepening'

Table 10 shows the projections of qualifications in ICT occupations for 2022 under Scenario I. It shows a small shift in the qualification profile in these occupations in 2022 compared to that in 2007. This shift can be attributed largely to the change in the occupational structure of employment in these occupations.

Table 10 Scenario I projections: Level of qualification by occupation, persons employed in ICT occupations, Victoria, 2022 (%)

Occupation group	Level of highest non-school qualification					Total		
	Postgraduate	Graduate dip/cert	Bachelor	VET	With qualification	Without qualification	%	Number
ICT occupations	11	6	39	27	83	17	100	135
<i>Managers</i>	4	15	38	33	91	9	100	20
<i>Professionals</i>	15	7	48	17	87	13	100	78
<i>Technicians/Trades</i>	5	1	21	49	76	24	100	32
<i>Sales assistants</i>	2	1	7	19	29	71	100	5
Others	4	4	19	32	60	40	100	2,743
All	5	4	20	32	61	39	100	2,878

Note: Rows may not add to the total due to rounding.

3.2.2 Scenario II—‘skills deepening’

Tables 11 and 12 show the projections of qualifications in ICT occupations in Victoria for 2022 under Scenario II. They show:

- About 128,000, or 94 per cent, will have qualifications—about 63 per cent with higher education qualifications. In contrast, across all occupations the proportion with qualifications will increase from 60 per cent in 2007 to 78 per cent in 2022.
- Almost all those working in managerial occupations will have qualifications. However, a majority of the qualifications will be at the VET level.⁸
- A higher education qualification will be almost universal among those working in professional occupations—about 30 per cent will have postgraduate, graduate diploma or graduate certificate qualifications.
- More than one in every five technicians, tradespersons and sales assistants will have higher education qualifications. Shah, Cooper and Burke (2007) show growing proportions of people with higher education qualifications in many intermediate and elementary clerical, sales and service occupations. Some university graduates use jobs in these occupations as an entry point into the labour market while they search for jobs that are more directly related to their qualification.

Table 11 Scenario II projections: Level of qualification by occupation, persons employed in ICT occupations, Victoria, 2022 (‘000)

Occupation group	Level of highest non-school qualification					Total	
	Postgraduate	Graduate dip/cert	Bachelor	VET	With qualification	Without qualification	Total
ICT occupations	21	7	59	42	128	8	135
<i>Managers</i>	2	1	6	11	20	0	20
<i>Professionals</i>	17	5	44	10	76	2	78
<i>Technicians/Trades</i>	2	1	7	20	29	3	32
<i>Sales assistants</i>	0	0	1	1	3	2	5
Others	171	67	717	1,151	2,106	637	2,743
All	191	74	776	1,193	2,233	644	2,878

Note: Rows and columns may not add to the total due to rounding.

⁸ The proportion with VET qualifications across all managerial occupations in 2022 was projected to be 56 per cent, which is a little higher than for ICT managers (Shah, Cooper and Burke 2007).

Table 12 Scenario II projections: Level of qualification by occupation, persons employed in ICT occupations, Victoria, 2022 (%)

Occupation group	Level of highest non-school qualification						Total	
	Postgraduate	Graduate			With qualification	Without qualification	%	Number
		dip/cert	Bachelor	VET				
ICT occupations	15	5	43	31	94	6	100	135
<i>Managers</i>	11	3	32	53	99	1	100	20
<i>Professionals</i>	21	7	57	12	97	3	100	78
<i>Technicians/Trades</i>	5	2	22	63	91	9	100	32
<i>Sales assistants</i>	0	0	22	28	50	50	100	5
Others	6	2	26	42	77	23	100	2,743
All	7	3	27	41	78	22	100	2,878

Note: Rows may not add to the total due to rounding.

3.3 Additional people with qualifications required in ICT occupations

The number of people with qualifications required in the next 15 years to achieve the qualification profile in 2022 in Scenario II will be more than just that due to growth. There will also be a need to replace people due to turnover (people leaving work due to retirement, emigration, ill health, death etc.).

This section provides estimates of all additional qualified people who will be needed over the next 15 years in ICT occupations to achieve the qualification profile projected for 2022 in Scenario II.

To estimate the additional numbers with qualifications required, first, new entrants in each occupation and at each qualification level are estimated. In some occupations, new entrants with qualifications will be insufficient to achieve the target qualification profile for 2022. In such instances, existing workers will need to upgrade qualifications to make up the shortfall. Thus, existing workers who undertake training to achieve a higher qualification are counted towards meeting the targets for qualified workers.

Not all new entrants to an occupation have qualifications, just as not every existing worker upgrades their qualifications.

3.3.1 New entrants with qualifications

The calculation of the numbers of new entrants to ICT occupations considers occupational growth and net turnover. Furthermore, as new entrants in any occupation are generally the youngest, their qualifications profile is also likely to be similar to workers of around the same age. Qualifications of leavers (who need to be replaced) are also generally likely to be similar to qualifications of the oldest in an occupation. The mathematical details of the calculation can be found in Appendix 4 in Shah, Cooper and Burke (2007).

Tables 13 and 14 show the numbers of new entrants with qualifications required in ICT occupations in Victoria in Scenario II from 2008 to 2022. They include only those new entrants who will have qualifications. The tables show:

- Over 41,000 new entrants with qualifications will be required—69 per cent with higher education qualifications. In contrast, across all occupations, 756,000 new entrants with qualifications will be required—54 per cent with higher education qualifications.
- About 59 per cent of new entrants will be for professional occupations, and most of these will have higher education qualifications.
- About half the new entrants to managerial occupations and a third to technicians and trades occupations will also have higher education qualifications.

Table 13 Scenario II projections: Level of qualification and occupation, new entrants with qualifications to ICT occupations, Victoria, 2008–2022 ('000)

Occupation group	Level of highest non-school qualification				Total
	Postgraduate	Graduate dip/cert	Bachelor	VET	
ICT occupations	3	1	24	13	41
<i>Managers</i>	1	0	4	4	9
<i>Professionals</i>	2	1	17	4	24
<i>Technicians/Trades</i>	0	0	2	4	6
<i>Sales assistants</i>	0	0	1	1	2
Others	26	17	339	334	716
All	29	18	363	346	757

Note: Rows and columns may not add to the total due to rounding.

Table 14 Scenario II projections: Level of qualification by occupation, new entrants with qualifications to ICT occupations, Victoria, 2008–2022 (%)

Occupation group	Level of highest non-school qualification				Total
	Postgraduate	Graduate dip/cert	Bachelor	VET	
ICT occupations	7	2	59	31	100
<i>Managers</i>	7	2	46	45	100
<i>Professionals</i>	9	3	72	16	100
<i>Technicians/Trades</i>	3	1	31	65	100
<i>Sales assistants</i>	0	0	47	53	100
Others	4	2	47	47	100
All	4	2	48	46	100

Note: Rows may not add to the total due to rounding.

3.3.2 Existing workers to upgrade qualifications

In some occupations, new entrants with qualifications may be insufficient to achieve the qualification profile for 2022. The shortfall in these instances will need to be made up by some existing workers in these occupations upgrading their qualifications.

By comparing the qualification profiles of existing workers in 2007 and 2022, the number who will need to upgrade qualifications by level can be estimated. Note that existing workers are those who are employed at 2007 as well as at 2022. Mathematical details of the calculations can be found in Appendix 5 in Shah, Cooper and Burke (2007).

Tables 15 and 16 show the numbers of existing workers in ICT occupations in Victoria required to upgrade qualifications in Scenario II from 2008 to 2022.

- About 30,000 will be required to upgrade qualifications—50 per cent will be to higher education levels. In contrast, across all occupations, 750,000 existing workers will be required to upgrade qualifications—37 per cent to higher education levels.
- While existing workers in managerial, technician and trade occupations will mostly upgrade to a VET qualification, in professional occupations they will mostly upgrade to a postgraduate qualification.

Table 15 Scenario II projections: Level of qualification and occupation, existing workers upgrading qualifications in ICT occupations, Victoria, 2008–2022 ('000)

Occupation group	Level of highest non-school qualification				Total
	Postgraduate	Graduate dip/cert	Bachelor	VET	
ICT occupations	11	0	4	15	30
<i>Managers</i>	1	0	0	5	6
<i>Professionals</i>	9	0	2	1	13
<i>Technicians/Trades</i>	1	0	2	8	10
<i>Sales assistants</i>	0	0	0	0	1
Others	111	13	140	456	720
All	122	13	144	471	750

Note: Rows and columns may not add to the total due to rounding.

Table 16 Scenario II projections: Level of qualification by occupation, existing workers upgrading qualifications in ICT occupations, Victoria, 2008–2022 (%)

Occupation group	Level of highest non-school qualification				Total
	Postgraduate	Graduate dip/cert	Bachelor	VET	
ICT occupations	36	1	13	50	100
<i>Managers</i>	13	0	1	86	100
<i>Professionals</i>	73	1	14	11	100
<i>Technicians/Trades</i>	8	0	17	74	100
<i>Sales assistants</i>	1	0	39	60	100
Others	15	2	19	63	100
All	16	2	19	63	100

Note: Rows may not add to the total due to rounding.

3.3.3 Total additional numbers of qualified workers

The total additional number of qualified people required in an occupation is equal to new entrants to it and existing workers upgrading their qualifications. Note that in some occupations the total number of additional people required may be more than this as some people may not have qualifications.

Tables 17 and 18 show the total number of people with qualifications required in ICT occupations in Victoria in Scenario II from 2008 to 2022. Table 19 provides a summary of total requirements. The tables show:

- About 71,000 additional people with qualifications will be required—61 per cent with higher education qualifications.⁹ In contrast, across all occupations, the total number with qualifications required will be about 1.5 million—46 per cent with higher education qualifications. Note that new entrants and existing workers who acquire skills that are not formally accredited, or are at a level lower or the same as that of their current highest qualification, are not included in this total. In the ICT sector, because of rapid advances in technology, a high level of skill development activity of this type can be expected.
- About half of all qualifications required will be for professional occupations and the rest in roughly equal proportions for managerial and technician and trade occupations.
- While the requirements for postgraduate qualifications in ICT occupations will mostly be met through existing workers, those for bachelor degrees will mostly be met through new entrants.

⁹ Employment in ICT occupations is projected to be 135,000 in 2022. Of these 128,000 are projected to have qualifications.

Table 17 Scenario II projections: Level of qualification and occupation, additional persons with qualifications required in ICT occupations, Victoria, 2008–2022 ('000)

Occupation group	Level of highest non-school qualification				Total
	Postgraduate	Graduate dip/cert	Bachelor	VET	
ICT occupations	14	1	28	28	71
<i>Managers</i>	2	0	4	9	15
<i>Professionals</i>	11	1	19	5	36
<i>Technicians/Trades</i>	1	0	4	12	17
<i>Sales assistants</i>	0	0	1	1	2
Others	137	30	478	790	1,436
All	151	31	506	817	1,506

Note: Rows and columns may not add to the total due to rounding.

Table 18 Scenario II projections: Level of qualification by occupation, additional persons with qualifications required in ICT occupations, Victoria, 2008–2022 (%)

Occupation group	Level of highest non-school qualification				Total
	Postgraduate	Graduate dip/cert	Bachelor	VET	
ICT occupations	20	1	39	39	100
<i>Managers</i>	13	0	27	60	100
<i>Professionals</i>	31	3	53	14	100
<i>Technicians/Trades</i>	6	0	24	71	100
<i>Sales assistants</i>	0	0	50	50	100
Others	10	2	33	55	100
All	10	2	34	54	100

Note: Rows may not add to the total due to rounding.

Table 19 Scenario II projections: Summary of additional qualification requirements in ICT occupations, Victoria, 2008–2022

	Persons with qualifications employed in 2022		Required number of additional persons with qualifications 2008–2022					
			New entrants		Existing workers		Total	
	'000	%	'000	%	'000	%	'000	%
ICT occupations	128	100	41	100	30	100	71	100
<i>Managers</i>	20	16	9	22	6	20	15	22
<i>Professionals</i>	76	59	24	59	13	43	37	52
<i>Technicians/Trades</i>	29	23	6	15	10	33	16	23
<i>Sales assistants</i>	3	2	2	5	1	3	3	3
<i>Postgraduate</i>	21	16	3	7	11	37	14	20
<i>Grad dip/cert</i>	7	5	1	2	0	0	1	1
<i>Bachelor</i>	59	46	24	59	4	13	28	39
<i>VET</i>	42	33	13	31	15	50	28	39

Note: Columns may not add to the total due to rounding.

4 Potential supply of people with higher education qualifications for ICT occupations

The main source of supply of people with higher education qualifications for ICT occupations in Victoria is the state's universities.

This supply is augmented with graduates from interstate universities, private providers of higher education¹⁰ and international migration.

While the state's Technical and Further Education (TAFE) sector has recently started offering degree level courses in a limited number of fields, the numbers graduating are still relatively small.

This chapter analyses the:

- types of university graduates who get employed in ICT occupations in Victoria
- occupational and labour force destinations of IT graduates from Victorian universities
- patterns of enrolments, commencements and completions of IT and related courses in Victorian universities
- projection of the potential supply of IT graduates for ICT occupations in Victoria
- international migration of people for ICT occupations in Victoria.

The two main sources of data used for the analysis are:

- 2006 *Graduate Destination Survey* (GDS)
- *Higher Education Student Data Collection*.

Key findings

Which Victorian university graduates are employed in ICT occupations?

The following key findings relate to the 2005 cohort of graduates from Victorian universities who were employed in ICT occupations in 2006.

- About 2,900 were employed—63 per cent in Victoria, 22 per cent overseas and 15 per cent interstate.
- About 2,300 were employed in professional occupations (1,300 as business and systems analysts and programmers) and about 200 in managerial occupations. Most of the rest were employed as ICT telecommunication technicians.
- About 1,100, or 36 per cent, were international graduates. In contrast, in all other occupations, 22 per cent were international graduates.
- Over 61 per cent had bachelor degrees, 31 per cent had postgraduate qualifications and about 8 per cent had graduate diplomas or graduate certificates.
- Only about 49 per cent had an IT qualification. The field of education of the others were engineering (18 per cent), management and commerce (16 per cent), humanities (11 per cent) and other fields (about 6 per cent).
- Of the 1,800 employed in Victoria, about 400, or 22 per cent, were international graduates.

Where do university IT graduates go?

The following key findings relate to occupational and labour force status in 2006 of the 2005 cohort of IT graduates from Victorian universities.

¹⁰ Some private providers are included in the DEEWR *Higher Education Student Data Collection*.

- About 6,300 completed IT courses—62 per cent were working in 2006 and 38 per cent were not working. Of those not working, half were engaged in further study.
- About 3,900, or 61 per cent, were international graduates.
- About 1,400, or 22 per cent, were employed in ICT occupations.
- Of the 2,400 domestic graduates, 82 per cent were resident in Victoria—76 per cent were working (30 per cent in ICT occupations and 46 per cent in other occupations) and 24 per cent were not working.
- Of the 3,900 international graduates, 62 per cent were resident in Victoria—48 per cent were working (11 per cent in ICT occupations and 37 per cent in other occupations) about 52 per cent were not working.
- About 20 per cent of domestic and 34 per cent of international graduates were engaged in further study in 2006, the proportions were higher among those who were working in non-ICT occupations or not working.

Of the 2005 cohort of IT graduates from Victorian and interstate universities, how many were potentially available for ICT occupations in Victoria in 2006?

- About 1,260 domestic and international graduates were potentially available. The number includes graduates:
 - working in an ICT occupation in Victoria
 - 80 per cent of domestic graduates resident in Victoria who are not working and not studying
 - 25 per cent of international graduates resident in Victoria who are not working and not studying.
- Under alternative scenarios, where some proportion of IT graduates working in non-ICT occupations are included as part of the supply for ICT occupations, the potential number available can range from 1,570 to 1,970 graduates.

Enrolments in IT and related courses in Victorian universities from 2001 to 2006

- Enrolments in IT courses fell from 22,200 to 17,800 from 2001 to 2006, an overall fall of 20 per cent. After increasing by 7 per cent in 2002, they fell every year after that. The biggest falls were in the last two years. International students comprised 59 per cent of all enrolments in 2006.
- Enrolments in engineering (electrical and electronic) also declined but not by as much as in IT. International students comprised 42 per cent of all enrolments in engineering in 2006.
- An increasing proportion of enrolments were in postgraduate courses. In information systems courses, about half of all enrolments were at the postgraduate level in 2006.
- Domestic student enrolments in IT and engineering fell 41 and 29 per cent, respectively, from 2001 to 2006, and may have yet to bottom out. Enrolments in other fields increased 9 per cent.
- International student enrolments in IT and engineering increased 10 and 47 per cent, respectively. In both fields, numbers peaked in 2004. Enrolments in other fields increased 73 per cent.

Commencements of IT and related courses in Victorian universities from 2001 to 2006

- Commencements of IT courses fell from about 10,100 to 6,100 from 2001 to 2006, a drop of 40 per cent. They fell each year with the largest fall of 27 per cent in 2005. Commencements in some courses varied greatly from one year to the next, for instance, commencements of other IT courses increased 15 per cent in 2004 but fell 42 per cent the following year.

- Commencements of IT courses by domestic students fell 55 per cent and those by international students 25 per cent.
- Commencements of IT courses at the graduate diploma and graduate certificate level fell from 24 per cent of the total to 5 per cent, mainly because of a collapse in international student demand for courses at this level. This shift is probably related to changes in the skilled migration assessment test for permanent residency in Australia. The changes reward postgraduate qualifications more than lower level qualifications.
- Commencements of engineering courses also fell though by not as much as IT.
- However, commencements of engineering courses by international students actually increased 47 per cent although demand has softened since 2004. The shift in demand towards postgraduate level courses also occurred in engineering.

Completions of IT and related courses in Victorian universities from 2001 to 2006

- Completions of IT courses increased from 5,100 in 2001 to 5,800 in 2006, an increase of 15 per cent. Completions have however declined since 2003.
- An increasing number of completions of IT courses were at the postgraduate level, reflecting the shift away from graduate diploma and graduate certificate courses.
- IT course completions by domestic students fell 27 per cent to 2,000 in 2006.
- IT course completions by international students increased 64 per cent to 3,800 in 2006. In 2006, 57 per cent of all completions were by international students.
- Completions of engineering courses increased from about 1,000 in 2001 to 1,500 in 2006, an increase of 41 per cent. They increased every year except in 2006 when they fell 22 per cent. The main contributing factor for the decline was a massive drop in completions at the postgraduate level.
- Engineering course completions by domestic students increased 3 per cent to about 700 in 2006.
- Engineering course completions by international students increased 111 per cent to about 800 in 2006. In 2006, 53 per cent of all completions were by international students.

Projections of IT graduates from Victorian universities from 2008 to 2022

- If commencements in IT courses remain at current levels, then Victoria will produce about 61,200 IT graduates from 2008 to 2022—37 per cent with postgraduate qualifications, 61 per cent with bachelor degrees and the rest with graduate diplomas or graduate certificates.
- Domestic graduates will comprise just 36 per cent of graduates—20 per cent of postgraduates, 54 per cent of graduate diplomas or graduate certificates and 45 per cent of bachelors.

Other sources of supply

- Estimating the number of IT graduates who have higher education qualifications from Australia's migration programmes for ICT occupations in Victoria is difficult because of the complexity of these programmes and paucity of good data on them. A tentative estimate from all programmes is for an annual net gain of about 600. However not all will be able to work in an ICT occupation because of the problems some will have in having their qualifications recognised and the downward occupational mobility some will experience.

4.1 Which university graduates were employed in ICT occupations?

This section describes the graduates from Victorian and interstate universities who were employed in ICT occupations in Victoria.

The analysis is based on data on the destinations in 2006 of the 2005 cohort of graduates. These data were collected in the 2006 GDS. The survey is administered by Graduate Careers Australia and

is conducted around four months after students complete their courses. All students who complete a course receive the survey but less than 60 per cent actually complete and return it. Notwithstanding this limitation, the survey provides useful information on the occupational destination of graduates from different higher education courses. In the analyses to follow, the estimates from the 2006 GDS are weighted by population weights derived from the *Higher Education Student Data Collection*.¹¹ The occupation information in the GDS is classified using the ASCO (second edition). In the analyses reported below, the ANZSCO classification is used. The conversion from ASCO to ANZSCO was done using a concordance that CEET has developed using 2006 Census data.

4.1.1 Where were graduates employed in ICT occupations working?

The labour market for higher education graduates increasingly has a national or global scope. It is particularly so for those working in ICT occupations.

Victorian university graduates often obtain jobs interstate or overseas. This is true for both domestic and international students, though international graduates are more likely to work overseas (most likely in their country of origin) than domestic students. Conversely, some interstate graduates find jobs in Victoria.

Among graduates from both Victorian and interstate universities are international students, some of whom also participate in the Victorian labour market. Victorian universities enrol and graduate relatively higher numbers of international students. They had 26 per cent of the total number of students enrolled in Australian universities in 2007 but 30 per cent of the share of international students.

Table 20 shows where the 2005 cohort of Victorian university graduates employed in ICT occupations were working in 2006. It shows:

- About 2,900 were employed altogether—63 per cent in Victoria, 15 per cent interstate and 22 per cent overseas. In contrast, of all graduates employed 70 per cent were in Victoria, 17 per cent interstate and 13 per cent overseas.
- Most were employed in managerial or professional occupations. However, about 240 were employed as ICT telecommunication technicians.
- About 1,300 were employed as business and systems analysts and programmers, which is more than half the total in professional occupations.

¹¹ The Higher Education Student Data Collection includes offshore students, which are generally excluded from the GDS survey. The difference in the scope of the two may introduce some bias in the population estimates of graduate destinations. However, the bias is not expected to be large because the offshore component is relatively small.

Table 20 Place of employment by occupation, 2005 cohort of Victorian university graduates working in ICT occupations in 2006 (%)

Occupation	Place of employment			Total	
	Victoria	Interstate	Overseas	%	Number
All ICT	63	15	22	100	2,880
ICT managers	62	21	17	100	190
Professionals	62	15	23	100	2,340
<i>Technical writer/ICT trainer</i>	64	17	20	100	80
<i>ICT sales professional</i>	60	11	29	100	160
<i>Multimedia & web designer</i>	65	16	18	100	70
<i>Electronics engineer</i>	66	16	18	100	70
<i>Business & systems analysts & programmers</i>	61	15	24	100	1,330
<i>Database & systems admin & ICT security</i>	61	15	24	100	270
<i>ICT network & support</i>	63	15	22	100	360
Technicians/Trades	68	16	16	100	280
<i>Electronic eng. draughtpersons & technician</i>	66	18	17	100	20
<i>ICT & telecommunications technician</i>	69	15	15	100	240
<i>Electronics & telecommunications trade</i>	62	19	18	100	20
ICT sales assistant	81	15	4	100	70
Others	71	17	12	100	41,970
All	70	17	13	100	44,850

Source: Unpublished data from *Graduate Destinations Survey 2006* (GCA) and *Higher Education Student Data Collection* (DEEWR).

Note: A person is classified to be working if they indicated 1) working more than zero hours per week; or 2) described an occupation they were working in. The table includes students who completed a bachelor degree or higher qualification. Excludes some records for which there were missing values for international student indicator. The numbers in this table have been rounded to the nearest ten. The row and column sums may not add to the margin totals because of rounding errors.

Table 21 shows where the 2005 cohort of interstate university graduates employed in ICT occupations were working in 2006. It shows:

- About 6,500 were employed altogether—3 per cent in Victoria, 77 per cent interstate and 20 per cent overseas. This means 31 per cent of all graduates employed in ICT occupations in Australia were from Victorian universities and 69 per cent from interstate universities.
- About 180 graduates from interstate universities were working in Victoria, compared to 440 Victorian graduates working interstate.

Table 21 Place of employment by occupation, 2005 cohort of interstate university graduates working in ICT occupations in 2006 (%)

Occupation	Place of employment			Total	
	Victoria	Interstate	Overseas	%	Number
All ICT	3	77	20	100	6,540
ICT managers	3	74	23	100	440
Professionals	3	76	21	100	5,240
<i>Technical writer/ICT trainer</i>	3	81	16	100	200
<i>ICT sales professional</i>	2	71	27	100	440
<i>Multimedia & web designer</i>	2	82	16	100	190
<i>Electronics engineer</i>	3	79	18	100	220
<i>Business & systems analysts & programmers</i>	3	76	21	100	2,800
<i>Database & systems admin & ICT security</i>	3	76	21	100	560
<i>ICT network & support</i>	3	77	20	100	830
Technicians/Trades	2	80	17	100	720
<i>Electronic eng. draughtpersons & technician</i>	3	77	20	100	60
<i>ICT & telecommunications technician</i>	2	80	18	100	600
<i>Electronics & telecommunications trade</i>	2	88	10	100	60
ICT sales assistant	3	92	5	100	140
Others	3	84	14	100	11,6690
All	3	83	14	100	12,3230

Source: Unpublished data from *Graduate Destinations Survey 2006* (GCA) and *Higher Education Student Data Collection* (DEEWR).

Note: A person is classified to be working if they indicated 1) working more than zero hours per week; or 2) described an occupation they were working in. The table includes students who completed a bachelor degree or higher qualification. Excludes some records for which there were missing values for international student indicator. The numbers in this table have been rounded to the nearest ten. The row and column sums may not add to the margin totals because of rounding errors.

Table 22 also shows where the 2005 cohort of Victorian university graduates employed in ICT occupations were working in 2006, but unlike Table 20 the information on domestic and international graduates is provided separately. It shows:

- International graduates comprised 36 per cent of the total in these occupations compared to 22 per cent in all other occupations.
- Of the 1,800 domestic graduates in these occupations, about 1,400 (78 per cent) were employed in Victoria.
- Of the 1,100 international graduates in these occupations, about 400 (37 per cent) were employed in Victoria.

Table 22 Place of employment by occupation and citizenship, 2005 cohort of Victorian university graduates working in ICT occupations in 2006 (%)

Occupation	Domestic students					International students				
	Place of employment				Total No.	Place of employment				Total No.
	Vic	IS	OS	%		Vic	IS	OS	%	
All ICT	78	18	4	100	1830	37	10	53	100	1,050
ICT managers	74	23	3	100	130	35	16	49	100	60
Professionals	78	18	4	100	1440	36	9	55	100	900
<i>Technical writer/ICT trainer</i>	76	19	5	100	60	27	8	65	100	20
<i>ICT sales professional</i>	82	15	3	100	100	23	5	72	100	60
<i>Multimedia & web designer</i>	75	20	5	100	50	34	6	60	100	20
<i>Electronics engineer</i>	75	21	4	100	60	41	2	57	100	20
<i>Bus & sys analyst & prog.</i>	78	18	4	100	790	37	10	53	100	550
<i>Dbase & sys admin & ICT sec.</i>	78	18	4	100	160	37	10	53	100	110
<i>ICT network & support</i>	77	19	4	100	230	38	9	53	100	130
Technicians/Trades	79	18	3	100	200	43	11	45	100	80
<i>Electronic eng. draughts & tech</i>	76	21	3	100	20	39	9	52	100	10
<i>ICT & telecom technician</i>	80	17	4	100	170	44	12	43	100	70
<i>Electronics & telecomm trade</i>	72	26	1	100	20	40	4	56	100	10
ICT sales assistant	82	16	2	100	50	74	11	14	100	10
Others	78	19	3	100	32,740	46	11	43	100	9,230
All	78	19	3	100	34,570	45	11	44	100	10,280

Source: Unpublished data from *Graduate Destinations Survey 2006* (GCA) and *Higher Education Student Data Collection* (DEEWR).

Note: A person is classified to be working if they indicated 1) working more than zero hours per week; or 2) described an occupation they were working in. The table includes students who completed a bachelor degree or higher qualification. Excludes some records for which there were missing values for international student indicator. The numbers in this table have been rounded to the nearest ten. The row and column sums may not add to the margin totals because of rounding errors.
IS = interstate, OS = overseas

Table 23 has similar information to Table 22 for the 2005 cohort of interstate university graduates. The patterns in the destinations are generally similar to those for graduates from Victorian universities. The table shows:

- About 190 were employed in Victoria—150 domestic and 40 international graduates.
- International graduates comprise 32 per cent of the total number employed, 4 percentage points lower than the corresponding number from Victorian universities. They are also more likely to be employed overseas than international graduates from Victorian universities.

Table 23 Place of employment by occupation and citizenship, 2005 cohort of interstate university graduates working in ICT occupations in 2006 (%)

Occupation	Domestic students					International students				
	Place of employment				Total	Place of employment				Total
	Victoria	IS	OS	%	No.	Victoria	IS	OS	%	No.
All ICT	3	93	4	100	4,460	2	43	55	100	2,080
ICT managers	4	91	5	100	310	1	32	67	100	130
Professionals	3	92	4	100	3,510	2	43	55	100	1,730
<i>Technical writer/ICT trainer</i>	3	93	4	100	160	1	34	65	100	40
<i>ICT sales professional</i>	3	93	4	100	270	2	33	65	100	160
<i>Multimedia & web designer</i>	3	94	3	100	150	1	36	63	100	40
<i>Electronics engineer</i>	3	93	4	100	160	1	38	62	100	60
<i>Bus & sys analyst & prog</i>	3	92	4	100	1,820	2	45	53	100	980
<i>Dbase & sys admin & ICT sec.</i>	4	92	4	100	370	2	44	54	100	190
<i>ICT network & support</i>	3	92	4	100	570	2	43	55	100	260
Technicians/Trades	3	94	3	100	530	1	43	56	100	190
<i>Electronic eng. draughts & tech</i>	4	95	1	100	40	1	40	59	100	20
<i>ICT & telecom technician</i>	3	94	3	100	450	1	39	60	100	150
<i>Electronics & telecomm trade</i>	3	92	6	100	40	1	79	20	100	20
ICT sales assistant	2	97	2	100	110	5	79	16	100	40
Others	3	93	4	100	91,690	2	48	50	100	25,000
All	3	93	4	100	96,150	2	47	51	100	27,080

Source: Unpublished data from *Graduate Destinations Survey 2006 (GCA)* and *Higher Education Student Data Collection (DEEWR)*.

Note: A person is classified to be working if they indicated 1) working more than zero hours per week; or 2) described an occupation they were working in. The table includes students who completed a bachelor degree or higher qualification. Excludes some records for which there were missing values for international student indicator. The numbers in this table have been rounded to the nearest ten. The row and column sums may not add to the margin totals because of rounding errors.

IS = interstate, OS = overseas

4.1.2 What were the qualifications of graduates employed in ICT occupations?

While some qualifications are occupation-specific, others are more general and can lead to jobs in a range of occupations. Furthermore, occupations people work in while studying can be very different to the occupations they work in after graduation. Young people often have jobs in low-skill occupations while studying.

Table 24 shows the level of qualification of the 2005 cohort of Victorian university graduates who were employed in ICT occupations in 2006.¹² It shows:

- About 61 per cent had bachelor degrees, 31 per cent postgraduate degrees and the rest had graduate diploma or graduate certificate. While the proportion with bachelor degrees is comparable to that in all other occupations, the proportion with postgraduate degrees is much higher and the proportion with graduate diploma or graduate certificate is much lower.
- About 80 per cent of all postgraduates employed were in professional occupations, although managerial occupations employed a higher proportion of postgraduates than professional occupations did.
- About half the technical writers and ICT trainers had qualifications at levels higher than bachelor level. This suggests that additional specialist skills, over and above those acquired from a bachelor course, are probably preferred in these occupations.
- A number of ICT and telecommunication technicians also had qualifications at levels higher than bachelor level. Some of them are possibly international graduates who wish to gain permanent residency in Australia. These students complete higher level, particularly postgraduate, qualifications because higher qualifications attract additional points in the skills migration test. Limited English language and networking skills, however, restrict their employment opportunities.

¹² Table A1 in Appendix 3 includes similar information for graduates from interstate universities.

Table 24 Level of qualification by occupation, 2005 cohort of Victorian university graduates working in ICT occupations in 2006 (%)

Occupation	Level of qualification			Total	
	Postgraduate	Grad dip/cert	Bachelor	%	Number
All ICT	31	7	61	100	2,880
ICT managers	46	16	39	100	190
Professionals	31	6	63	100	2,340
<i>Technical writer/ICT trainer</i>	29	15	56	100	80
<i>ICT sales professional</i>	27	8	65	100	160
<i>Multimedia & web designer</i>	19	11	70	100	70
<i>Electronics engineer</i>	17	7	76	100	70
<i>Business & systems analysts & programmers</i>	33	5	62	100	1,330
<i>Database & systems admin & ICT security</i>	34	6	61	100	270
<i>ICT network & support</i>	30	6	64	100	360
Technicians/Trades	28	12	60	100	280
<i>Electronic eng. draughtpersons & technician</i>	12	10	78	100	20
<i>ICT & telecommunications technician</i>	30	12	58	100	240
<i>Electronics & telecommunications trade</i>	26	11	63	100	20
ICT sales assistant	12	5	83	100	70
Others	23	17	60	100	41,970
All	23	17	60	100	44,850

Source: Unpublished data from *Graduate Destinations Survey 2006* (GCA) and *Higher Education Student Data Collection* (DEEWR).

Note: A person is classified to be working if they indicated 1) working more than zero hours per week; or 2) described an occupation they were working in. The table includes students who completed a bachelor degree or higher qualification. Excludes some records for which there were missing values for international student indicator. The numbers in this table have been rounded to the nearest ten. The row and column sums may not add to the margin totals because of rounding errors.

Table 25 shows the field of education of the 2005 cohort of Victorian university graduates who were employed in ICT occupations in 2006.¹³ It shows:

- Only about 49 per cent had an IT qualification. The field of education of the others were engineering (18 per cent), management and commerce (16 per cent), humanities (11 per cent) and other fields (about 6 per cent). Some who have a non-IT qualification may indeed have IT skills, perhaps acquired as a minor study.
- Overall, about 53 per cent of those employed in professional occupations had an IT qualification but the proportion varied by occupation. For example, while most of those employed as technical writers, ICT trainers and ICT sales professionals had qualifications in humanities or management and commerce, most employed as multimedia and web designers had qualifications in engineering or humanities.
- Surprisingly, more than half of those employed as ICT and telecommunications technicians had qualifications in fields other than IT or engineering.

¹³ Table A2 in Appendix 3 includes similar information for graduates from interstate universities.

Table 25 Field of education by occupation, 2005 cohort of Victorian university graduates working in ICT occupations in 2006 (%)

Occupation	Field of education					Total	
	IT	Engineering	Man & commerce	Humanities ^a	Other ^b	%	Number
All ICT	49	18	16	11	7	100	2,880
ICT managers	35	18	34	7	5	100	190
Professionals	53	19	14	9	5	100	2,340
<i>Technical writer/ICT trainer</i>	8	4	38	38	13	100	80
<i>ICT sales professional</i>	7	5	59	22	6	100	160
<i>Multimedia & web designer</i>	4	26	7	46	17	100	70
<i>Electronics engineer</i>	5	62	7	3	23	100	70
<i>Bus & sys analysts & programmers</i>	65	17	9	6	3	100	1,330
<i>Dbase & sys admin & ICT security</i>	63	17	11	6	3	100	270
<i>ICT network & support</i>	50	26	11	6	8	100	360
Technicians/Trades	31	14	21	16	17	100	280
<i>Electronic eng. draughts & tech</i>	4	25	13	9	49	100	20
<i>ICT & telecom technician</i>	34	13	23	16	14	100	240
<i>Electronics & telecomm trade</i>	22	20	14	27	17	100	20
ICT sales assistant	9	4	25	41	21	100	70
Others	6	5	28	24	37	100	41,970
All	9	6	27	23	35	100	44,850

Source: Unpublished data from *Graduate Destinations Survey 2006* (GCA) and *Higher Education Student Data Collection* (DEEWR).

Note: A person is classified to be working if they indicated 1) working more than zero hours per week; or 2) described an occupation they were working in. The table includes students who completed a bachelor degree or higher qualification. Excludes some records for which there were missing values for international student indicator. The numbers in this table have been rounded to the nearest ten. The row and column sums may not add to the margin totals because of rounding errors.

a Includes society and culture and creative arts.

b Includes science, architecture & building, agriculture & environment, health, education, food, hospitality and personal services and mixed field programmes.

An increasing number of students complete double degrees, which gives them a wider range of job opportunities. Table 26 shows the field of education of the 2005 cohort of Victorian university graduates with double degrees who were employed in ICT occupations in 2006.¹⁴ It shows:

- About 270, or 9 per cent, of graduates had double degrees. The proportion with double degrees in other occupations is similar.
- The main field of education of 30 per cent of double degree holders was management and commerce and for a further 30 per cent it was engineering. Perhaps IT was their second major.
- About 60 per cent of double degree holders were employed as business and system analysts and programmers or ICT network and support personnel.

¹⁴ The corresponding table for graduates from interstate universities is A4 in Appendix 3.

Table 26 Field of education by occupation, 2005 cohort of Victorian university graduates with double degrees working in ICT occupations in 2006 (%)

Occupation	Field of education					Total	
	IT	Engineering	Man & commerce	Humanities ^a	Other ^b	%	Number
All ICT	20	30	30	14	6	100	270
ICT managers	28	19	39	7	8	100	10
Professionals	21	32	30	13	4	100	230
<i>Technical writer/ICT trainer</i>	5	5	48	36	5	100	10
<i>ICT sales professional</i>	2	7	64	28	0	100	10
<i>Multimedia & web designer</i>	2	35	12	34	17	100	10
<i>Electronics engineer</i>	3	56	12	5	23	100	10
<i>Bus & sys analysts & programmers</i>	27	31	29	11	1	100	120
<i>Dbase & sys admin & ICT security</i>	27	31	30	11	1	100	20
<i>ICT network & support</i>	18	39	24	10	9	100	40
Technicians/Trades	9	22	27	18	23	100	20
ICT sales assistant	5	4	25	50	15	100	10
Others	3	8	31	33	24	100	3,410
All	5	10	31	31	23	100	3,680

Source: Unpublished data from *Graduate Destinations Survey 2006* (GCA) and *Higher Education Student Data Collection* (DEEWR).

Note: A person is classified to be working if they indicated 1) working more than zero hours per week; or 2) described an occupation they were working in. The table includes students who completed a bachelor degree or higher qualification. Excludes some records for which there were missing values for international student indicator. The numbers in this table have been rounded to the nearest ten. The row and column sums may not add to the margin totals because of rounding errors.

a Includes society and culture and creative arts.

b Includes science, architecture & building, agriculture & environment, health, education, food, hospitality and personal services and mixed field programmes.

4.2 Where did IT graduates go?

The analysis in the previous section showed only about half of all graduates employed in ICT occupations had IT qualifications, although some of those with non-IT qualifications may have IT skills or minor qualifications in IT.

This section traces the occupational and other labour force destinations of the 2005 cohort of IT graduates. It also estimates how many IT graduates from Victorian and interstate universities are potentially available for ICT occupations in Victoria.

Table 27 shows the labour market destinations in 2006 of the 2005 cohort of IT graduates from Victorian universities. It shows:

- The size of the cohort was about 6,300 of which 62 per cent were working (22 per cent in ICT occupations and 40 per cent in non-ICT occupations) and 38 per cent were not working.
- Domestic graduates comprised 2,400, or 39 per cent, of the cohort—82 per cent were resident in Victoria in 2006.
- International graduates comprised 3,900, or 61 per cent, of the cohort—62 per cent were resident in Victoria in 2006.
- Among domestic graduates resident in Victoria, 76 per cent were working—30 per cent in ICT occupations and 46 per cent in non-ICT occupations.¹⁵ A higher proportion of those who left the state were working, particularly in ICT occupations.
- About 48 per cent of international graduates resident in Victoria were working—11 per cent in ICT occupations and 36 per cent in non-ICT occupations—and 52 per cent were not working. As is the case with domestic graduates, international graduates who left Victoria were more likely to be working, particularly in ICT occupations.

¹⁵ The proportion not working is higher among IT graduates than among engineering, health, education or management and commerce graduates (Shah, Cooper and Burke (2007)).

- Among domestic graduates working in non-ICT occupations in Victoria, 52 per cent were employed in occupations other than managerial or professional. The corresponding proportion for international graduates was 71 per cent.

Table 27 Occupation by citizenship and place of residency in 2006, 2005 cohort of IT graduates from Victorian universities (%)

Occupation	Domestic students		International students	
	Resident in Victoria	Not resident in Victoria	Resident in Victoria	Not resident in Victoria
Working	76	90	48	59
ICT occupations	30	40	11	24
Non-ICT occupations	46	51	36	35
<i>Managers</i>	7	7	4	4
<i>Professionals</i>	15	16	6	14
<i>Business, HR & marketing</i>	8	9	3	7
<i>Others</i>	7	8	3	7
<i>Technicians/Trades</i>	2	2	1	2
<i>Community & personal service</i>	2	3	3	2
<i>Clerical & administration</i>	9	9	6	7
<i>Others</i>	11	14	15	7
Not working	24	10	52	41
All (%)	100	100	100	100
All (number)	2,000	430	2,420	1,470

Source: Unpublished data from *Graduate Destinations Survey 2006* (GCA) and *Higher Education Student Data Collection* (DEEWR).

Note: A person is classified to be working if they indicated 1) working more than zero hours per week; or 2) described an occupation they were working in. The table includes students who completed a bachelor degree or higher qualification. Excludes some records for which there were missing values for international student indicator. The numbers in this table have been rounded to the nearest ten. The row and column sums may not add to the margin totals because of rounding errors.

Table 28 shows the labour market destinations in 2006 of the 2005 cohort of IT graduates from interstate universities. Many of the patterns observed in Table 27 are repeated in this table and thus will not be commented on. The table shows:

- The cohort consisted of about 11,300 graduates. Although the proportion employed, 61 per cent, is about the same as for the cohort from Victorian universities, the proportion employed in ICT occupations is higher (about 40 per cent).
- Victoria attracted a small number of interstate IT graduates to its workforce. Among those who were working, about half of all domestic graduates were in ICT occupations but most international graduates were in non-ICT occupations.

Table 28 Occupation by citizenship and place of residency in 2006, 2005 cohort of IT graduates from interstate universities (%)

Occupation	Domestic students		International students	
	Resident in Victoria	Not resident in Victoria	Resident in Victoria	Not resident in Victoria
Working	84	79	89	47
ICT occupations	43	35	18	17
Non-ICT occupations	41	44	71	30
<i>Managers</i>	8	6	7	5
<i>Professionals</i>	15	16	2	7
<i>Business, HR & marketing</i>	5	8	2	3
<i>Others</i>	10	8	0	4
<i>Technicians/Trades</i>	1	2	6	2
<i>Community & personal service</i>	4	2	11	3
<i>Clerical & administration</i>	5	8	6	5
<i>Others</i>	9	10	40	9
Not working	16	21	11	53
All (%)	100	100	100	100
All (number)	110	4,530	140	6,490

Source: Unpublished data from *Graduate Destinations Survey 2006* (GCA) and *Higher Education Student Data Collection* (DEEWR).

Note: A person is classified to be working if they indicated 1) working more than zero hours per week; or 2) described an occupation they were working in. The table includes students who completed a bachelor degree or higher qualification. Excludes some records for which there were missing values for international student indicator. The numbers in this table have been rounded to the nearest ten. The row and column sums may not add to the margin totals because of rounding errors.

Many students engage in further study after graduation. Some combine study with either full or part-time work. Table 29 shows the proportions engaged in further study in 2006 among the 2005 cohort of IT graduates from Victorian universities.¹⁶ It shows:

- As expected, the proportion engaged in further study was higher among those who were not working than among those who were working.
- A higher proportion of international graduates were engaged in further study than were domestic graduates.
- The proportion who was studying was lower among those who were working in ICT occupations than in non-ICT occupations.

Table 29 Proportion undertaking further study in 2006 by labour force status and citizenship, 2005 cohort of IT graduates from Victorian universities (%)

Labour force status	Domestic graduates		International graduates	
	% studying	Total (number)	% studying	Total (number)
Working	14	1,910	17	2,020
<i>ICT occupations</i>	10	770	12	630
<i>Non-ICT occupations</i>	17	1,140	19	1,390
Not working	39	520	52	1,860
All	20	2,430	34	3,880

Source: Unpublished data from *Graduate Destinations Survey 2006* (GCA) and *Higher Education Student Data Collection* (DEEWR).

Note: A person is classified to be working if they indicated 1) working more than zero hours per week; or 2) described an occupation they were working in. The table includes students who completed a bachelor degree or higher qualification. Excludes some records for which there were missing values for international student indicator. The numbers in this table have been rounded to the nearest ten. The row and column sums may not add to the margin totals because of rounding errors.

4.3 Potential new IT graduates for ICT occupations

As shown in the previous section, not all IT graduates are employed immediately after graduation in ICT occupations. While some who are not working are studying, others are not studying and some of them could be available for work in ICT occupations. Similarly, some among those who are working in non-ICT occupations, especially low-skill occupations, could also be available.

This section estimates the number of new (domestic and international) IT graduates from Victorian and interstate universities who potentially could have been available for ICT occupations in Victoria. Four possible scenarios are presented.

Table 30 shows the potential supply in these four scenarios in 2006.

- In **Base Scenario**, about 1,260 IT graduates were potentially available. The number includes graduates:
 - working in an ICT occupation in Victoria
 - 80 per cent of domestic graduates resident in Victoria who are not working and not studying¹⁷
 - 25 per cent of international graduates resident in Victoria who are not working and not studying.
- As already noted, about half of all IT graduates not working in an ICT occupation were working in a low-skill occupation. Less than 20 per cent were engaged in further study. Lack of adequate language and other employability skills are possible factors why some international graduates find it difficult to secure jobs in ICT occupations. With appropriate assistance, their full

¹⁶ Table A5 in Appendix 3 shows the proportions engaged in further study in 2006 among the 2005 cohort of IT graduates from interstate universities. The patterns are similar to those observed for graduates from Victorian universities.

¹⁷ Not all who complete a course will necessarily work or look for work.

potential could be realised. In a scenario where at least some IT graduates who are working in non-ICT occupations are available for ICT occupations, the potential supply could be higher than that calculated in Base Scenario. Three alternative scenarios are considered. Each augments the supply estimated in the Base Scenario

- **Alternative Scenario 1** includes 50 per cent of domestic graduates resident in Victoria who are working in non-ICT occupations and not studying. In this case, 1,650 graduates were potentially available.
- **Alternative Scenario 2** includes 40 per cent of international graduates resident in Victoria who are working in non-ICT occupations and not studying. In this case, 1,570 graduates were potentially available.
- **Alternative Scenario 3** includes 50 per cent of domestic and 40 per cent of international graduates resident in Victoria who are working in non-ICT occupations and not studying. In this case, 1,970 graduates were potentially available.¹⁸
- Depending on the scenario, international graduates (more than 60 per cent with postgraduate qualifications) comprised between 22 and 44 per cent of the supply and postgraduates between 32 and 41 per cent.

¹⁸ Further research on occupational labour mobility could provide better estimates of these proportions.

Table 30 Scenarios for potential supply of new IT graduates for ICT occupations by level of qualification, Victoria, 2006

Occupation (residency)	Postgraduate		Grad dip/cert		Bachelor		All	
	Number	%	Number	%	Number	%	Number	%
Graduates from Victorian universities								
Domestic students	530	100	190	100	1,710	100	2,430	100
Working in ICT (Victoria)	140	26	40	21	420	25	600	25
Working in ICT (elsewhere)	50	9	10	5	100	6	170	7
Working in non-ICT (Victoria)	170	32	90	47	660	39	920	38
Working in non-ICT (elsewhere)	50	9	20	11	140	8	220	9
Not working (Victoria)	90	17	30	16	370	22	480	20
Not studying	70	13	10	5	200	12	280	12
Studying	20	4	20	11	160	9	200	8
Not working (elsewhere)	20	4	0	0	20	1	40	2
International students	1,840	100	160	100	1,890	100	3,880	100
Working in ICT (Victoria)	180	10	10	6	80	4	270	7
Working in ICT (elsewhere)	110	6	0	0	240	13	350	9
Working in non-ICT (Victoria)	510	28	40	25	340	18	880	23
Working in non-ICT (elsewhere)	250	14	10	6	250	13	510	13
Not working (Victoria)	450	24	80	50	730	39	1,260	32
Not studying	140	8	10	6	140	7	290	7
Studying	300	16	70	44	600	32	970	25
Not working (elsewhere)	340	18	20	13	240	13	600	15
Graduates from interstate universities								
Domestic students	820	100	430	100	3,410	100	4,660	100
Working in ICT (Victoria)	30	4	0	0	20	1	50	1
Working in ICT (elsewhere)	270	33	110	26	1,180	35	1,560	33
Working in non-ICT (Victoria)	10	1	10	2	20	1	50	1
Working in non-ICT (elsewhere)	350	43	220	51	1,420	42	2,000	43
Not working (Victoria)	10	1	0	0	10	0	20	0
Not studying	10	1	0	0	10	0	10	0
Studying	0	0	0	0	0	0	0	0
Not working (elsewhere)	140	17	80	19	740	22	960	21
International students	2,640	100	780	100	3,220	100	6,650	100
Working in ICT (Victoria)	10	0	0	0	10	0	20	0
Working in ICT (elsewhere)	530	20	20	3	560	17	1,110	17
Working in non-ICT (Victoria)	60	2	0	0	40	1	100	2
Working in non-ICT (elsewhere)	850	32	170	22	930	29	1,940	29
Not working (Victoria)	0	0	0	0	10	0	20	0
Not studying	0	0	0	0	10	0	10	0
Studying	0	0	0	0	0	0	10	0
Not working (elsewhere)	1,180	45	590	76	1,670	52	3,440	52
Potential supply for ICT occupations in Victoria								
Base Scenario ^a	460		60		740		1,260	
Alternative Scenario 1 ^b	530		100		1,020		1,650	
Alternative Scenario 2 ^c	640		70		860		1,570	
Alternative Scenario 3 ^d	720		110		1,140		1,970	

Source: Unpublished data from *Graduate Destinations Survey 2006* (GCA) and *Higher Education Student Data Collection* (DEEWR).

Note: A person is classified to be working if they indicated 1) working more than zero hours per week; or 2) described an occupation they were working in. The table includes students who completed a bachelor degree or higher qualification. Excludes some records for which there were missing values for international student indicator. The numbers in this table have been rounded to the nearest ten. The row and column sums may not add to the margin totals because of rounding errors.

a Includes domestic and international graduates working in ICT, 80 per cent of domestic graduates resident in Victoria who are not working and not studying and 25 percent of international graduates resident in Victoria who are not working and not studying.

b Includes those calculated under Base Scenario plus 50 per cent of domestic graduates resident in Victoria and who are working in non-ICT occupations and not studying.

c Includes those calculated under Base Scenario plus 40 per cent of international graduates resident in Victoria and who are working in non-ICT occupations and not studying.

d Includes those calculated under Base Scenario plus 50 per cent of domestic and 40 per cent of international graduates resident in Victoria and who are working in non-ICT occupations and who are not studying.

4.4 Enrolments, commencements and completions of IT and related courses, 2001–2006

This section describes the pattern of enrolments, commencements and completions of IT and related courses by students in Victorian universities from 2001 to 2006. Completion of these courses can lead to jobs in ICT occupations. The section also provides projections of the number of IT courses that will be completed from 2008 to 2022. As shown in section 4.1, IT graduates make up about half the graduates employed in ICT occupations.

The number of IT graduates available after 2006, and the proportion available for ICT occupations, depends on a range of factors. These include:

- Future patterns of commencements in IT courses.
- Future completion rates of IT courses.
- The international students market in Australia, which is increasingly affected by Australia's skilled migration policy. The policy allows onshore applications for permanent residency and rewards Australian qualifications in the visa assessment.
- Relative attraction of IT courses for international students compared to other courses—many ICT occupations are on the migration occupations in demand list (MODL) and hence attract additional points in the assessment for permanent residency in Australia.
- Relative attraction of careers in ICT occupations vis a vis salaries and conditions of work (security of employment and hours of work).

4.4.1 Enrolments by level of qualification and field

Tables 31 and 32 show the numbers of students enrolled in IT and related courses in Victoria from 2001 to 2006.

- Enrolments in IT courses declined 20 per cent to about 17,800 from 2001 to 2006. After increasing by 7 per cent in 2002, they fell each year after that. The biggest falls were in the last two years. In contrast, enrolments in all other courses increased 21 per cent over the same period.
- Enrolments in engineering (electrical and electronic) also declined but not by as much as in IT.¹⁹
- The share of enrolments generally increased in postgraduate courses and fell in lower level courses.
- In IT, there was a shift in enrolments from graduate diplomas and graduate certificates to postgraduate courses.
- About half the enrolments in information systems were at the postgraduate level and the other half at the bachelor level in 2006.

¹⁹ Enrolments in some other engineering disciplines such as civil have increased recently though (Shah, Cooper and Burke (2007)).

Table 31 Annual changes in enrolments in IT and related courses, Victoria, 2001–2006

Field of education	Year-on-year change (%)						Total change 2001–06 (%)
	2001 to 2002	2002 to 2003	2003 to 2004	2004 to 2005	2005 to 2006	Average	
IT	7	-1	-2	-12	-13	-4	-20
<i>Computer science</i>	1	1	-4	-12	-10	-5	-22
<i>Information sys</i>	7	-6	-7	-9	-15	-6	-28
<i>Other IT</i>	15	5	8	-16	-13	0	-4
Engineering ^a	9	6	-5	-9	-10	-2	-10
Others	5	4	3	2	5	4	21
All	5	4	2	1	4	3	16

Source: Unpublished *Higher Education Student Data Collection* (DEEWR). Scope: Bachelor and higher levels.

a Includes electrical and electronic engineering only (ASCED code 313)

Table 32 Enrolments in IT and related courses by level of qualification, Victoria, 2001–2006 (%)

Field of education by level	2001	2002	2003	2004	2005	2006
IT (number)	100 (22,158)	100 (23,749)	100 (23,596)	100 (23,191)	100 (20,373)	100 (17,804)
<i>Postgraduate</i>	20	24	29	34	35	34
<i>Graduate dip/cert</i>	18	13	7	4	3	3
<i>Bachelor</i>	62	63	64	62	62	63
Computer science (number)	100 (7,709)	100 (7,821)	100 (7,916)	100 (7,566)	100 (6,663)	100 (6,021)
<i>Postgraduate</i>	20	25	29	29	29	28
<i>Graduate dip/cert</i>	26	16	8	5	4	3
<i>Bachelor</i>	54	59	62	65	67	69
Information systems (number)	100 (8,754)	100 (9,392)	100 (8,796)	100 (8,157)	100 (7,408)	100 (6,305)
<i>Postgraduate</i>	30	34	36	41	46	47
<i>Graduate dip/cert</i>	15	11	9	6	3	3
<i>Bachelor</i>	55	55	55	53	51	50
Other IT (number)	100 (5,696)	100 (6,536)	100 (6,884)	100 (7,468)	100 (6,302)	100 (5,479)
<i>Postgraduate</i>	6	9	18	30	29	25
<i>Graduate dip/cert</i>	12	11	4	1	1	2
<i>Bachelor</i>	82	79	78	69	70	73
Engineering ^a (number)	100 (6,254)	100 (6,804)	100 (7,190)	100 (6,846)	100 (6,256)	100 (5,647)
<i>Postgraduate</i>	16	22	28	31	28	26
<i>Graduate dip/cert</i>	4	3	2	2	3	3
<i>Bachelor</i>	80	75	70	68	70	70
Others (number)	100 (187,743)	100 (196,717)	100 (204,516)	100 (210,500)	100 (215,723)	100 (227,383)
<i>Postgraduate</i>	17	18	20	21	20	21
<i>Graduate dip/cert</i>	9	9	9	9	9	9
<i>Bachelor</i>	74	73	71	70	71	71
All (number)	100 (216,156)	100 (227,270)	100 (235,303)	100 (240,537)	100 (242,352)	100 (250,835)
<i>Postgraduate</i>	17	19	21	22	22	22
<i>Graduate dip/cert</i>	10	10	9	8	8	8
<i>Bachelor</i>	73	72	70	70	70	70

Source: Unpublished *Higher Education Student Data Collection* (DEEWR). Scope: Bachelor and higher level.

a Includes electrical and electronic engineering only (ASCED code 313)

4.4.2 Enrolments by international students

Table 33 shows the proportions of enrolments in IT and related courses by international students from 2001 to 2006. It shows:

- Overall enrolments in IT courses by international students increased 10 per cent from 2001 to 2006.²⁰ However, numbers peaked in 2004 and have been falling since. In contrast, enrolments by domestic students fell 41 per cent and may have yet to bottom out.

²⁰ Across all courses, the increase in international student enrolments was 59 per cent and that of domestic students 4 per cent.

- Enrolments by international students in IT courses as a proportion of the total increased 15 percentage points, although the rate of increase has slowed in the last couple of years. The share of enrolments in computer science courses increased faster than in any other IT course.
- Enrolments in engineering courses by international students increased 47 per cent, and peaked in 2004. Once again, enrolments by domestic students have been contracting, with a 29 per cent reduction from 2001 to 2006.
- The share of enrolments by international students in engineering increased even faster than in IT, from 26 to 42 per cent, but as in the case with IT, the rate of increase has slowed in the last two years.

Table 33 Enrolments in IT and related courses by citizenship, Victoria, 2001–2006

Field of education	2001	2002	2003	2004	2005	2006	% change 2001 to 2006
International students							
IT	9,234	10,812	11,639	12,492	11,407	10,131	10
<i>Computer science</i>	2,779	3,099	3,736	3,894	3,608	3,338	20
<i>Information systems</i>	3,948	4,424	4,231	4,137	4,078	3,572	-10
<i>Other IT</i>	2,506	3,289	3,672	4,461	3,721	3,222	29
Engineering ^a	1,621	2,052	2,704	2,744	2,528	2,376	47
Others	35,031	39,449	44,848	50,169	53,160	60,631	73
All	45,886	52,313	59,192	65,405	67,095	73,139	59
Domestic students							
IT	12,924	12,937	11,957	10,699	8,966	7,673	-41
<i>Computer science</i>	4,929	4,722	4,180	3,672	3,055	2,683	-46
<i>Information systems</i>	4,806	4,968	4,565	4,020	3,330	2,733	-43
<i>Other IT</i>	3,189	3,247	3,212	3,007	2,581	2,257	-29
Engineering	4,633	4,752	4,486	4,102	3,728	3,271	-29
Others	152,712	157,268	159,668	160,331	162,563	166,752	9
All	170,269	174,957	176,111	175,132	175,257	177,696	4
International students as a % of total							
IT	42	46	49	54	56	57	
<i>Computer science</i>	36	40	47	51	54	55	
<i>Information systems</i>	45	47	48	51	55	57	
<i>Other IT</i>	44	50	53	60	59	59	
Engineering	26	30	38	40	40	42	
Others	19	20	22	24	25	27	
All	21	23	25	27	28	29	

Source: Unpublished *Higher Education Student Data Collection* (DEEWR). Scope: Bachelor and higher level.

a Includes electrical and electronic engineering only (ASCED code 313)

4.4.3 Commencements by level of qualification and field

Changes in course commencements are more likely to reflect the impact of more recent policy changes than changes in enrolments. Tables 34 and 35 show commencements in IT and related courses in Victoria from 2001 to 2006. They show:

- Total commencements increased 12 per cent to about 93,400 in 2006. After a decline between 2003 and 2005, there was a sharp increase of 7 per cent in 2006. The period of decline coincides with Australian Government reforms to higher education, which increased student contributions for higher education courses. Bachelor commencements, as a proportion of the total, bottomed out in 2003, although the proportion in 2006 is still lower than in 2001.
- Commencements of IT courses declined 40 per cent to about 6,070 in 2006. They declined each year with the largest drop of 27 per cent in 2005. Considerable volatility, however, exists in the number of commencements in individual courses from one year to the next, for example, commencements in other IT courses increased 15 per cent in 2004 but declined 42 per cent the following year.

- Relative numbers of IT course commencements at the different qualification levels changed substantially. Commencements at the graduate diploma and graduate certificate level collapsed from 24 per cent of the total to 5 per cent from 2001 to 2006 but the main decline occurred in 2002 and 2003. The proportions at the other two levels correspondingly increased, especially at the postgraduate level.
- Commencements in engineering courses also declined though by not as much as in IT. The relative numbers at the three levels of qualifications changed, with a shift from bachelor to postgraduate—the percentages at these levels were 71 and 21 in 2001 compared to 54 and 38 in 2006.

Table 34 Annual changes in commencements in IT and related courses, Victoria, 2001–2006

Field of education	Year-on-year change (%)						Total change 2001–06 (%)
	2001 to 2002	2002 to 2003	2003 to 2004	2004 to 2005	2005 to 2006	Average	
IT	-3	-6	-1	-27	-8	-9	-40
<i>Computer science</i>	-7	2	-14	-24	-4	-9	-40
<i>Information sys</i>	-1	-19	-1	-15	-21	-11	-47
<i>Other IT</i>	-1	1	15	-42	5	-4	-30
Engineering ^a	13	9	-21	-4	-8	-2	-15
Others	4	5	1	1	9	4	20
All	4	4	0	-2	7	2	12

a Includes electrical and electronic engineering only (ASCED code 313)

Table 35 Commencements in IT and related courses by level of qualification, Victoria, 2001–2006 (%)

Field of education by level	2001	2002	2003	2004	2005	2006
IT (number)	100 (10,110)	100 (9,760)	100 (9,151)	100 (9,060)	100 (6,603)	100 (6,073)
<i>Postgraduate</i>	22	28	36	44	36	35
<i>Graduate dip/cert</i>	24	15	7	4	4	5
<i>Bachelor</i>	54	57	57	52	60	60
Computer science (number)	100 (3,526)	100 (3,272)	100 (3,338)	100 (2,885)	100 (2,204)	100 (2,124)
<i>Postgraduate</i>	20	27	36	32	27	34
<i>Graduate dip/cert</i>	31	16	6	5	5	4
<i>Bachelor</i>	48	58	58	63	68	62
Information systems (number)	100 (3,879)	100 (3,824)	100 (3,113)	100 (3,072)	100 (2,598)	100 (2,063)
<i>Postgraduate</i>	35	40	41	53	53	51
<i>Graduate dip/cert</i>	21	15	12	6	5	6
<i>Bachelor</i>	44	45	46	41	42	42
Other IT (number)	100 (2,704)	100 (2,664)	100 (2,700)	100 (3,103)	100 (1,801)	100 (1,886)
<i>Postgraduate</i>	6	13	31	46	23	20
<i>Graduate dip/cert</i>	19	15	1	1	3	4
<i>Bachelor</i>	75	72	68	53	74	76
Engineering ^a (number)	100 (2,158)	100 (2,436)	100 (2,664)	100 (2,095)	100 (2,001)	100 (1,837)
<i>Postgraduate</i>	21	33	43	46	37	38
<i>Graduate dip/cert</i>	8	4	2	3	6	7
<i>Bachelor</i>	71	63	54	50	56	54
Others (number)	100 (71,073)	100 (74,263)	100 (77,790)	100 (78,194)	100 (78,642)	100 (85,516)
<i>Postgraduate</i>	17	19	23	22	20	21
<i>Graduate dip/cert</i>	15	16	15	15	15	15
<i>Bachelor</i>	68	65	62	63	65	64
All (number)	100 (83,341)	100 (86,459)	100 (89,605)	100 (89,349)	100 (87,246)	100 (93,426)
<i>Postgraduate</i>	18	21	25	24	22	23
<i>Graduate dip/cert</i>	16	16	14	14	14	14
<i>Bachelor</i>	67	64	61	62	64	64

Source: Unpublished *Higher Education Student Data Collection* (DEEWR). Scope: Bachelor and higher level.

a Includes electrical and electronic engineering only (ASCED code 313)

4.4.4 Commencements by international students

Table 36 shows the proportion of commencements in IT and related courses by international students in Victoria from 2001 to 2006. Overall, the changes in commencement patterns mirror those in enrolment patterns. The table shows:

- Commencements by international students, as a proportion of the total, have generally been rising. The proportion did however decline in 2005. While commencements by international students increased 43 per cent from 2001 to 2006, those by domestic students increased only 1 per cent. Almost all growth in total commencements can be attributed to growth in international student numbers.
- Overall commencements in IT courses by international students declined 25 per cent from 2001 to 2006, with numbers peaking in 2004. In contrast, commencements by domestic students fell 55 per cent and may not yet have bottomed out.
- Commencements by international students in IT courses, as a proportion of the total, increased 13 percentage points, but it peaked at 65 per cent in 2004.
- Commencements in engineering courses by international students increased 47 per cent, but those by domestic students declined by the same proportion. Once again, commencements by international students peaked in 2004.
- Commencements in engineering courses by international students, as a proportion of total commencements, increased from 34 to 59 per cent. The proportion, however, remained largely unchanged from 2003 to 2005.

Table 36 Course commencements in IT and related courses by citizenship, Victoria, 2001–2006

Field of education	2001	2002	2003	2004	2005	2006	% change 2001 to 2006
International students							
IT	4,976	5,215	5,307	5,854	4,107	3,751	-25
<i>Computer science</i>	1,527	1,638	1,978	1,780	1,302	1,291	-15
<i>Information systems</i>	2,046	2,013	1,655	1,839	1,653	1,284	-37
<i>Other IT</i>	1,402	1,564	1,674	2,235	1,152	1,176	-16
Engineering ^a	743	1,015	1,397	1,124	1,090	1,090	47
Others	16,294	18,235	20,518	22,091	21,604	26,570	63
All	22,013	24,465	27,222	29,069	26,801	31,411	43
Domestic students							
IT	5,134	4,545	3,844	3,206	2,496	2,322	-55
<i>Computer science</i>	1,999	1,634	1,360	1,105	902	833	-58
<i>Information systems</i>	1,833	1,811	1,458	1,233	945	779	-58
<i>Other IT</i>	1,302	1,100	1,026	868	649	710	-45
Engineering	1,415	1,421	1,267	971	911	747	-47
Others	54,779	56,028	57,273	56,103	57,038	58,946	8
All	61,328	61,994	62,384	60,280	60,445	62,015	1
International students as a % of total							
IT	49	53	58	65	62	62	
<i>Computer science</i>	43	50	59	62	59	61	
<i>Information systems</i>	53	53	53	60	64	62	
<i>Other IT</i>	52	59	62	72	64	62	
Engineering	34	42	52	54	54	59	
Others	23	25	26	28	27	31	
All	26	28	30	33	31	34	

Source: Unpublished *Higher Education Student Data Collection* (DEEWR). Scope: Bachelor and higher level.

a Includes electrical and electronic engineering only (ASCED code 313)

4.4.5 Completions by level of qualification and field

Not all who commence a higher education course complete it, although some return to education later in life and do complete a course. The changes in completions generally lag behind the changes in commencements.

Tables 37 and 38 show the numbers of IT and related course completions in Victoria from 2001 to 2006. They show:

- Total completions increased 22 per cent to about 63,700 in 2006. Completions at the postgraduate level, as a proportion of the total, increased from 16 to 22 per cent.
- Completions of IT courses increased 15 per cent to about 5,800 in 2006. They increased 22 per cent in 2002, but numbers have been on the decline since 2003. Completions in 2006 were substantially lower than in 2005, mainly because of a 19 per cent fall in completions of computer science courses.
- IT course completions at the different qualification levels mainly reflect the changes in enrolment and commencements. The major change is the shift to postgraduate completions and away from graduate diploma and graduate certificate completions. Bachelor completions, as a proportion of the total, peaked in 2004.
- Completions of engineering courses increased 41 per cent from 2001 to 2006. They increased every year except in 2006 when they declined 22 per cent. The main factor in the decline was a massive drop in completions at the postgraduate level. In contrast, completions increased 38 per cent in 2003.

Table 37 Annual changes in completions of IT and related courses, Victoria, 2001–2006

Field of education	Year-on-year change (%)						Average	Total change 2001–06 (%)
	2001 to 2002	2002 to 2003	2003 to 2004	2004 to 2005	2005 to 2006			
IT	22	3	-1	0	-8	3	15	
<i>Computer science</i>	4	8	1	4	-19	0	-4	
<i>Information sys</i>	22	1	-11	-1	-4	2	6	
<i>Other IT</i>	48	0	10	-3	-1	11	58	
Engineering ^a	5	38	18	6	-22	9	41	
Others	2	2	9	3	5	4	22	
All	4	3	8	3	3	4	22	

Source: Unpublished *Higher Education Student Data Collection* (DEEWR). Scope: Bachelor and higher levels.

a Includes electrical and electronic engineering only (ASCED code 313)

Table 38 Completions of IT and related courses by level of qualification, Victoria, 2001–2006 (%)

Field of education by level	2001	2002	2003	2004	2005	2006
IT (number)	100 (5,082)	100 (6,203)	100 (6,391)	100 (6,307)	100 (6,311)	100 (5,823)
<i>Postgraduate</i>	22	24	27	28	37	41
<i>Graduate dip/cert</i>	21	21	11	7	6	4
<i>Bachelor</i>	57	54	62	65	57	55
Computer science (number)	100 (1,707)	100 (1,774)	100 (1,917)	100 (1,943)	100 (2,022)	100 (1,643)
<i>Postgraduate</i>	24	28	29	30	36	32
<i>Graduate dip/cert</i>	24	21	11	8	7	5
<i>Bachelor</i>	52	51	60	62	58	63
Information systems (number)	100 (2,194)	100 (2,686)	100 (2,726)	100 (2,439)	100 (2,416)	100 (2,317)
<i>Postgraduate</i>	31	34	36	36	44	53
<i>Graduate dip/cert</i>	22	17	14	9	6	3
<i>Bachelor</i>	47	49	51	55	50	43
Other IT (number)	100 (1,181)	100 (1,742)	100 (1,747)	100 (1,926)	100 (1,873)	100 (1,863)
<i>Postgraduate</i>	4	6	12	15	31	34
<i>Graduate dip/cert</i>	14	28	6	5	3	3
<i>Bachelor</i>	82	66	82	80	66	64
Engineering ^a (number)	100 (1,038)	100 (1,088)	100 (1,498)	100 (1,769)	100 (1,867)	100 (1,461)
<i>Postgraduate</i>	23	34	46	47	49	35
<i>Graduate dip/cert</i>	4	4	3	2	4	7
<i>Bachelor</i>	72	62	51	50	47	58
Others (number)	100 (46,153)	100 (47,179)	100 (48,100)	100 (52,204)	100 (53,797)	100 (56,408)
<i>Postgraduate</i>	15	15	18	19	21	20
<i>Graduate dip/cert</i>	17	17	16	16	16	16
<i>Bachelor</i>	68	67	66	65	63	64
All (number)	100 (52,273)	100 (54,470)	100 (55,989)	100 (60,280)	100 (61,976)	100 (63,693)
<i>Postgraduate</i>	16	17	20	21	23	22
<i>Graduate dip/cert</i>	17	17	15	15	15	14
<i>Bachelor</i>	67	66	65	64	62	63

Source: Unpublished *Higher Education Student Data Collection* (DEEWR). Scope: Bachelor and higher level.

a Includes electrical and electronic engineering only (ASCED code 313)

4.4.6 Completions by international students

Table 39 shows the proportion of completions in IT and related courses by international students in Victoria from 2001 to 2006. Overall, the changes in completion patterns mirror those in commencement and enrolment patterns. The table shows:

- Completions of all courses by international students, as a proportion of the total, have generally been rising. While completions by international students increased 72 per cent from 2001 to 2006, those by domestic students increased only 7 per cent. Most of the growth in completions can be attributed to international students.
- Overall completions of IT courses by international students increased 64 per cent from 2001 to 2006, with numbers peaking in 2005. In contrast, completions by domestic students fell 27 per cent and may not yet have bottomed out.
- Completions of IT courses by international students, as a proportion of the total, increased 15 percentage points, although the rate of increase has slowed recently.
- Completions of engineering courses by international students increased 111 per cent, but by domestic students, the increase is only 3 per cent. However, completions by international students peaked in 2005 with a massive drop of 31 per cent in 2006. Completions by domestic students peaked a year earlier.
- Completions of engineering courses by international students, as a proportion of total completions, increased from 26 to 42 per cent.

Table 39 Completions of IT and related courses by citizenship, Victoria, 2001–2006

Field of education	2001	2002	2003	2004	2005	2006	% change 2001 to 2006
International students							
IT	2330	3174	3437	3532	3880	3823	64
<i>Computer science</i>	742	726	959	1043	1229	1027	38
<i>Information systems</i>	1016	1373	1433	1275	1403	1480	46
<i>Other IT</i>	571	1075	1045	1213	1248	1315	130
Engineering ^a	364	415	768	952	1114	769	111
Others	9394	10334	10542	12718	14649	16210	73
All	12089	13923	14747	17203	19644	20802	72
Domestic students							
IT	2752	3029	2954	2775	2431	2000	-27
<i>Computer science</i>	965	1048	958	899	793	616	-36
<i>Information systems</i>	1177	1314	1294	1164	1013	837	-29
<i>Other IT</i>	609	667	702	712	625	547	-10
Engineering	674	673	730	817	753	692	3
Others	36759	36844	37558	39486	39148	40198	9
All	40185	40547	41242	43078	42332	42891	7
International students as a % of total							
IT	42	46	49	54	56	57	
<i>Computer science</i>	36	40	47	51	54	55	
<i>Information systems</i>	45	47	48	51	55	57	
<i>Other IT</i>	44	50	53	60	59	59	
Engineering	26	30	38	40	40	42	
Others	19	20	22	24	25	27	
All	21	23	25	27	28	29	

Source: Unpublished *Higher Education Student Data Collection* (DEEWR). Scope: Bachelor and higher level.

a Includes electrical and electronic engineering only (ASCED code 313)

4.4.7 Time to course completion

Table 40 shows the time students took to complete IT and related courses from 2001 to 2006. It shows:

- The mean time to complete a postgraduate course in IT and engineering was lower than in other fields. This is probably due to a higher percentage of postgraduate courses in IT and engineering at the masters than doctoral level.
- Graduate diploma and graduate certificate courses took a little longer to complete in IT than in other fields.
- Bachelor courses in engineering took about a year longer to complete than in other fields. This is because most engineering courses are usually structured as a four-year programme.

Table 40 Time taken to complete IT and related courses by level of qualification, Victoria, 2001–2006 (%)

Field of education by level	Time to completion (years)						Total	Mean	Median
	1	2	3	4	5	>5			
IT									
<i>Postgraduate</i>	11	52	27	6	2	2	100	2.5	2
<i>Graduate dip/cert</i>	26	45	19	6	2	2	100	2.2	2
<i>Bachelor</i>	6	19	34	23	12	7	100	3.4	3
Engineering ^a									
<i>Postgraduate</i>	26	53	10	4	3	3	100	2.2	2
<i>Graduate dip/cert</i>	51	36	7	3	1	2	100	1.8	1
<i>Bachelor</i>	2	8	12	27	31	19	100	4.4	4
Others									
<i>Postgraduate</i>	12	38	21	11	8	11	100	3.1	2
<i>Graduate dip/cert</i>	48	31	12	5	2	2	100	1.9	2
<i>Bachelor</i>	5	13	31	26	14	12	100	3.8	4

Source: Unpublished *Higher Education Student Data Collection* (DEEWR). Scope: Bachelor and higher level.

a Includes electrical and electronic engineering only (ASCED code 313)

4.4.8 Projections of IT course completions

This section provides projections of the number of IT graduates from Victorian and interstate universities.

The number of domestic students commencing IT courses in Australia has been on the decline since 2001. More recently, international student numbers in these courses have also declined.

Consequently, enrolments and completions have also been falling.

Recent data on course enrolments from Victorian Tertiary Admission Centre (VTAC) suggest the decline in commencements in IT courses is likely to have continued at least in 2007.²¹ They indicate a drop in enrolments at the bachelor level of about 4.9 per cent in 2007.

Table 41 shows the projections of commencements, enrolments and completions of IT courses in Victoria from 2008 to 2022. For each group of students, the calculations assume:

- Commencements will decline by 4.9 per cent in 2007 and 2.3 per cent in 2008.
- The average of the ratio of commencements in period $t-1$ to enrolments in period t from 2001 to 2006 will be applicable for future periods.
- The average of the ratio of enrolments in period $t-1$ to completions in period t from 2001 to 2006 will be applicable for future periods.

The table shows:

- Victoria will produce about 61,200 IT graduates from 2008 to 2022—37 per cent with postgraduate degrees, 61 per cent with bachelor degrees and the rest with graduate diplomas or graduate certificates.
- Qualifications of domestic graduates will be 36 per cent of the total—20 per cent of postgraduate degrees, 54 per cent of graduate diplomas and graduate certificates and 45 per cent of bachelor degrees.

²¹ VTAC enrolment data is on domestic and international students who have completed schooling in Australia. Unlike DEEWR data, which are for the full year, VTAC enrolment data are as at March 31. Many students however bypass VTAC and enrol directly in universities or enrol at other times than at the beginning of the year.

Table 41 Projections of commencements, enrolments and completions of IT courses by level of qualification and citizenship, Victorian universities, 2008–2022

	Actual		Projections			
	2006	2007	2008	2009	2010–2022	Total 2008–2022
	Domestic students					
Commencements	2,322	2,208	2,208	2,208	28,707	33124
<i>Postgraduate</i>	481	457	457	457	5,947	6861
<i>Graduate dip/cert</i>	171	163	163	163	2,114	2439
<i>Bachelor</i>	1,670	1,588	1,588	1,588	20,646	23823
Enrolments ^a	7,673	6,658	6,332	6,332		
<i>Postgraduate</i>	1,744	1,330	1,264	1,264		
<i>Graduate dip/cert</i>	335	280	266	266		
<i>Bachelor</i>	5,594	5,049	4,802	4,802		
Completions	2,000	1,770	1,535	1,459	18,973	21967
<i>Postgraduate</i>	403	407	310	295	3,836	4441
<i>Graduate dip/cert</i>	118	81	68	65	840	973
<i>Bachelor</i>	1,479	1,281	1,156	1,100	14,296	16553
	International students					
Commencements	3,751	3,567	3,567	3,567	46,375	53509
<i>Postgraduate</i>	1,674	1,592	1,592	1,592	20,696	23880
<i>Graduate dip/cert</i>	118	112	112	112	1,459	1683
<i>Bachelor</i>	1,959	1,863	1,863	1,863	24,220	27946
Enrolments	10,131	8,622	8,200	8,200		
<i>Postgraduate</i>	4,278	3,552	3,378	3,378		
<i>Graduate dip/cert</i>	159	131	125	125		
<i>Bachelor</i>	5,694	4,939	4,697	4,697		
Completions	3,823	3,232	2,744	2,610	33,926	39280
<i>Postgraduate</i>	1,976	1,508	1,252	1,191	15,481	17924
<i>Graduate dip/cert</i>	96	70	58	55	717	830
<i>Bachelor</i>	1,751	1,653	1,434	1,364	17,728	20526

a Aggregating enrolments over time is not meaningful because of double counting.

Table 42 shows the projections of commencements, enrolments and completions of IT courses in interstate universities from 2008 to 2022. It shows:

- Interstate universities will produce about 103,600 IT graduates—37 per cent with postgraduate degrees, 54 per cent with bachelor degrees and the rest with graduate diplomas or graduate certificates.
- Qualifications of domestic graduates will be 40 per cent—25 per cent of postgraduate degrees, 39 per cent of graduate diplomas and graduate certificates and 51 per cent of bachelor degrees.
- Completions of graduate diplomas and graduate certificates are relatively more common interstate than in Victoria. Conversely, completions of postgraduate and bachelor level courses are relatively more common in Victoria.

Table 42 Projections of commencements, enrolments and completions of IT courses by level of qualification and citizenship, interstate universities, 2008–2022

	Actual		Projections			Total 2008–2022
	2006	2007	2008	2009	2010–2022	
	Domestic students					
Commencements	5135	4883	4883	4883	63485	73252
<i>Postgraduate</i>	909	864	864	864	11238	12967
<i>Graduate dip/cert</i>	463	440	440	440	5724	6605
<i>Bachelor</i>	3763	3579	3579	3579	46523	53680
Enrolments	17461	14670	13951	13951		
<i>Postgraduate</i>	3051	2393	2276	2276		
<i>Graduate dip/cert</i>	874	768	730	730		
<i>Bachelor</i>	13536	11509	10945	10945		
Completions	3666	3471	2903	2761	35891	41555
<i>Postgraduate</i>	718	849	666	634	8237	9537
<i>Graduate dip/cert</i>	351	282	248	236	3064	3547
<i>Bachelor</i>	2597	2339	1989	1892	24590	28471
	International students					
Commencements	6094	5796	5796	5796	75342	86934
<i>Postgraduate</i>	2517	2394	2394	2394	31119	35906
<i>Graduate dip/cert</i>	549	522	522	522	6788	7832
<i>Bachelor</i>	3028	2880	2880	2880	37436	43196
Enrolments	16299	13173	12528	12528		
<i>Postgraduate</i>	6352	5045	4798	4798		
<i>Graduate dip/cert</i>	758	673	640	640		
<i>Bachelor</i>	9188	7455	7090	7090		
Completions	6686	5355	4336	4123	53604	62063
<i>Postgraduate</i>	2914	2520	2001	1903	24741	28645
<i>Graduate dip/cert</i>	648	444	395	375	4879	5649
<i>Bachelor</i>	3124	2391	1940	1845	23984	27769

a Aggregating enrolments over time is not meaningful because of double counting.

4.5 Other sources of supply

While the publicly funded higher education sector supplies Victoria with most of its people with qualifications to work in ICT occupations, there are other sources of supply.

- Some TAFE institutes have begun offering degree level courses in the last few years. However, the total numbers completing courses from these institutes are quite small.
- Australia's immigration programmes provide workers with higher education qualifications. However, Australia also loses qualified people through emigration. Estimating the net effect of these flows to Victoria's labour supply, let alone those with IT skills and qualifications, is complex because of the multitude of programmes under which people enter the country and the difficulty in converting arrival and departure movements into numbers available for work in the state by occupation and qualification. The task is made difficult because detailed statistics on the flows of people into and out of Australia, that includes their occupation and qualification, are usually not available to the public. Visa category 'jumping' compounds this problem. For example, a person who arrives on a student visa can apply for either a temporary working visa (visa subclass 457) or permanent residency visa after completing their course and while onshore.
- International students may apply to work while studying in Australia but their hours are generally capped at 20 per week during term time. No studies of the type of work they perform have been completed. In addition, overseas students are sometimes included in the ABS *Labour Force* surveys and at other times excluded. Even when included they are difficult to identify.

Most student contribution to labour supply while they are studying is likely to be at the semi-skilled or unskilled level.

- Private higher education providers are another potential source of graduates in Victoria. Enrolments with some of these providers are already included in the *Higher Education Student Data Collection* but others are not. Data on those not included in this collection do not exist, at least not in the public domain.

4.5.1 Net migration

Shah, Cooper and Burke (2007) provide a detailed analysis of permanent and temporary movement of people to and from Victoria. This section draws on that research to estimate the net supply of people with ICT qualifications to Victoria. Note that since that research was completed the skilled migration programme has been expanded. Net flow of people with ICT qualifications can result through a number of different streams. These are:

- *Net permanent movements.* Permanent arrivals consist largely of settlers visaed offshore under the Migration and Humanitarian programmes and permanent departures consist of Australian permanent residents (including former settlers) leaving Australia who do not intend to return on a permanent basis. Assuming a similar occupation and qualification distribution to that of the Victorian workforce for the migrants²², the annual net gain to Victoria of people with IT qualifications²³, and who are available for work, was estimated to be 230.
- *Net long-term resident movements.* Long-term resident departures are of people with permanent residency in Australia who expect to be absent for 12 months or more, while long-term resident arrivals are people with the same status who are returning to Australia after an absence of 12 months or more. Net gain to Victoria of people with IT qualifications in this stream is estimated to be 40.
- *Net movements of New Zealand citizens.* New Zealand citizens are free to enter and leave Australia without restrictions for tourism, visiting family and friends, study and work under the Trans-Tasman Travel Arrangement. A number come as permanent settlers and their numbers are included in the estimates of net permanent movements. Others come on long or short-term visits. Only long-term movements of New Zealand citizens are used to assess the potential addition to the labour supply for Victoria, as short-term arrivals are unlikely to work. Net gain to Victoria of people with IT qualifications in this stream is also estimated to be 40.
- *Movements of temporary migrants (visa 457).* Australia's temporary migration programme (457 visa sub-class) provides up to four years temporary residency to people recruited by Australian companies as skilled workers or to people whose primary purpose is business-related. The primary purpose of the programme now is to alleviate short-term skills shortages though the original aim was somewhat different. Those sponsored are not allowed to change jobs for the duration of their stay unless explicitly permitted by the sponsoring employer. People recruited under this programme must satisfy some minimum skills requirements and they must be paid a gross salary above a minimum level. The current minimum gross salary that must be paid to an IT professional is \$57,300. A number apply for permanent residency onshore each year (DIMA 2007). Assessing the net contribution from this stream to Victoria's supply of graduates to ICT occupations is highly problematic for at least two reasons. First, the temporary migrant group is highly mobile with 50 per cent staying in the country for about 5.5 months. Second, as

²² Migrants, at least during the first few years of settlement, suffer from downward occupational mobility but this depends on factors such as their country of origin, proficiency in English and recognition of their qualifications. This means the qualification distribution by occupation for migrants is likely to vary from that for Australian-born (Shah and Burke (2005)).

²³ Higher education levels only.

applications for a 457 visa can be made onshore (e.g. Khoo et al. (2003) calculated 23,000 out of a total of 37,000 457 visa grants in 2001 were processed onshore), it is possible that international students can apply for this visa once they have completed their studies, provided they can find a sponsoring employer. International students working in Australia have, however, already been included as part of the supply of graduates from Australian universities. Care thus needs to be exercised when assessing the contribution of people on 457 visas to Victoria's supply of ICT graduates. The gain in supply to state through this stream is estimated to be 120 per year.

- *Onshore visa grants.* While the majority of people still make their application to migrate to Australia offshore, an increasing number are applying onshore. Those making onshore applications include temporary migrants (457 visa) and international students. As these two groups are already accounted for elsewhere, they are excluded when estimating the contribution of onshore visa grants on the state's supply of ICT graduates. The net annual gain in ICT graduates through this stream is estimated to be 110.
- *Movements of working holiday makers.* The Australian Government's Working Holiday Makers programme is a potential source of labour for Victoria. However, in spite of often being skilled, most people who come under this scheme work in semi-skilled or unskilled jobs. Furthermore, as part of their visa condition, there are restrictions on the period they can work for a particular employer. The average stay in the country by working holiday makers in 2002 was nine months (DIMA 2007). It is not clear if a working holiday maker can change their visa status to temporary (visa 457) or permanent status while onshore. According to our current knowledge there are no regulations preventing such an application. New regulations permit working holiday makers to extend their stay for up to two years under certain conditions. Hence, estimating the contribution of working holiday makers to the supply of graduate labour to Victoria is difficult. Tentative estimates can be made using findings from a 2002 survey of working holiday makers (Harding and Webster 2002). Based on the results of that survey annual gain in ICT graduates to Victoria from this programme is estimated to be about 100. As the programme is extended to more countries and employment rules relaxed, the supply from this source is likely to increase.

Total net annual gain in ICT graduates to Victoria from all types of migration programmes is estimated to be 640. It should however be acknowledged that this estimate is tentative given the complexity of the migration programmes and paucity of good data on the subject. Furthermore, migrants, especially those from non-English speaking countries, experience significant downward occupational mobility in the early years of settlement (Shah and Burke 2005; Chiswick, Lee and Miller 2002).

4.5.2 Private providers of higher education

Watson (2000) estimated just over 30,000 enrolments with private providers in 1999. Most enrolments were by Australian students (96 per cent) with 72 per cent on a part-time basis. About 90 per cent of enrolments were at the postgraduate or bachelor level, with just over half at the postgraduate level. Enrolments were concentrated in a narrow set of fields: business related (36.6 per cent), religious studies (25.8 per cent), health technology (7.5 per cent), law (4.3 per cent) and arts (four per cent). Surprisingly, an insignificant number of enrolments were in IT. Furthermore, data on completions or the average time to completions were unavailable. On this basis, it is not possible to estimate the supply of ICT graduates to Victoria through this source.

5 Shortfall/surplus in IT qualifications

Chapter 3 provided projections of the size and qualifications profile of ICT occupations in Victoria in 2022. Projections of the numbers of new entrants with qualifications and the numbers of existing workers who need to upgrade qualifications from 2008 to 2022 to achieve the target were provided.

Chapter 4 assessed the potential numbers of qualified people that may be available to ICT occupations in Victoria from Australian universities, mainly Victorian, and from Australia's migration programmes over the same period. The analyses show people who are employed in ICT occupations have a range of qualifications, with only about half in IT. At the same time new IT graduates are employed in a range of occupations and only a minority are in ICT occupations. In Victoria, international students are a majority of the student cohort in IT courses. Their destinations after graduation is often uncertain, as many apply for permanent residency in Australia.

In this chapter, we tentatively assess whether the supply of IT graduates from Victorian universities will be sufficient to meet requirements in ICT occupations from 2008 to 2022. Four scenarios of potential supply are considered.

Key findings

- The base scenario projects a shortfall of 3,700 IT graduates for ICT occupations in Victoria from 2008 to 2022—shortfalls of 1,700 postgraduates and 2,700 bachelors but surplus of 700 graduate diplomas and graduate certificates.
 - Alternative scenarios generally project surpluses of up to 3,100 IT graduates.
 - International students are the major source of the supply of postgraduate IT qualifications.
-

5.1 Shortfall/surplus in the numbers with IT qualifications

The calculations of the potential supply of graduates with IT qualifications for Victoria assume:

- The observed pattern in labour force destinations of IT graduates in 2006 (see Table 30) to continue in the future.
- The number of people completing IT courses in Victorian and interstate universities will be as shown in Table 40.
- The level of net migration of people with IT qualifications will be 50 per cent of the numbers estimated in section 4.3.1 and this level will remain constant over time. The reason for discounting the estimate in section 4.3.1 by half is because not all migrants who previously worked in an ICT occupation will have an IT qualification recognised in Australia. Furthermore, migrants, especially those from non-English speaking countries, often experience downward occupational mobility in the early years of settlement in Australia.

Four scenarios of potential supply, as defined in section 4.1.3, are considered for evaluating shortfall or a surplus of IT graduates from 2008 to 2022.

Table 43 shows the requirements and, for each scenario of supply, the potential supply and shortfall or surplus in graduates with IT qualifications for ICT occupations in Victoria from 2008 to 2022. It shows:

- Total graduate requirements in ICT occupations will be 42,900. Of these, 20,800 will have IT qualifications—8,000 postgraduate, 300 graduate diploma or graduate certificate and 12,500 bachelor qualifications.

- Base Scenario projects a shortfall of 3,700 IT graduates—shortfall of 1,700 postgraduates and 2,700 bachelors but a surplus of 700 graduate diplomas and graduate certificates. Alternative scenario 2 also projects a small shortfall.
- Alternative Scenarios 1 and 3 project surpluses of between 1,600 and 3,100 IT graduates.
- All scenarios project a surplus of graduate diplomas and graduate certificates.
- International students are the major source of supply of postgraduate IT qualifications.

Table 43 Projected shortfall/surplus of people with IT qualifications for ICT occupations by level of qualification, Victoria, 2008–2022 ('000)

	Postgraduate	Graduate dip/cert	Bachelor	Total
Requirements	13.9	1.2	27.8	42.9
<i>With IT qualifications</i>	8.0	0.3	12.5	20.8
<i>Other qualifications</i>	5.9	0.9	15.3	22.1
Supply of IT qualifications (Base scenario)^a	6.3	1.0	9.8	17.1
<i>Domestic graduates (Victoria)</i>	1.7	0.2	5.7	7.5
<i>International graduates (Victoria)</i>	2.1	0.1	1.3	3.5
<i>Domestic graduates (Interstate)</i>	0.4	0.1	0.3	0.8
<i>International graduates (Interstate)</i>	0.2	0.1	0.1	0.4
<i>Migration^e</i>	1.9	0.5	2.4	4.8
Supply of IT qualifications (Alternative scenario 1)^b	7.5	1.4	13.5	22.4
<i>Domestic graduates (Victoria)</i>	2.2	0.4	8.3	11.0
<i>International graduates (Victoria)</i>	2.9	0.1	2.1	5.1
<i>Domestic graduates (Interstate)</i>	0.4	0.3	0.6	1.3
<i>International graduates (Interstate)</i>	0.1	0.1	0.1	0.3
<i>Migration</i>	1.9	0.5	2.4	4.8
Supply of IT qualifications (Alternative scenario 2)^c	8.0	1.1	11.0	20.1
<i>Domestic graduates (Victoria)</i>	1.7	0.2	5.7	7.5
<i>International graduates (Victoria)</i>	3.7	0.1	2.5	6.3
<i>Domestic graduates (Interstate)</i>	0.4	0.1	0.3	0.8
<i>International graduates (Interstate)</i>	0.3	0.2	0.1	0.6
<i>Migration</i>	1.9	0.5	2.4	4.8
Supply of IT qualifications (Alternative scenario 3)^d	8.5	1.5	13.9	23.9
<i>Domestic graduates (Victoria)</i>	2.2	0.4	8.3	11.0
<i>International graduates (Victoria)</i>	3.7	0.1	2.5	6.3
<i>Domestic graduates (Interstate)</i>	0.4	0.3	0.6	1.3
<i>International graduates (Interstate)</i>	0.3	0.2	0.1	0.6
<i>Migration</i>	1.9	0.5	2.4	4.8
Shortfall (-)/surplus (+)				Net total
Base Scenario	-1.7	0.7	-2.7	-3.7
Alternative Scenario 1	-0.5	1.1	1.0	1.6
Alternative Scenario 2	0	0.8	-1.5	-0.7
Alternative Scenario 3	0.5	1.2	1.4	3.1

a Includes domestic and international graduates working in ICT, 80 per cent of domestic graduates resident in Victoria who are not working and not studying and 25 per cent of international graduates resident in Victoria who are not working and not studying.

b Includes supply calculated under Base Scenario plus 50 per cent of domestic graduates resident in Victoria and who are working in non-ICT occupations and not studying.

c Includes supply calculated under Base Scenario plus 40 per cent of international graduates resident in Victoria and who are working in non-ICT occupations and not studying.

d Includes supply calculated under Base Scenario plus 50 per cent of domestic and 40 per cent of international graduates resident in Victoria and who are working in non-ICT occupations and who are not studying.

e Only 50 per cent of migrants whose pre-migration occupation was in ICT are assumed to add to the graduate supply for ICT occupations in Victoria. This is because many migrants experience downward occupational mobility as well as have difficulties in having their overseas qualifications recognised. International students who complete their qualifications in Australia and apply onshore for migration are already included elsewhere just as are domestic graduates who leave to work overseas. The distribution of qualifications of migrants will be 40 per cent postgraduate, 10 per cent graduate diploma or graduate certificate and 50 per cent bachelor.

5.2 Short- and medium-term prospects

Employment in ICT occupations is forecast to grow at just under 2 per cent per year in Victoria from 2008 to 2022. In each occupation, the annual rate of net replacement is assumed to remain constant over time. This generally means requirements (demand) will increase over time.

The supply side modelling assumes the annual level of commencements in IT courses will remain constant from 2008 to 2022. However, because of the *pipeline* effect, the supply of graduates over the next five years will be higher than in the following five years, but only by one per cent.

Therefore, in Base Scenario and Alternative Scenario 2, the supply of IT graduates for ICT occupations will exceed demand in the short-term (2008 to 2012), and possibly medium-term (2013 to 2017), and in the long-term (2018 to 2022) demand will exceed supply, though overall there will be a shortfall.

In Alternative Scenarios 1 and 3, there will possibly be excess supply in the short- and medium-term and possibly also in the long-term, though overall supply will exceed demand.

6 Concluding remarks

This report has assessed the possible imbalance in the number of people with higher education IT qualifications to meet demand in ICT occupations in Victoria from 2008 to 2022.

The projection of the 2022 qualifications profile in ICT occupations was modelled in the context of the general changing industrial and occupational structure of employment and skills deepening within occupations.

Requirements for people with qualifications in ICT occupations resulting from employment growth, turnover in jobs and skills deepening were estimated.

Although these requirements are sufficient to achieve the qualifications profile in 2022, new entrants and existing workers will also acquire additional skills that are not formally accredited, or are at a level lower or the same as that of their current highest qualification.

ICT occupations employ people with a range of skills. Current data suggest only about half the new graduates entering these occupations have IT qualifications. Others have qualifications in engineering, management and commerce and humanities, although their qualifications may include studies in IT.

At the same time, IT graduates are employed in a range of occupations, with only a minority in ICT occupations. A relatively high proportion of IT graduates entering the Victorian labour market are international students seeking permanent residency in Australia. The supply is increasingly augmented by migration of people who already have higher education IT qualifications.

The labour market for ICT occupations lacks clear boundaries in terms of the qualifications and skills required to work in them, which makes assessing the balance of supply and demand problematic. The assessments made in this report are therefore tentative.

At current levels of supply from Australian universities and migration programmes, an overall shortfall in IT graduates for ICT occupations is projected. The shortfall is only at the postgraduate and bachelor degree levels. At the graduate diploma and graduate certificate levels surplus is projected. This assessment assumes the demand for IT graduates relative to other graduates in ICT occupations will remain unchanged from that observed recently. It also assumes the number of IT graduates being employed in ICT occupations relative to other occupations will remain at their current levels.

Some alternative scenarios of supply project a surplus of qualified IT workers. These alternative scenarios assume that a proportion of IT graduates currently employed in non-ICT occupations (particularly those in low-skill occupations) become part of the potential supply.

The above assessments of imbalance may change with changes in the relative salaries paid in ICT occupations compared to other occupations remaining at current levels.

If the labour force participation rate increases above that assumed in this report, then overall employment growth is likely to be higher. This could mean higher requirements in ICT occupations and, hence, under the base scenario, a bigger shortfall in the number of people with IT qualifications.

The IT faculties of Victorian universities are highly dependent on the international student market. There are more international than domestic students graduating from these faculties. Some international students' motivation for enrolling in higher education courses, including IT courses, is the prospect of permanent residency in Australia at the completion of their course. In reality, many find it difficult getting employment in ICT occupations and find employment in low-skill occupations. Possible reasons for this are inadequate English language skills, a lack of other

employability skills and most importantly not having connections to local employment market either through family, social or professional networks.

Hence, IT faculties of Victorian universities are exposed to the vagaries of the international student market and policies on skilled migration.

The fall in domestic student enrolments in IT courses in Victoria since 2001 has been quite significant. The flight of domestic students from IT courses partly reflects the conditions of the ICT labour market, and the media attention it received following the collapse of the dotcom bubble at the beginning of the decade. Employment in ICT occupations remained largely unchanged from 2001 to 2007 and earnings for computing professionals increased by less than in other professional occupations.²⁴ At the same time, international student enrolments as a proportion of all enrolments in IT courses increased from 42 to 57 per cent from 2001 to 2006, although in the last two years there has been a slowing in the rate of growth. An increasing number of international students have been opting to work in Victoria after graduation and apply onshore for residency under the skilled migration or temporary migration programmes. Offshore applicants to these programmes add to the total supply of IT graduates available. The relationship between the fall in domestic students' interest in IT courses and these other factors needs investigation.

²⁴ Earnings of computing professionals increased 18 per cent from 2000 to 2006 compared to 33 per cent for all professionals (ABS 2006).

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Appendix 1 ICT specialists' occupations

Table A1 ICT specialists' occupations

Code	Description
1	Managers
135111	Chief Information Officer
135112	ICT Project Manager
135199	ICT Managers nec
2	Professionals
212415	Technical Writer
223211	ICT Trainer
225211	ICT Account Manager
225212	ICT Business Development Manager
225213	ICT Sales Representative
232413	Multimedia Designer
232414	Web Designer
233411	Electronics Engineer
261111	ICT Business Analyst
261112	Systems Analyst
261211	Multimedia Specialist
261212	Web Developer
261311	Analyst Programmer
261312	Developer Programmer
261313	Software Engineer
261399	Software and Applications Programmers nec
262111	Database Administrator
262112	ICT Security Specialist
262113	Systems Administrator
263111	Computer Network and Systems Engineer
263112	Network Administrator
263113	Network Analyst
263211	ICT Quality Assurance Engineer
263212	ICT Support Engineer
263213	ICT Systems Test Engineer
263299	ICT Support and Test Engineers nec
263311	Telecommunications Engineer
263312	Telecommunications Network Engineer
3	Technicians and Trades Workers
312411	Electronic Engineering Draftsperson
312412	Electronic Engineering Technician
313111	Hardware Technician
313112	ICT Customer Support Officer
313113	Web Administrator
313199	ICT Support Technicians nec
313211	Radio communications Technician
313212	Telecommunications Field Engineer
313213	Telecommunications Network Planner
313214	Telecommunications Technical Officer or Technologist
342311	Business Machine Mechanic
342312	Communications Operator
342313	Electronic Equipment Trades Worker
342314	Electronic Instrument Trades Worker (General)
342315	Electronic Instrument Trades Worker (Special Class)
342411	Cabler (Data and Telecommunications)
342412	Telecommunications Cable Jointer
342413	Telecommunications Linesworker (Aus)
342414	Telecommunications Technician
6	Sales Workers
621211	ICT Sales Assistant
8	Labourers
899914	Electrical or Telecommunications Trades Assistant

Appendix 2 MONASH model for forecasting employment

MONASH is a computational general equilibrium model for forecasting employment by occupation (Adams et al. 1994; Dixon and Rimmer 1996; Meagher 1997; and Dixon and Rimmer 2000). It is maintained by the Centre of Policy Studies (CoPS), Monash University. An intuitive description of the model is contained in Appendix O in Industry Commission (1997)

In brief, the MONASH model is a sequence of single-period models, linked through time by the behaviour of capital and labour markets. It has three main elements—a database, theory and parameters—that are embodied in the model’s system of equations. These equations describe how industries and consumers respond to changes in policy. The core of the database is a large input-output matrix, which shows how each sector of the economy is linked to other sectors. These linkages are only for a particular point in time. Behaviour responses of different groups to policy changes are based on economic theory. The model specifies likely responses of producers, consumers, foreigners and investors to policy changes. It also includes a government sector, the revenue and expenditure behaviour of which is modelled separately. While theory guides the model’s broad assumptions (which can be altered to accommodate different scenarios), actual numerical parameters are required to estimate the size of the responses. In MONASH, these parameters are derived either from the input-output database or from other external sources.

MONASH converts the forecast for aggregate output to forecasts for output by industry. These are then converted to forecasts of employment by industry, which in turn are converted to employment by occupation. MONASH uses the ACCESS Economics’ macro forecasts of output by industry as an input.

Appendix 3 Additional tables

Table A2 Level of qualification by occupation, 2005 cohort of interstate university graduates working in ICT occupations in 2006 (%)

Occupation	Level of qualification			Total	
	Postgraduate	Grad dip/cert	Bachelor	%	Number
ICT managers	42	18	40	100	440
Professionals	32	8	60	100	5,240
<i>Technical writer/ICT trainer</i>	29	15	56	100	200
<i>ICT sales professional</i>	29	8	64	100	440
<i>Multimedia & web designer</i>	21	10	68	100	190
<i>Electronics engineer</i>	23	7	70	100	220
<i>Business & systems analysts & programmers</i>	34	7	59	100	2,800
<i>Database & systems admin & ICT security</i>	35	8	57	100	560
<i>ICT network & support</i>	31	8	61	100	830
Technicians/Trades	29	13	58	100	720
<i>Electronic eng. draughtpersons & technician</i>	25	13	62	100	60
<i>ICT & telecommunications technician</i>	31	13	56	100	600
<i>Electronics & telecommunications trade</i>	16	15	69	100	60
ICT sales assistant	13	5	82	100	140
All ICT	32	9	59	100	6,540
Others	25	14	62	100	116,690
All	25	13	61	100	123,230

Source: Unpublished data from *Graduate Destinations Survey 2006* (GCA) and *Higher Education Student Data Collection* (DEST).

Note: A person is classified to be working if they indicated 1) working more than zero hours per week; or 2) described an occupation they were working in. The table includes students who completed a bachelor degree or higher qualification. Excludes some records for which there were missing values for international student indicator. The numbers in this table have been rounded to the nearest ten. The row and column sums may not add to the margin totals because of rounding errors.

Table A3 Field of education by occupation, 2005 cohort of interstate university graduates working in ICT occupations in 2006 (%)

Occupation	Qualification (field)					Total	
	IT	Engineering	Man & commerce	Humanities ^a	Other ^b	%	Number
ICT managers	29	8	44	8	10	100	440
Professionals	47	14	20	11	7	100	5,240
<i>Technical writer/ICT trainer</i>	4	2	37	42	14	100	200
<i>ICT sales professional</i>	5	2	66	22	5	100	440
<i>Multimedia & web designer</i>	2	24	8	49	17	100	190
<i>Electronics engineer</i>	3	58	11	2	25	100	220
<i>Bus & sys analysts & programmers</i>	62	11	15	7	5	100	2,800
<i>Dbase & sys admin & ICT security</i>	60	11	17	7	5	100	560
<i>ICT network & support</i>	43	23	16	7	11	100	830
Technicians/Trades	20	11	30	22	17	100	720
<i>Electronic eng. draughts & tech</i>	5	38	21	9	27	100	60
<i>ICT & telecom technician</i>	22	7	33	24	15	100	600
<i>Electronics & telecomm trade</i>	17	21	17	17	29	100	60
ICT sales assistant	7	2	31	38	22	100	140
All ICT	42	13	23	13	9	100	6,540
Others	4	4	29	25	39	100	116,690
All	6	5	28	24	37	100	123,230

Source: Unpublished data from *Graduate Destinations Survey 2006* (GCA) and *Higher Education Student Data Collection* (DEEWR).

Note: A person is classified to be working if they indicated 1) working more than zero hours per week; or 2) described an occupation they were working in. The table includes students who completed a bachelor degree or higher qualification. Excludes some records for which there were missing values for international student indicator. The numbers in this table have been rounded to the nearest ten. The row and column sums may not add to the margin totals because of rounding errors.

a Includes society and culture and creative arts.

b Includes science, architecture & building, agriculture & environment, health, education, food, hospitality and personal services and mixed fields.

Table A4 Field of education by occupation, 2005 cohort of interstate university graduates with double degrees working in ICT occupations in 2006 (%)

Occupation	Qualification (field)					Total	
	IT	Engineering	Man & commerce	Humanities ^a	Other ^b	%	Number
ICT managers	25	14	39	10	12	100	20
Professionals	32	23	22	13	9	100	390
<i>Technical writer/ICT trainer</i>	4	3	39	43	11	100	20
<i>ICT sales professional</i>	1	1	62	31	6	100	40
<i>Multimedia & web designer</i>	3	25	8	47	17	100	20
<i>Electronics engineer</i>	4	59	4	3	31	100	20
<i>Bus & sys analysts & programmers</i>	46	22	19	8	5	100	190
<i>Dbase & sys admin & ICT security</i>	45	22	20	8	5	100	40
<i>ICT network & support</i>	28	35	15	8	15	100	70
Technicians/Trades	13	12	29	31	15	100	50
ICT sales assistant	2	1	34	46	17	100	10
All ICT	28	21	24	16	10	100	480
Others	2	5	30	34	29	100	9,020
All	4	6	30	33	28	100	9,500

Source: Unpublished data from *Graduate Destinations Survey 2006* (GCA) and *Higher Education Student Data Collection* (DEEWR).

Note: A person is classified to be working if they indicated 1) working more than zero hours per week; or 2) described an occupation they were working in. The table includes students who completed a bachelor degree or higher qualification. Excludes some records for which there were missing values for international student indicator. The numbers in this table have been rounded to the nearest ten. The row and column sums may not add to the margin totals because of rounding errors.

a Includes society and culture and creative arts.

b Includes science, architecture & building, agriculture & environment, health, education, food, hospitality and personal services and mixed fields.

Table A5 Proportion undertaking further study in 2006 by labour force status and citizenship, 2005 cohort of IT graduates from interstate universities (%)

Labour force status	Domestic graduates		International graduates	
	% studying	Total (number)	% studying	Total (number)
Working	12	3,660	21	3,180
<i>ICT occupations</i>	10	1,610	14	1,130
<i>Non-ICT occupations</i>	14	2,050	24	2,040
Not working	35	980	52	3,450
All	17	4,640	37	6,630

Source: Unpublished data from *Graduate Destinations Survey 2006* (GCA) and *Higher Education Student Data Collection* (DEEWR).

Note: A person is classified to be working if they indicated 1) working more than zero hours per week; or 2) described an occupation they were working in. The table includes students who completed a bachelor degree or higher qualification. Excludes some records for which there were missing values for international student indicator. The numbers in this table have been rounded to the nearest ten. The row and column sums may not add to the margin totals because of rounding errors.