

Demographic impacts on the future supply of vocational skills

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Program 2:
The nature of the labour supply

*A well-skilled future: Tailoring vocational education
and training to the emerging labour market*



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The views and opinions expressed in this document are those of the author/project team and do not necessarily reflect the views of the Australian Government, state and territory governments or NCVER

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Additional information relating to this research is available in *Demographic impacts on the future supply of vocational skills: Support document*. It can be accessed from NCVER's website <<http://www.ncver.edu.au/publications/1995.html>>.

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About the research



Demographic impacts on the future supply of vocational skills by Yan Tan and Sue Richardson

This report examines the effect of an ageing population on the future skills supply. It gives a detailed analysis of projected vocational education and training (VET) employment and VET qualifications by occupation and age group to 2020, highlighting those occupations using VET-acquired skills. It also quantifies the compositional effects of changing demographics on both the quantitative ('how many?') and qualitative ('what type?') dimensions of the supply of vocational skills.

Key messages

- Over the next 15 years, the workforce will continue to grow but its age structure will change significantly. By 2020 people aged between 50 and 65 will comprise 45% of the working-age population. However, the age distribution of new entrants will remain constant for males and get a little younger for females.
- By 2020 almost all the non-trade occupations are expected to have more people aged over 55 than under 25. People in the trades have the youngest age profile and this is expected to persist for the next 15 years.
- The workforce will become more qualified as more qualified age cohorts move through the labour market (and because within VET-intensive occupations there will be an increase in associate professional and managerial and administrative occupations). Skill deepening will lead to even higher levels of qualifications.
- There will be a growing demand for the VET sector to:
 - assist in improving the skills and hence employability of people currently marginal to the workforce, including older workers
 - provide training that helps people upgrade or enhance their VET qualifications at higher levels (especially advanced diploma/diploma) and in the business/management disciplines
 - offer older workers a quick return on their training investment.

The report is part of a suite of research undertaken by the National Institute of Labour Studies, Flinders University, and the Centre for Post-compulsory Education and Lifelong Learning, University of Melbourne, whose findings are synthesised in *A well-skilled future* by Sue Richardson and Richard Teese. Two other NCVER publications address similar issues: *Will we run out of young men?* by Tom Karmel and Koon Ong (NCVER, 2007) and *Higher-level vocational education and training qualifications: Their importance in today's training market* by Sue Foster et al. (NCVER 2007).

Tom Karmel
Managing Director, NCVER

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Executive summary

Introduction

This report is a component of the research program entitled *A well-skilled future: Tailoring VET to the emerging labour market*, in which the evolving labour market and changing work organisation and management in the context of the vocational education and training (VET) sector are examined. The research has been undertaken by a consortium of researchers from the National Institute of Labour Studies and the Centre for Post-compulsory Education and Lifelong Learning of the University of Melbourne.

The ageing of the Australian population and its impact on the Australian labour market is an issue of national concern. The impact of population ageing on the supply of vocational skills is an important part of the story and yet to be properly understood. This study analyses and quantifies the effects of ageing on both the quantitative ('how many?') and qualitative ('what type?') dimensions of the supply of vocational skills in Australia. We measure skills supply in two ways: *employment in a job that uses VET skills* and *the number of people with VET qualifications* in the Australian workforce. Focusing particularly on VET-intensive occupations, this study provides an analysis, over a 15-year period to 2020, of projected VET employment and VET qualifications by occupation and by age groups.

From the nine major groups of occupations (as defined by the Australian Standard Classification of Occupations [ASCO]), five VET-intensive occupations are identified (among workers aged 25–49). 'Tradespersons' is found to be the only occupation where a majority of workers have VET qualifications. The other VET-intensive categories include: 'Associate professionals', 'Managers and administrators', 'Intermediate' and 'Advanced clerical and service workers'.

We use cohort analysis methods to understand workforce dynamics and use age or age–sex specific analysis methods to project the share and size of employment and VET qualifications in each occupational category. The historical employment patterns in each occupation and for each age group between and within occupations over time are irregular, and so changes to employment shares need to be smoother. Based on the changing age structure of the workforce and the pattern of qualifications among the different age groups, the number of workers with VET qualifications (within each occupation) is projected.

Impacts of the ageing population on labour supply

Over the next 15 years, the workforce will continue to grow (by 1.7 million people), albeit with a declining rate of growth. The age composition of the workforce will change significantly to comprise a large proportion of older workers. The share of the prime-age group (25–49) reached a maximum of 48% of those of working age (15–65) in 1996 and has fallen steadily since then. It will decrease from 45% in 2005 to 37% in 2020. By 2014, there will be as many people aged 50–65 years as there are people aged 25–49 years. The older group will comprise 45% of the working-age population by 2020.

This study analyses the movement of people into and out of the workforce arising from the interaction between the age–sex structure of the population and age–sex specific participation rates

in the future. As the large baby boomer generation approaches traditional ages of retirement, the number of outflows from the labour market is expected to increase. However, there will be virtually no change in the number of young people entering the workforce. In fact, the age distribution of new entrants will remain constant for males and get a little younger for females. Together, these trends highlight the importance of extending the working lives of older workers. Furthermore, there will be a necessity for the VET sector to assist in increasing the skills of people who are currently marginal to the workforce, as an important way to supplement the slowly growing workforce.

Projections of employment in VET-intensive occupations

The supply of skills is a difficult thing to observe. People obtain work skills by undertaking formal education courses and obtain formal qualifications in the process. We can measure supply as the numbers of people who have particular *qualifications*. But many people who have a qualification do not use that qualification directly in their job. And many people who work in a skilled or semi-skilled job have no formal qualifications, or have one not relevant to the job. Thus a reliance on measuring qualifications is not sufficient. A second way to measure supply is to assume that everyone who does a skilled job has the necessary skills for the job and therefore is part of the supply of those skills. With this approach, the changes of the overall *employment* in VET-intensive jobs and its distributions among occupations and across age groups can be deemed to be the supply of VET skills. We use both approaches.

Based on recent patterns of growth, the categories of ‘Generalist managers’, ‘Specialist managers’, ‘Business and administration associate professionals’, ‘Skilled agricultural and horticultural workers’, and ‘Intermediate service workers’ will be the largest and probably the fastest growing VET occupations. In contrast, there is likely to be a decline in employment of ‘Farmers and farm managers’, ‘Automotive tradespersons’, ‘Food tradespersons’, and ‘Secretaries and personal assistants’. Within the trades, ‘Construction tradespersons’ and ‘Skilled agricultural and horticultural workers’ are anticipated to grow in share by approximately 1.0 and 1.8%, respectively, over the period 2005 to 2020. In absolute terms, this means an additional 36 000 and 30 000 people, respectively.

For all of the VET-intensive occupations, the share of older workers (especially those aged 55 and over) will rise, and the share of prime age workers will decline. While the whole workforce will be older, the VET-intensive ‘Associate professional’ and ‘Advanced clerical occupations’ will be particularly affected. The occupations that will have the most rapidly ageing profile include ‘Science/engineering’, ‘Health/welfare’ and ‘Secretaries/personal assistants’. Almost all of the non-trade occupations are expected to have more people aged over 55 than under 25 by 2020. Those in the trade occupations (especially automotive, construction and food) have the youngest age profile and this is expected to persist for the next 15 years.

Projections of VET skills supply in VET-intensive occupations

To estimate the persons with VET *qualifications* to be employed in each occupation, this study uses education clusters to assign a ‘VET skills ratio’ to the projected employment in each of the five VET-intensive major occupations. We expect a more rapid increase in the supply of qualified people in each of the major occupations than in the number employed. By 2020, the total number of people with VET qualifications projected to be employed in the five VET-intensive occupations will, at around 2.81 million, be almost half a million more than in 2004. Most of the increase will be for qualifications in the fields of Associate professional and Managerial and administrative work, with men predominating. There will be an increasing demand for training to upgrade or enhance people’s VET qualifications at higher levels (especially advanced diploma/diploma) and in the business/management disciplines. The smallest increases will be in the ‘Advanced clerical and service workers’ and the ‘Trades’. Overall, 60% of the additional VET qualifications will go to men.

The changing age profiles in 2-digit occupations are apparent in the synthetic cohort analyses of the projected VET qualifications, as people enter and exit specific VET occupations at different points in the life course. The analyses demonstrate that people with VET qualifications enter occupational groups in widely varying ways, and at different ages. People enter the trades (and farming) at a young age and start to leave the occupation by their mid-20s. In contrast, people enter the ‘Management’, ‘Associate professionals’ and ‘Intermediate’ clerical jobs at every age up to the mid-40s. The age and stage in the life course of the student body will differ, according to the type of VET qualifications being sought.

Implications for VET

The changes in age profile have implications for the VET sector. In the non-manual occupations, older workers are quite close substitutes for prime-aged workers and are likely to be as, if not more, productive. This is less true for the more manual VET occupations, including the trades. Both groups of older workers have large amounts of skills obtained from experience but lower levels of formal education than younger workers. For both reasons, they are likely to find it harder to use the formal VET system to update their skills, or to shift to the skills needed for a new occupation. The VET sector will be required to design and deliver courses for such workers to meet their particular requirements. These requirements include:

- ✧ having a quick return (in terms of higher wages or better job prospects) on the costs of obtaining the VET skill, since workers over the age of 55 may not expect to remain in the workforce for a long period
- ✧ being able to manage a very diverse range of backgrounds among students, as most will have obtained their (often considerable) skills from informal on-the-job experience, rather than from some more homogeneous curriculum
- ✧ accommodating people who, while wanting flexible course delivery to fit into their complex adult lives, will often not be very proficient in the use of the latest information technologies.

The formal recognition of prior learning is likely to be especially important as a means of engaging older workers in skills development opportunities provided by the VET system.

The VET sector will also be under pressure to expand its provision of higher-level qualifications—diplomas and associate diplomas—to meet the expansion of managerial and semi-professional jobs. It will be a challenge for the culture of the sector to provide high-quality teaching simultaneously to two very different groups—aspiring managers/professionals and older, perhaps marginally attached, workers who have no post-school qualifications.

Introduction

The ageing of the Australian population has become an issue of substantial national significance, with the former federal Treasurer's *Intergenerational report* (Costello 2002, 2004) drawing attention to the closing gap in the ratio of working age to retiree populations. One dimension of this is the ageing of the national workforce. Two key features of Australia's demographic transformation are the low fertility rates and the passing of the large 'baby boom' generation through late middle age into retirement. These demographic changes mirror the changes occurring in many other OECD countries and are well documented (McDonald & Kippen 1999, 2000, 2001; Access Economics 2001). Yet their impact on the availability of skills in the workforce is still largely unknown. Scant literature has focused on how the changing demographics will impact on the future supply of vocational skills. To assist in informed vocational education and training (VET) planning, it is not sufficient simply to know the size of the latent labour supply. It is important also to know what proportion is employed in occupations that intensively use vocational skills and the distributions of vocational skills in these occupations. Both the quantitative ('how many?') and qualitative ('what type?') dimensions of VET skills supply are particularly relevant to VET planning.

The future skills supply depends on both the stock of skills in the population of working age and the extent to which that stock is offered for employment at any given time. There are two principal factors influencing the magnitude of the supply of labour or people with required skills by occupations. One is the size of the civilian population of working age (assumed to be between 15 and 64 years). The other is the labour force participation rate—the proportion of the labour force in the working-age population. Different age–sex specific populations will have different patterns of participation and skills supply to different occupations.

The supply of VET skills is a difficult thing to observe. In this study, we measure the skills supply in two ways: employment in a job that uses VET skills and the number with VET qualifications in the Australian workforce. People obtain work skills through undertaking formal educational courses, and obtain formal qualifications in the process. We can use surveys of the Australian population to describe the numbers of people who have particular qualifications. But this is not the same thing as the supply of skills. First, many people who have a qualification do not use that qualification directly in their job. For example, there are metal tradesmen who work as security officers; nurses who work as florists; teachers who are public service managers. Second, many people who work in a skilled or semi-skilled job do not have a formal qualification at all, or have one that is not relevant to their current job. For example, in 2005, about one-third of people employed as 'Managers', 'Associate professionals' or 'Tradespersons and related workers' had *no post-school qualifications*. Even among professionals, 10% had no post-school qualification and a further 19% had VET qualifications.¹ These realities reflect the important fact that many people obtain their work skills informally. They learn by doing a job, by observing, by obtaining informal instruction from co-workers, and from in-house short courses. The only way to measure the supply of skills obtained in this way is to count the number of people who are employed in jobs that require the relevant skill. This presumes that if a person is employed in a job that requires a specific skill, then they have that skill, even if they do not have a relevant formal qualification. This

¹ ABS CURF data from the Survey of Education and Work 2005.

is one reason why we respond to the question ‘what is the future supply of skills’ by studying the employment of people in skilled occupations.

A second reason is that Australia’s unemployment rate has reached its lowest level in the last three decades. At any given time, the number of people who are actually employed is determined by the intersection of the numbers and types of workers that employers want (the demand-side) and the number and types of people who are willing to work (the supply-side). Only occasionally do these match, at which point full employment occurs. When, as is historically the usual case, the supply of workers for particular jobs exceeds the demand for workers at the prevailing wage rate, it is the number that employers want to employ that determines the numbers who are actually employed (the ‘short-side’ dominates). In this case, there will be people ‘supplying’ their skills (applying for skilled jobs) but unable to obtain a job that uses them. But Australia’s recent strong employment growth and commensurate low unemployment mean that the ‘short side’ is now more often the supply side, especially for skilled occupations. This means that all the people who want a skilled job and have appropriate skills are able to obtain such a job. Looking into the future, we cannot know if this will persist. But on balance it is reasonable to assume that it will, or at least that there will not be substantial surpluses of skilled workers, especially in the face of the slow growth in the workforce, which we demonstrate in a later section. This is the base upon which the projections for the changes of the overall employment and its distributions among occupations can be deemed to be the supply of labour or skills.

This report analyses and quantifies the compositional effects of the changing demographics on the supply of VET skills to occupations. Focusing particularly on VET-intensive occupations, the specific aims of this study are:

- ✧ To identify the occupations that are large users of VET skills;
- ✧ To analyse the stock, inflow (new entrants) and outflow (exits), of the overall workforce implied by the demographic changes;
- ✧ To model the occupational employment shares and numbers of different age groups of people with VET skills or qualifications over a 25-year period to 2020; and,
- ✧ To draw implications of the above for the future supply of VET skills.

The research that underlies this paper is highly quantitative and involves extensive manipulation of large data sets. In the interests of clear presentation, none of the detailed results is presented. We include only the principal findings from the analyses. The detail is provided in the support document.

This report is structured as follows. Section 2 considers the research methods of the study. Section 3 identifies the occupations that intensively use VET skills, through defining and classifying occupation–education clusters. Section 4 analyses the demographic changes expected over the next 15 years and the impact on the dynamics of overall supply of the workforce. Section 5 presents the main results of the projections for the changes in employment for those VET-intensive occupations at both 1-digit and 2-digit ASCO levels.² A final section presents the estimates of VET qualifications to be employed (indicating skills supply) within 1-digit and 2-digit occupations concerned in this study. The uncertainty in the overall employment share projections and the impacts of changes in population and the workforce on skills supply in the next 15 years are discussed.

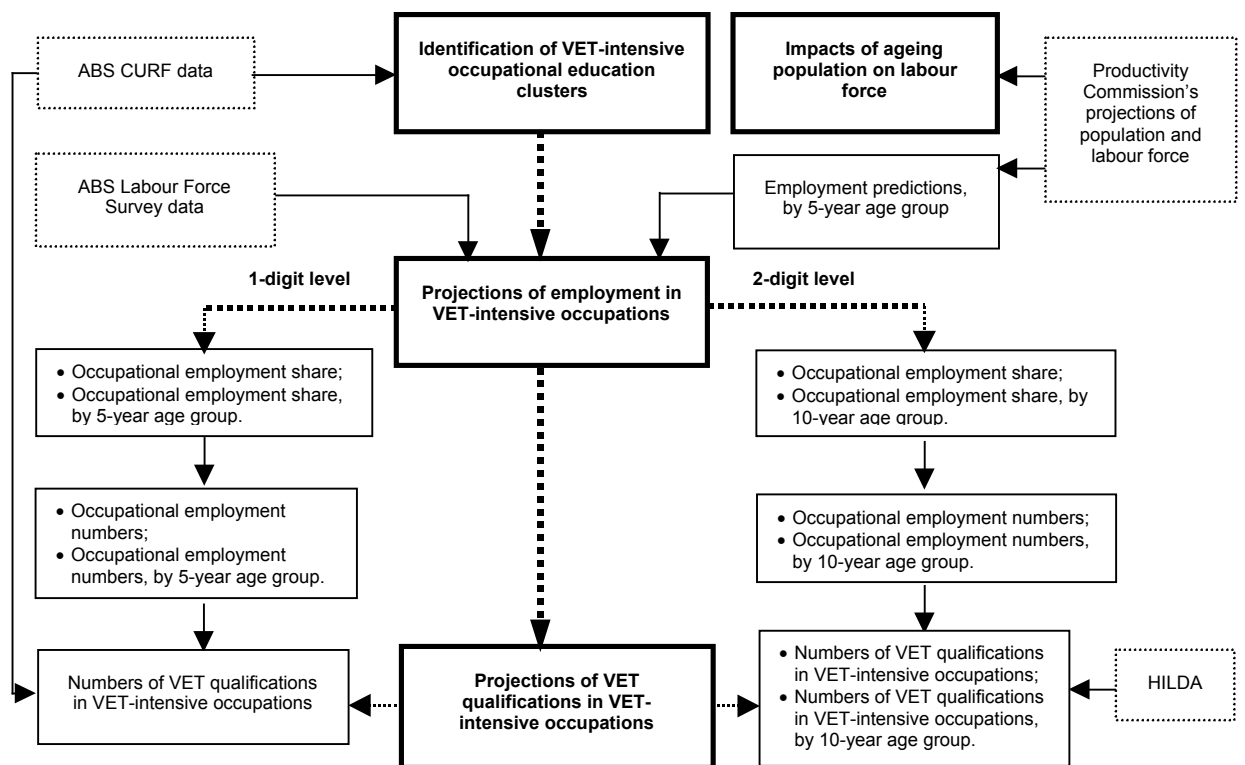
² Australian Standard Classification of Occupations. According to the ABS ASCO Second Edition (ABS cat. no. 1220.2), occupations are categorised into five hierarchical levels. The ‘major groups’ at the top level, dominated by 1-digit codes, comprise 9 occupations. They are: Managers and Administrators; Professionals; Associate Professionals; Tradespersons and Related Workers; Advanced Clerical and Service Workers; Intermediate Clerical, Sales and Service Workers; Intermediate Production and Transport Workers; Elementary Clerical, Sales and Service Workers; and Labourers and Related Workers. The ‘sub-major occupation groups’ at the second level, dominated by 2-digit codes, comprise 35 occupations.

Research methods

Analytical framework

This study seeks feasible methods to analyse and project the changes in VET skills supply in occupations that require relatively large proportions of VET skills. There are four major steps in our analysis. The flow chart below sets out the different steps and sources of data required to get to our final views about the future supply of vocational skills (Figure 1).

Figure 1 Steps in the projection of future skills supply



First, we measure the supply of skills in two ways. One is to measure the supply of people who do jobs that require vocational skills to perform them (regardless of whether or not people have formal vocational qualifications). The other is to measure the supply of people who have formal vocational qualifications and are employed in jobs that require such qualifications (excluding, for example, people with vocational qualifications who are employed in professional jobs or in labouring jobs).

Second, we analyse the effects that population ageing will have on the future skill supply. People of different ages have different levels and types of skills. Generally, older workers, being more experienced, have higher levels of skill. Offsetting this, younger workers have higher rates of qualifications. Thus the changing age structure of the population and workforce will affect the overall supply of vocational skills.

Third, we need to look forward 15 years. Many forces that are affecting the supply of skills over time are at work. These include technological change, increasing levels of education, the changing patterns of labour force participation of men and of women, and the changing structure of the economy. We do not attempt to model all these sources of change explicitly. Instead we rely on a process that captures recent trend changes in employment by occupation, age and qualification to summarise the net effects of these forces. We then extrapolate these trends forward for 15 years.

Our final step is to project changes in skill supply, measured both as employment and as VET qualifications, at different levels of disaggregation. In the first place, we use a high level of aggregation of occupations into groups, combined with 5-year age intervals. In the second place, we use more disaggregated occupational groups, combined with 10-year age intervals. We do not have the data to enable us to use disaggregated occupations with 5-year age intervals.

Data and sources

The main data and sources used in the analyses and projections of this report include:

- ✧ ABS Confidentialised Unit Record Files (CURF) data: Education and Training Experience, Australia (1997, 2001, cat. no. 6278.0); Survey of Education and Work, Australia (2003, cat. no. 6227.0);
- ✧ ABS Labour Force, Australia, Detailed – Electronic Delivery, Quarterly (E07–Employed persons by sex, occupation, age, status in employment, cat. no. 6291.0.55.001);
- ✧ Population and labour force projections (including participation rates, and unemployment ratio) for Australia from 2004 to 2051, sourced from the website of the Productivity Commission <<http://www.pc.gov.au/study/ageing/finalreport/data/index.html>>; and
- ✧ Household Income and Labour Dynamics in Australia (HILDA) survey (2004), provided by the Melbourne Institute of Applied Economic and Social Research at Melbourne University.³

There are no data in Australia that trace the same people over an extended period of time to see how they move into and out of jobs that require VET skills, or when they acquire VET qualifications. Therefore, we have constructed age–sex specific datasets instead. These were derived from data on employment collected by the ABS Labour Force surveys, from 1996 to 2005. The derived data were used to develop the projections of occupational employment shares. The results of the Productivity Commission’s population and labour force projections are extensively used as basic data sources for in-depth analyses and projections in this study.

Analytical methods

We use cohort analysis methods to understand workforce dynamics; and use age or age–sex specific analysis methods to project the share and size of employment and VET qualifications in each occupational category over a 15-year period to 2020. The method for analysing VET skills supply involves two aspects. First, to predict the size and age structure of the aggregate employed workforce, this study applies the projected levels of participation and unemployment for the labour force and the projected population for all successive 5-year age groups, as provided by the Productivity Commission (2005). Second, the study projects the changes in employment shares and numbers of both the 1-digit ASCO occupations and 2-digit occupations pertinent to this study, over the projection time horizon. The pattern of people’s lifetime employment profile in

³ The HILDA survey is a random survey of the Australian population, managed by the Melbourne Institute of Applied Economic and Social Research at the University of Melbourne, on behalf of the former Commonwealth Department of Family and Community Services and Indigenous Affairs. It has been conducted annually since 2001, and follows the same sample of people over time. It provides great detail on occupation and age, though its modest sample size prevents much of this detail from being used for reliable projections.

occupations, which points to the supply of skills, is determined by occupational employment patterns over time. The whole working-age population is grouped into 11 age groups in intervals of 5 years (that is, 15–19, 20–24, ... 65+ years) for 1-digit occupations, and 6 age groups in intervals of ten years (that is, 15–24, 25–34, ... 65+ years) for 2-digit occupations, respectively.

The manner in which the evolution of VET-intensive employment is modelled is a key issue in building a dynamic model to project changes in employment. The evolution of employment in each occupation will be determined by two factors: the change in the share of total employment that is in each occupation for each age group, and the change in the demographic structure of the employed working-age population by age. The patterns of employment, between or within occupations, for each age group over time are irregular, making it difficult to project future patterns. Since employment shares by occupation or by age groups change as people age, they are modelled as sigmoidal (S-shaped) curves. A detailed description of the modelling methods used is presented in appendix A.

VET-intensive occupational education clusters

Definition and regrouping criteria

The nine 1-digit occupations are re-classified into new occupation–education clusters. A worker’s qualification represents an important signal to the labour market of his or her skills. Hence, historical data on qualifications provide an indication of the skill level of workers and also a measure of the outcome of the training system. Such education clusters provide a natural hierarchical sorting of the occupations, which reflects increasing levels of skills, education and training. The clusters are applied to analyse which occupations use VET skills and to what extent. Furthermore, in Sections 5 and 6, clusters that intensively employ VET skills will be used in the predictions of the ratios and numbers of workers who will be using VET skills in the future. The methods and criteria for classifications are adapted from those that have been used by the United States Bureau of Labor Statistics (BLS 2004). The definitions and criteria of occupation–education clusters are given in Table 1. ‘VET occupations’ are deemed to be those that have at least 60% of workers (aged 25–49) with VET qualifications as their highest educational attainment. ‘University occupations’ and ‘No post-school occupations’ are similarly defined. VET-intensive occupations are those wherein at least 20% of workers have VET qualifications.

Table 1 Definitions and criteria of occupational education clusters

Occupational education clusters	Percentage of employed people aged 25–49 years in the occupation whose highest educational qualification is –		
	Bachelor degree or above	VET qualifications	No post-school qualifications
University occupations	Greater than or equal to 60%	Less than 20%	Less than 20%
University/ VET occupations	Greater than or equal to 20%	Greater than or equal to 20%	Less than 20%
VET/university/no-post school occupations	Greater than or equal to 20%	Greater than or equal to 20%	Greater than or equal to 20%
VET occupations	Less than 20%	Greater than or equal to 60%	Less than 20%
VET/no post-school occupations	Less than 20%	Greater than or equal to 20%	Greater than or equal to 20%
No post-school occupations	Less than 20%	Less than 20%	Greater than or equal to 60%

Source: Adapted from BLS (2004, p.2).

Table 2 shows the actual percentage of employed persons aged 25 to 49 years in each 1-digit occupation with different highest educational qualifications. The distributions are shown for the three recent years for which such data are available (1997, 2001 and 2003). It is inevitable that at the high level of aggregation there is a wide diversity of education levels of people in every major occupation group. The most homogeneous groups are ‘Professionals’, over 70% of whom are graduates; ‘Trades’, over 70% of whom have VET qualifications; and ‘Labourers’, almost 70% of whom have no post-school qualification. ‘Professionals’ are the only major occupation group for which fewer than one in five workers have a VET qualification as their highest educational attainment (in 2003). Note that people with VET qualifications are employed in *all* the major groups of occupations.

Table 2 Percentage of employed persons (aged 25–49 years) at 1-digit ASCO occupation level, by highest qualification

Occupations	Bachelor degree or above			VET qualification			No post-school qualifications		
	1997	2001	2003	1997	2001	2003	1997	2001	2003
Managers & administrators	26.1	36.1	35.7	36.7	23.9	29.6	35.6	39.9	32.4
Professionals	61.9	68.6	70.7	26.4	17.7	19.0	10.3	13.7	9.1
Associate professionals	13.3	20.4	23.6	42.8	35.9	38.0	41.8	43.4	35.3
Tradespersons & related workers	2.3	4.8	3.1	70.7	66.0	72.6	24.7	29.3	22.1
Advanced clerical & service workers	7.6	13.4	12.7	41.9	19.9	36.3	48.3	66.7	48.0
Intermediate clerical, sales & service workers	8.0	10.0	11.8	35.7	27.8	36.0	53.8	62.0	49.0
Intermediate production & transport workers	3.0	4.5	4.6	31.0	25.4	29.4	65.0	69.6	63.5
Elementary clerical, sales & service workers	6.7	6.2	9.2	29.5	18.3	27.7	62.0	75.4	60.1
Labourers & related workers	2.0	3.9	4.4	25.5	22.7	25.2	70.6	73.3	67.6

Note: The total percentage of those with different educational qualifications within occupational employment is not 100%, as a minor number with 'Certificate not further defined' are excluded in the calculations.

Data source: ABS CURF data from the Education and Training Survey spanning years 1997 and 2001 and the Education and Work Survey (2003).

By comparing the actual percentages of employed persons in Table 2 against the criteria in Table 1, five groupings of occupation–education clusters are constructed (Table 3). The occupations that mainly use VET skills are identified from these occupation–education clusters.

Table 3 Occupational education clusters

Occupational education clusters	Occupations
University occupations	Professionals
VET/university/no-post school occupations	Managers & administrators; Associate professionals
VET occupations	Tradespersons & related workers
VET/no post-school occupations	Advanced clerical & service workers; Intermediate clerical, sales & service workers
No post-school occupations	Intermediate production & transport workers; Elementary clerical, sales & service workers; Labourers & related workers

VET-intensive occupations

'Tradespersons and related workers' is the only occupation group in the VET education cluster. The occupations placed into the VET-intensive categories include: 'Intermediate clerical, sales and service workers', 'Associate professionals', 'Managers and administrators', and 'Advanced clerical and service workers'. In general, the occupations classified as 'VET/no Post-school' occupations have a greater concentration of VET skills as their single most significant source of skills. The widest range of education and training categories is found in the full mixture, 'VET/university/no-Post school' occupations. Such a mix reflects the interaction between training requirements, informal learning opportunities and employer preferences for various skills that can result in significant diversity in the educational attainment of people hired into the occupation. It also reflects the fact that there is a great diversity in the types of jobs that are done by people who are classified to that occupation. We include as VET-intensive occupations both the VET occupation of trades and the VET-intensive mixture occupations.

Impacts of ageing population on labour supply

Ageing population

Population is a pivotal factor affecting the size and structure of the workforce of the future. Australia is in the process of a demographic transition characterised by a rapid ageing of the population, with an increasing proportion of the population accounted for by older age groups. According to the population projections of PC-M series (Productivity Commission 2005, p.7), the proportion of those aged 65 years and over in the total population will rise significantly from 13.3% in 2005 to 18.5% in 2020. Specifically, during the phase from 2004 to 2012 the ageing process will accelerate. The proportion of children (aged 0 to 14 years) in the total population is expected to drop from 19.3% in 2005 to 17.5% in 2020. The proportion of those aged 65 years or over will exceed those aged 15 years and younger by 2019, reaching 17.7% and 17.6% respectively. It is these young people who will reach working age, pursue education, enter the workforce, or combine study with some part-time work. They will be a main source of new workers in the next 15 years. Population ageing implies that the availability of young workers in years to come will shrink as a share of the total workforce. The changing proportions of the different age groups in the population will impact on the age structure of the workforce. Behind the baby boomers, the size of the working-age population aged 15 to 50 years will continue to shrink in relative terms, reflecting the protracted decline in fertility since the late 1960s.

The size of the working-age population, which is the maximum size of the labour force, has generally been growing over time. There will be a net growth in the working-age population of 3.3 million from 2005 (some 16.2 million) to 2020 (some 19.5 million). But the growth rate per annum will continue decreasing, from around 1.5% in 2005 to 1.1% in 2020. Moreover, after 2007, the population of working age will grow more slowly than the total population. This suggests that ageing results in a gradual slowing of the workforce growth rate.

Impacts of ageing on labour supply

Labour supply is a function of a range of demographic and socio-economic factors, among which demographic elements are especially significant. The size of the adult population (aged 15 years and over) has generally been growing over time (see figure 1 in appendix B in the support document). But the age structure of both the adult population and the component that is of traditional working age (15–64) will change. Over the next 15 years the population of working age will continue to grow (by 1.7 million people), albeit at a declining rate. The most rapid growth will be among the older ages. The population aged 50–64 will rise from 25% to 30% in the fifteen years to 2020, while the proportion aged 30–49 will fall from 44% to 41% (ABS 3322.0).

This section examines the movement of people into and out of the workforce mediated by the interaction between the age–sex structure of the population and age–sex specific labour force participation rates of that population in the future.

‘Entrants’ and ‘exits’

The labour force is expected to grow by around 1.7 million persons, to approximately 12 million by 2020. Yet this growth masks a more dynamic underlying process: the flows of people into and out of the workforce. The size of the workforce in a year comprises three components: ‘entrants’ (those newly joining the workforce), ‘stayers’ (those remaining in work), and ‘exits’ (those leaving the workforce). ‘Exits’ refers to the net reduction in the labour force as people who were initially in the workforce for a specific age–sex cohort are not in the labour force five years later. ‘Entrants’ refers to the net increase in the labour force as people who were not initially in the labour force for a specific age–sex cohort five years previously move into the workforce. Population ageing has significant effects on the flows of the total workforce via increasing outflows, due mainly to retirement, combined with limited inflows of new workers. Exits arising from retirement and other mobility factors out of the workforce deplete the stock of workers, at the same time young entrants, net immigration and people re-entering the workforce after some years (for example, women after childbearing and caring) act to buffer the impact.

The following equations, introduced by Burniaux et al. (2004) for analysing the impact of policy changes on future labour supply in OECD countries, are used to calculate the ‘exits’ and ‘entrants’ of the labour force.

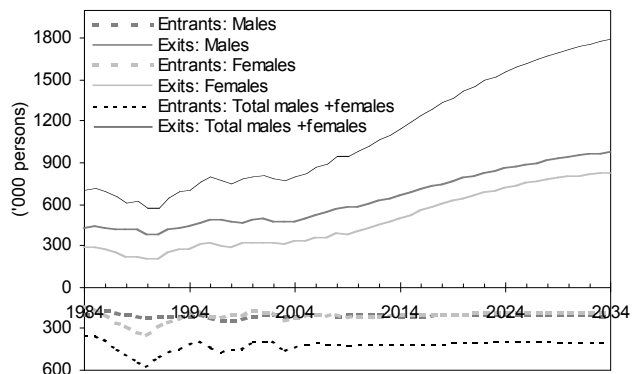
$$EX_{x,x+4}^t = (PR_{x,x+4}^{t-5} - PR_{x+5,x+9}^t) \cdot P_{x,x+4}^{t-5} \quad [1]$$

$$EN_{x,x+4}^t = (PR_{x+5,x+9}^t - PR_{x,x+4}^{t-5}) \cdot P_{x,x+4}^{t-5} \quad [2]$$

Where $EX_{x,x+4}$ and $EN_{x,x+4}$ are the numbers of individuals aged from x to $x+4$ who will exit or enter the labour market within five years by year t ; $PR_{x,x+4}$ and $PR_{x+5,x+9}$, the participation rates of the cohorts aged from x to $x+4$ in year $t-5$ and from $x+5$ to $x+9$ in year t respectively; and $P_{x,x+4}$, the civilian population aged from x to $x+4$ 5 years earlier.

In equation [1], the number of persons expected to withdraw from the workforce between age x and $x+4$ is calculated by comparing the participation rates of the age groups that belong to the same cohort; for instance, the participation rate of those aged 40 to 44 in 1999 with the participation rate of the corresponding individuals five years later in 2004, when they are aged 45 to 49. Similarly, the numbers of persons aged x to $x+4$ expected to enter the labour market within five years are computed using equation [2]. The Productivity Commission’s projected labour force participation rates disaggregated by age–sex group were applied to these predictions.

Figure 2 ‘Entrants’ into and ‘exits’ from the workforce, Australia 1984 to 2034



Note: The numbers of ‘exits’ over time are measured above the horizontal axis, whereas the numbers of ‘entrants’ are measured below the horizontal axis.

Data sources: Predicted from the labour force projections of the Productivity Commission (2005); ABS Labour Force, Australia, Detailed (cat. no. 6291.0.55.001) for earlier years.

Figure 2 shows the distributions of estimated total ‘entrants’ and ‘exits’ disaggregated by sex. The ‘exits’ (retirement) crunch is coming, with the number of people (both males and females) retiring per year set to rise strongly under the circumstances of the Productivity Commission’s projected labour force participation rates. This trend will continue from 2010 to 2027, with the addition of more than 28 000 persons annually to the number of people who retired in the previous year. The peak of retirement is expected to occur between 2012 to 2021, when retirements rise by more than 40 000 extra persons annually compared with the number retiring in the previous year. By 2021, about 1.4 million people (mainly baby boomers) are expected to exit the workforce in a year.

In contrast, the number of new ‘entrants’ per annum will be essentially static, at about 200 000 men and women, for a total of about 400 000 per annum. The ‘entrants’ varied between 352 000 persons (in 1984) and 576 928 (the maximum, in 1990) over the past two decades to 2004. Looking forward, the maximum ‘entrants’ are likely to be 425 203 in 2009. After then, the supply of entrants will keep decreasing until 2026, when the numbers will reach 310 000 persons. There are slightly more male ‘entrants’ than their female counterparts in most years, for example, by 144 689 persons by 2020. The numbers of males entering the workforce will slowly decrease from 213 000 in 2004 to 205 309 in 2020. The number of females entering the workforce will drop in a similar manner but at a relatively smaller magnitude, with 225 686 and 195 949 ‘entrants’ for the same time points.

It is worth emphasising that the total workforce will continue to expand, despite the fact that the number of persons exiting the workforce greatly exceeds those newly entering the workforce. The reason is that changes in the age structure of the workforce will increase the share that is in age groups (for example 25 to 54) with high rates of labour force participation. This momentum will more than counteract the reductions resulting from older people leaving the labour force. Retirements will, however, significantly reduce the rate at which the labour supply grows, particularly of males. This suggests that there will be benefits from increasing the labour supply in other ways. The possible ways include an increase in the participation rate at each age, an increase in average hours worked, employment of those unemployed or outside the workforce, and an increase in permanent immigrants or temporary workers. The VET sector has a valuable role to play in making workers from these sources productive employees. In order to retain or replace older workers it is increasingly important for the VET sector to provide courses for not only the young and primary age groups but also the older group, and others with a marginal attachment to paid work.

Age–sex distribution of ‘entrants’

New entrants are not affected by the ageing of the workforce in the sense that the age distribution of new entrants remains constant for males and gets a little younger for females. The pattern of the workers entering the workforce is markedly different between the male and female age groups.

For males, teenagers comprise around 85% of all ‘entrants’ flowing into the workforce, with youth (aged 20 to 24 years) accounting for another 15% (see figure 2(a) in appendix B). Trivial numbers of men enter the workforce at ages beyond 24.

For females, the age patterns of new entrants, and the ways that they are changing are more complicated (see figure 2(b) in appendix B). For instance, the youngest group (aged 15 to 19 years) comprised about 65% of new entrants between 1994 and 2002. But their share has been falling and will settle at about 52% over the next 15 years. Those aged 35 to 39 years comprise the second largest share of new ‘entrants’, varying between 24% (in 2006) and 19% (in 2020). The complex age patterns for female ‘entrants’ are largely associated with the specific life course of women and changes of female participation in the labour force since the 1980s. More women move into the workforce after childbirth and child caring between ages 35 to 44 years.

Age–sex distribution of ‘exits’

The distributions of the ratio within different age groups for both genders relative to the total numbers of male ‘exits’ or female ‘exits’ over time are shown in figure 3 in appendix B. The number of males leaving the workforce each year is expected to rise from 468 000 in 2004 to 780 000 in 2020. The number of females exiting the workforce will almost double, with 326 000 and 635 000 ‘exits’ for the same time points. For both males and females, the majority of the total of those exiting are aged over 54. For instance, for males, ‘exits’ at ages 55 years or over account for 70% and 81% of all exits in 2004 and 2020 respectively and for females, 51% and 78% over the same time period.

For males, some specific features can be highlighted, as follows:

- ✧ The share of males aged 65 years and over in total male exits rises sharply, from 16% in 1984 to 21% in 2004. By 2020, this proportion is expected to reach 31%, making it the largest group who will leave the workforce.
- ✧ Exits from the group aged 60 to 64 years account for about 30% of the total male ‘exits’ over the period 1984 to 2020. This age group continues to contribute the second largest number of exits among all the male age groups from which people exit the workforce.
- ✧ The share of men aged 50 and 59 years in total exits decreases slightly throughout the three decades from 2004. For men younger than 50 years, the share of exiting persons ranges between 10% and 19% between 1984 and 2012. After 2012, the share will fall steadily to less than 10%.

For females:

- ✧ Women aged over 50 have a share in female exits that is about equivalent to the male share.
- ✧ Significant changes are expected for young females aged between 20 and 29 years. For the younger group aged 20 to 24 years, the share was greater than 10% before 2001, with a peak of 28% in 1984. By 2012, it will drop radically to less than 1%. Very few in these age groups will leave the workforce.
- ✧ For other groups aged between 30 and 49 years, the share was 10% or higher in most cases before 2004. After 2004, this is expected to decline to less than 3% by 2020.

Projections of employment in VET-intensive occupations

In this section we analyse the impact of the changing age structure of the population on the *structure of employment* in the different occupations. The purpose is to make use of the fact that vocational skills are much more prominent in some occupations than in others. If the occupations that are expanding rapidly are intensive users of VET skills, then the supply of such skills will also be growing. But the supply of VET skills will be stagnant or falling if the fast-growing occupations rely, instead, on unskilled labour or on workers with higher education. We begin with the nine major occupation groupings at the ASCO 1-digit level. These combine together many different individual occupations. It is hard to understand exactly what is captured in, for example, ‘Intermediate clerical, sales and service workers’, and what this means in terms of VET training requirements. For this reason, we would have preferred to work with more disaggregated (and homogeneous) occupational groups. But we also needed detailed information on age, and there are no data sets that provide details of both age and occupation, over time. We first use the 1-digit occupation groups and five-year age groups. We then examine more detailed occupations, but can only use ten-year age intervals. The ‘Trades’ occupation, being the one with the greatest concentration of VET skills, has been examined in more detail, and shows considerable diversity within the different trades. The projection of employment proceeds by constructing (Richards 1959) curves of best fit for historic shares of employment levels by occupation and by age group, and projecting these curves to 2020. The results are then applied to the changing age structure to produce projections of occupational employment growth in the coming years.

Projected 1-digit occupational employment

Employment shares

The results of future employment shares for each ASCO 1-digit occupation are presented in Table 4 (also see figure 4 in Appendix B).⁴ Employment in two VET-intensive occupations (‘Associate professionals’; ‘Managers and administrators’) and the ‘University’ occupation (‘Professionals’) continues to grow, with percentage point increases in share of 2.4, 1.2 and 1.9, respectively, from 2004 to 2020. Rising employment shares for these occupations reflect their increasing importance for the economy, and therefore imply growing requirements for a supply of higher skills. The employment shares for the other occupations are projected to decline over the same period. Particularly, the shares of employment within the education–occupation cluster of ‘no Post-school qualifications’ are expected to fall more rapidly than some VET ‘mixture’ occupations. For example, the *reductions* of the shares for ‘Intermediate production and transport workers’ and ‘Labourers and related workers’ are expected to be 1.4 and 1.8%, respectively, over the period 2004 to 2020.

Employment in the five VET-intensive occupations comprised more than 50% of all employment in 2004. This share is projected to rise to 56% by 2020. However, the growth is not uniform among

⁴ The projections are only as good as the data and the curve-fitting techniques that are used. We are confident that Richards Curves are a suitable and robust technique. But it can be seen from Figure 2 in Appendix B that the historical shares for ‘Managers and administrators’, ‘Intermediate’ and ‘Elementary’ clerical, sales and service workers bounce around in a way that is impossible to capture in a smooth curve. This lack of good fit means that we are less confident in our extrapolations of employment in these occupations than we are in the remainder.

the different occupations. It is highest for ‘Associate professionals’ (2.2%), followed by ‘Managers and administrators’ (1.9%).

Table 4 Employment shares and growth rates by occupation

	2004 share (%)	2020 share (%)	% point change in share 2004 to 2020	avg. % growth p.a. 2004 to 2020
Managers & administrators*	7.9	9.1	1.2	1.9
Professionals	19.0	20.9	1.9	1.7
Associate professionals*	12.4	14.8	2.4	2.2
Tradespersons & related workers*	12.7	11.7	-1.0	0.5
Advanced clerical & service workers*	3.8	3.3	-0.5	0.2
Intermediate clerical, sales & service workers*	16.8	16.7	-0.1	1.0
Intermediate production & transport workers	8.4	7.0	-1.5	-0.1
Elementary clerical, sales & service workers	9.9	9.2	-0.6	0.6
Labourers & related workers	9.1	7.3	-1.8	-0.3
VET or VET-associated occupations*	53.6	55.5	2.0	1.3
Total	100.0	100.0		1.1

Note: * VET-intensive occupations.

** Total share in 2020 is not 100.0% due to rounding.

Data source: Authors' calculations.

The age structure of employment among the five VET-intensive occupations will change significantly in coming years (see figure 5 in Appendix B). In most cases, the primary age group (25 to 49 years) has occupied a major share in these occupations in the past and at present. In the future, older people (aged 50 and over) and younger people (15 to 24 years) will increasingly replace the primary age group. This general trend echoes the ageing process of the population and workforce in Australia.

In-depth analysis of the effects of age within an occupation provides a different dimension to the change dynamics. For ‘Tradespersons’, there is a very clear and pronounced age pattern. In the mid-1990s, there was a linear relation between age and share of ‘Trades’ employment: the younger the age, the greater the share. By 2020, we expect the share of employment to be similar for each age group under 60 (see Figure 5(a) in appendix B). As a result, the shares for age groups between 20 and 44 years are expected to fall from 68% in 1996 to be 53% by 2020, with a commensurate rise in the share of those aged over 45.

‘Intermediate, clerical, sales and service workers’ aged 20 to 44 years also fall as a share of employment in this occupation, from 68% in 1996 to 51% in 2020 (see figure 5(b) in appendix B). In contrast, those aged 55 to 64 years will experience large increases in their share of employment. If this trend continues, by 2024 the older (aged 45 and over) and young age groups (aged 15 to 19 years) are expected to overtake the primary aged group to become the dominant groups working in this occupation.

For ‘Associate professionals’, workers aged 20 to 54 years are the dominant source of labour supply in this occupation, comprising 89% in 1996 (see figure 5(c) in appendix B). The share of this age group is expected to fall to 75% by 2020. The share of those aged 55 years and over (especially those aged 55 to 64 years) and of the youngest group (15 to 19 years) is likely to rise in compensation in the next 15 years.

For ‘Managers and administrators’, the employment shares for workers aged 35 to 54 are comparatively stable, but there is a noticeable decrease for those aged 65 years and over (see figure 5(d) in appendix B). The largest percentage growth (6.9%) stems from those aged 55 to 64 years.

This reflects the increasing requirements for higher skills, of the sort provided by experience. A greater supply of skills from young people will also contribute to this occupational category.

For ‘Advanced clerical and service workers’, a relatively high proportion of young (15 to 34 years) and mature-aged people (45 to 49 years) worked in this occupation (see figure 5(e) in appendix B). The share for these age groups was 54% in 1996. Since 2001, the older age groups (50+) and people aged 35 to 44 years have become the major supply of labour in this occupational group. This trend is projected to continue over the next 15 years.

In short, for all the VET-intensive occupations, the share of older workers (especially those aged 55 and over) is projected to rise, and the share of prime-age workers is projected to decline. This will have important implications for the way in which VET skills are provided and for the character of the VET student body.

Employment numbers

The total number of persons employed in the five VET-intensive occupations are projected to increase by around 1.17 million over the period 2004 to 2020. The overall employment in all nine occupations is expected to expand by some 1.76 million (see table 2 in appendix C). The growth in VET-intensive occupations accounts for 66% of the entire projected increase in employment in all occupations from 2004 to 2020.

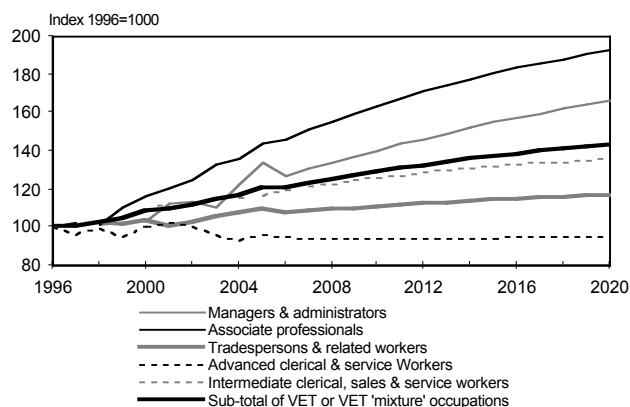
Among the five VET-intensive occupations, ‘Intermediate clerical, sales and service workers’ is the largest group. It makes up more than 30% of the total employment of the five occupations. Yet this proportion is predicted to fall slightly (by 1.3%) from 2004 to 2020. ‘Tradespersons’ had been the second highest component of employment among the five occupational groups before 2005. It is expected to shrink by 2.7 percentage points, from 23.7 in 2004 to 21.1% in 2020. This continues a long trend of no or slow growth in trades employment. In contrast, the numbers employed as ‘Associate professionals’ are expected to grow strongly, their share rising by 3.5 percentage points over the same period, reaching 27% by 2020. Employment of ‘Managers and administrators’ accounted for 14.8% of the total employment in the five occupations in 2004. It is expected to rise by 1.6 percentage points by 2020. The employment share of those working as ‘Advanced clerical and service workers’ is projected to fall by 1.2 percentage points, to about 6% in 2020.

Setting the observed employed persons in each occupation in 1996 a base value, we divided the actual and projected numbers of employed people in each occupation for years after 1997 by the 1996 value, for each occupation, to obtain a ray of indexes of changing employment within occupations. Figure 3 shows the results for the VET-intensive occupations by comparison with ‘university’ and ‘no post-school’ occupations. The average index is expected to be 143 by 2020 for the five VET-intensive occupations, indicating a rise of 43% in employment in these occupations between 1996 and 2020. The indices for ‘Associate professionals’ (192) and ‘Managers and administrators’ (166) by 2020 are above the average, indicating significant increases of employed persons by 92 and 66%, respectively. Slow growth is expected for ‘Intermediate clerical, sales and service workers’ and ‘Tradespersons’, together with a small fall in employment for ‘Advanced clerical and service workers’. In comparison, the ‘university’ occupation (‘Professionals’) is expected to see a 68% growth in employed persons in 2020 compared with the 1996 level. Low-skill occupations, ‘Labourers and related workers’ and ‘Intermediate production and transport workers’, will experience virtually no changes in employment. Employment for all occupations is expected to grow about 37% over the period 1996 to 2020.

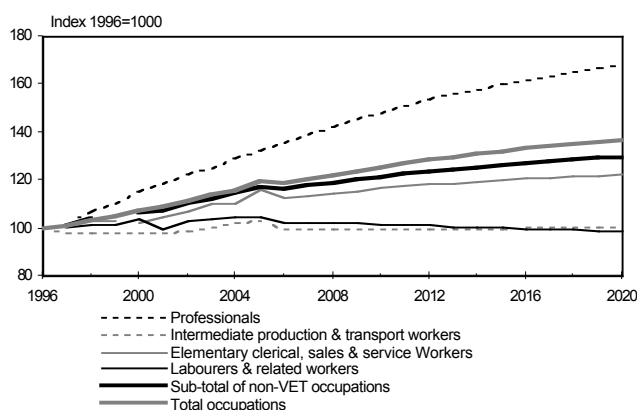
The changes in employed persons within age groups in the VET-intensive occupations are irregular (see table 3 in appendix C). In most cases, employment of workers at ages between 20 and 49 years tends to fall. Conversely, employment of workers at older ages (50 years and over) and younger ages (15 to 19 years) is expected to rise. The age group with the largest expected employment growth is 55 to 64 years. This implies that the workforce will have a significantly different age composition, with many more older people employed.

Figure 3 Growth trends of employed persons: VET-intensive occupations vs. non-VET occupations

a. VET-intensive occupations



b. 'University' or 'no post-school' occupations



Data sources: Authors' projections; 1996–2005 data are derived from ABS Labour Force, Australia, Detailed – Electronic Delivery, Quarterly, data cube, E07 (cat.no.6291.0.55.001).

Projected 2-digit occupational employment

Employment shares and numbers

In order to make our analysis more concrete, we repeated the major steps above, but used more detailed occupational groups. However, to produce greater occupational detail we were limited to using data in which ages are at 10-year intervals. The projected employment shares, numbers and their changes between 2005 and 2020 are shown in Table 5.

Among the 20 sub-major occupation groups, 11 groups are expected to decrease in share within their corresponding major groups. Some also fall in absolute numbers, namely 'Farmers and farm managers', 'Automotive tradespersons', 'Food tradespersons', and 'Secretaries and personal assistants'. For example, the absolute number of people employed as 'Automotive tradespersons' is expected to fall by 10 000 over the 15 years to 2020.

By contrast, some occupations will grow significantly. These include 'Generalist managers', 'Specialist managers', 'Business and administration associate professionals', 'Skilled agricultural and horticultural workers', and 'Intermediate service workers'. 'Business and administration associate professionals' will be the largest and probably the fastest growing occupation. By 2020, this occupation is expected to have a net addition of 275 800 workers, or a 3.2% per annum growth rate of employment.

We now take a closer look at the Trade occupations. Among these groups, 'Construction tradespersons' and 'Skilled agricultural and horticultural workers' are anticipated to grow in share by approximately 1.0 and 1.8%, respectively, over the period 2005 to 2020. In absolute terms, this means an additional 36 000 and 30 000 people, respectively. The former group has been the largest occupation within the 'Trades' since 1986 and is expected to expand from 26.6 to 27.7% of all 'Trades' employment between 2005 and 2020. This reflects economic momentum, particularly in the sectors of commercial property, residential property, and industrial property, since the late 1980s. Employment of skilled agricultural workers will also continue to grow, increasing from 6.6 to 8.5% of all 'Trades' and related employment over the same period. This occupation used to be the smallest one among 'Trades' occupations. Its employment share exceeded that of 'Food tradespersons' (6.7%) in 2005. If this growth trend persists, its share is likely to equal that of 'Automotive tradespersons' by 2030, at 9%. In the meantime, the shares for 'Automotive', 'Food', and 'Mechanical' tradespersons are expected to fall by 1.4, 1.0, and 0.4%, respectively, by 2020, based on 2005 levels. 'Electrical' and 'Other' tradespersons will remain almost unchanged at 14.7% and 17.8%, respectively, by 2020.

Table 5 Employment shares, numbers, and changes in 2-digit occupations, 2005–20

ASCO code	Occupations	Shares within 1-digit occupation		% point change in share 2005 to 2020	Numbers ('000s)		Change in total employment 2005 to 2020	avg. % employment growth p.a. 2005 to 2020
		2005	2020		2005	2020		
11	Generalist managers	0.22	0.26	4.2	184	273	89	2.6
12	Specialist managers	0.52	0.64	11.8	429	657	228	2.9
13	Farmers & farm managers	0.26	0.10	-16.0	217	104	-113	-4.8
31	Science, engineering & related associate professionals	0.11	0.10	-1.1	140	168	28	1.2
32	Business & administration associate professionals	0.37	0.44	7.2	463	738	275	3.2
33	Managing supervisors	0.38	0.34	-4.3	479	566	87	1.1
34	Health & welfare associate professionals	0.06	0.05	-0.7	73	87	14	1.1
39	Other associate professionals	0.09	0.07	-1.2	108	124	16	0.9
41	Mechanical & fabrication engineering tradespersons	0.17	0.16	-0.4	210	219	9	0.3
42	Automotive tradespersons	0.11	0.10	-1.4	139	129	-10	-0.5
43	Electrical & electronics tradespersons	0.15	0.15	-0.2	186	196	10	0.4
44	Construction tradespersons	0.27	0.28	1.0	333	369	36	0.7
45	Food tradespersons	0.06	0.05	-1.0	80	72	-8	-0.8
46	Skilled agricultural & horticultural workers	0.07	0.08	1.8	83	113	30	2.1
49	Other tradespersons & related workers	0.18	0.18	0.1	221	237	16	0.5
51	Secretaries & personal assistants	0.45	0.38	-7.4	173	143	-30	-1.2
59	Other advanced clerical & service workers	0.55	0.62	7.4	209	236	27	0.8
61	Intermediate clerical workers	0.54	0.51	-3.1	886	971	85	0.6
62	Intermediate sales & related workers	0.10	0.10	0.3	159	192	33	1.2
63	Intermediate service workers	0.36	0.39	2.7	591	739	148	1.5
	<i>NET or VET-associated occupations</i>	<i>0.54</i>	<i>0.56</i>	<i>1.6</i>	<i>5363</i>	<i>6331</i>	<i>968</i>	<i>1.1</i>

Changes of employment shares and numbers by age group

The distributions of shares and numbers in employment for each 10 year age group in each 2-digit occupational group between 2005 and 2020 are presented in Table 6. A striking finding is that both the percentage change and average growth of employment per annum will rise for the older age group (55 years or over) and fall for the prime working age group (25 to 54 years), across all occupations. For the young age group (15 to 24 years), the percentage change and average growth of employment per annum will decrease for many occupations, while they will increase within a few occupations.

Among the VET-intensive occupations, the proportion aged under 25 will fall by 1.0%; the proportion aged 25–54 will fall by 4.4% and the proportion aged 55 or over will rise by 6.0%. Those in the trades occupations (especially automotive, construction and food) have the youngest age profile. This is consistent with the finding by Martin (2006) that there is a steady outflow of trade occupations from the moment that people obtain their trade qualification. While this youthfulness is expected to persist, it will gradually diminish with the changing age structure. Almost all the non-trade occupations are expected, by 2020, to have more people aged over 55 than under 25 years.

It should also be noted that ‘Farmers and farm managers’ will face a reduction in absolute employment numbers at all ages. This occupation will be the oldest occupation in terms of the share of employed older people in the Managerial group. We expect 47% of all farmers to be 55 or older by 2020, 5.5 percentage points more than in 2005. ‘Generalist managers’ was the other occupation in which the employed people at older ages accounted for nearly a quarter (0.24) of the total employed workers. By 2020, this occupation is likely to be the second oldest occupation, with an increase of 4.6 percentage point share for the older ages.

The VET-intensive occupations with the most rapidly ageing profile are mostly the Associate professional and Advanced clerical jobs. The most rapidly ageing, measured by change in percentage points for people aged 55 years or over, are ‘Health and welfare’, ‘Science/ engineering’ and ‘Other associate professionals’, and ‘Secretaries and personal assistants’. These are the types of jobs where experience is particularly valuable, and physical capacity much less so. There is every chance, then, that the productivity of these workforces will actually increase as a result of the ageing that will occur over the next 15 years, as they become more experienced, even without any additional formal VET training. If we think of the supply of skills as the number of people employed multiplied by their productivity, as we should, then the effect of ageing for the most rapidly ageing occupations will most likely be to increase the supply.

The same thing is much less likely to be true for the ‘Trades’ occupations. One reason is that they are expected to age less rapidly (a relatively small proportion being in the ‘baby boom’ age group, because many have left the trades by their middle ages). A second reason is that the trades often make more physical demands on workers than do the white collar Associate professional jobs. As people pass their mid-50s, these physical demands are likely to be less easily managed, thus preventing an increase, or leading to a decrease, in productivity. The shape of the age–earnings profile of tradespeople, compared with that of many other occupations, including associate professionals, supports this conclusion. The age–earnings profile shows how the pay in an occupation changes as people get older. In almost all occupations, older people are paid more than younger people, up to a maximum age of around the mid-50s. Economists assume that, on average, people are paid about what they are worth to their employer. Thus if older people are paid more, they must be worth more, that is, be more productive. The reason they are more productive is presumed to be because they have learned skills on-the-job, while working. As Richardson (2004) shows, the pay (hence productivity) of people in ‘Trades’ jobs does not rise much for older age groups, whereas it does for most other occupations. From this we deduce that the productivity of tradespeople reaches a peak not long after they complete their qualification, and plateaus at that level for the remainder of their time in the occupation. This, in turn, means that changes in the age

distribution of tradespeople will have little effect on their average productivity, and hence on this aspect of the supply of trades skills.

Workers of prime age (25 to 54 years) comprise the major share in all occupations, varying between 0.50 and 0.84 over the period from 2005 to 2020. A striking change, however, is that there will be a fall in the share in this age group for all occupations. Significant declines in absolute numbers of workers of prime age are expected in a number of the trades, together with farmers and secretaries.

People in the young age group (15 to 24 years) have a relatively high presence in the occupational categories of 'Trades' and 'Intermediate clerical, sales and service workers', with a share of more than 0.15 between 2005 and 2020. Taking the seven occupations in the 'Trades' category as an example we look further into the employment shares for each 10-year age group within each occupation. The age patterns differ significantly between and within occupations over the period 1996 to 2020 (see figure 6 in appendix B). The main features are:

- ✧ Growing proportions of older people (aged 55 years and over) will work in all the trades. 'Skilled agricultural and horticultural tradespersons' will be the oldest occupation in terms of the share of the older people: projected to increase from 15% in 2005 to 20% in 2020.
- ✧ In most trades, the employment share for the age groups 25 to 44 years will decline, most sharply for those aged 25 to 34 years.
- ✧ 'Construction', 'Food trades', and 'Electrical and electronics' are expected to have a growing share of young workers (15 to 24 years), while in the remainder their share is likely to be steady, or even to fall.

These changes in age profile have implications for the VET sector. In the non-manual occupations, older workers are quite close substitutes for middle-aged workers. They have large amounts of skills obtained from experience but lower levels of formal education. For both reasons, they are likely to find it harder to use the formal VET system to update their skills, or to shift to the skills needed for a new occupation. It will require special attention from the VET sector to design and deliver courses for such workers that meet their particular requirements. These requirements include:

- ✧ Having a quick return (in terms of higher wages or better job prospects) on the costs of obtaining the VET skill, since workers over the age of 55 do not expect to remain in the workforce for a long period;
- ✧ Being able to manage a very diverse range of backgrounds among students, as most will have obtained their (often considerable) skills from informal on-the-job experience, rather than from some more homogeneous curriculum; and,
- ✧ Accommodating people who, while wanting flexible course delivery to fit into their complex adult lives, often will not be very proficient in the use of the latest information technologies.

Table 6 Employment shares and changes within 2-digit occupations, by age group, 2005–20

ASCO code	Occupations	15–24 years				25–54 years				55 years or over			
		2005 share	% point change in share 2005–20	Net increase ('000s) in employment 2005–20	avg. % employment growth p.a. 2005–20	2005 share	% point change in share 2005–20	Net increase ('000s) in employment 2005–20	avg. % employment growth p.a. 2005–20	2005 share	% point change in share 2005–20	Net increase ('000s) in employment 2005–20	avg. % employment growth p.a. 2005–20
11	Generalist managers	0.02	2.1	8	7.2	0.74	-6.8	47	2.0	0.24	4.6	34	3.9
12	Specialist managers	0.03	1.9	19	6.4	0.84	-4.3	162	2.5	0.14	2.4	47	4.0
13	Farmers & farm managers	0.03	-0.4	-3	-5.7	0.55	-5.1	-68	-5.4	0.42	5.5	-42	-4.0
31	Science, engineering and related associate professionals	0.10	-1.3	1	0.3	0.76	-5.4	12	0.7	0.15	6.7	16	3.8
32	Business & administration associate professionals	0.08	1.4	32	4.2	0.77	-6.4	166	2.6	0.15	5.0	77	5.2
33	Managing supervisors	0.10	2.3	21	2.6	0.74	-5.8	31	0.6	0.16	3.5	34	2.5
34	Health & welfare associate professionals	0.06	-1.8	-1	-1.4	0.81	-5.6	6	0.6	0.13	7.4	8	4.2
39	Other associate professionals	0.17	-0.8	2	0.6	0.75	-5.1	6	0.5	0.08	5.9	9	4.8
41	Mechanical & fabrication engineering tradespersons	0.17	-0.7	0	0.0	0.71	-3.9	-2	-0.1	0.12	4.5	11	2.4
42	Automotive tradespersons	0.26	-0.5	-3	-0.6	0.64	-4.4	-12	-1.0	0.11	4.9	5	2.1
43	Electrical & electronics tradespersons	0.20	0.6	3	0.6	0.71	-5.6	-4	-0.2	0.10	4.9	11	3.1
44	Construction tradespersons	0.23	1.9	15	1.2	0.66	-4.9	5	0.2	0.11	3.1	15	2.4
45	Food tradespersons	0.29	0.5	-2	-0.6	0.61	-3.1	-7	-1.1	0.10	2.6	1	0.8
46	Skilled agricultural & horticultural workers	0.16	-1.9	3	1.2	0.69	-2.6	18	1.8	0.15	4.5	10	3.8
49	Other tradespersons & related workers	0.20	-1.2	0	0.1	0.69	-2.4	5	0.2	0.11	3.6	10	2.4
51	Secretaries & personal assistants	0.12	-2.3	-7	-2.7	0.72	-5.1	-29	-1.7	0.17	7.3	6	1.2
59	Other advanced clerical & service workers	0.08	-1.1	0	-0.1	0.76	-3.4	12	0.5	0.16	4.4	15	2.5
61	Intermediate clerical workers	0.18	-0.4	12	0.5	0.71	-2.6	36	0.4	0.11	2.9	38	2.2
62	Intermediate sales & related workers	0.14	0.4	5	1.4	0.74	-3.2	18	0.9	0.12	2.8	9	2.7
63	Intermediate service workers VET or VET-associated occupations	0.31	-0.9	39	1.3	0.60	-2.7	69	1.2	0.10	3.5	40	3.6
		0.16	-1.0	144	1.1	0.70	-4.4	471	0.8	0.14	6.0	354	2.6

Data sources: Authors' projections; 2005 data are derived from ABS Labour Force, Australia, Detailed – Electronic Delivery, Quarterly, data cube, E07 (cat.no 6291.0.55.001).

Projections of numbers with VET qualifications in VET-intensive occupations

VET qualifications in 1-digit occupations

In this section, we focus in on the workforce with a formal VET qualification as their highest qualification. This is a more narrow measure of the supply of VET skills than previously adopted, but one that is perhaps of more obvious relevance to the VET providers. To do this, looking forward, we use the various education clusters identified earlier to identify the proportion of people employed in VET-intensive occupations within each cluster who possess a VET qualification.

To project the number of people with VET qualifications in an occupation, it is necessary to compute the ratio of the number of workers in that occupation who have VET qualifications to the number of employed persons in the same age group/occupation. In accord with the method used earlier, the ‘qualification ratio’ is based on those aged 25 to 49 years, who are treated as a single age group. The number of employed people with VET qualifications in the occupation is the value of this ratio multiplied by the projected employment level (for those of all ages) of the occupation. In this study, the ratios for the identified five VET-intensive occupations (termed ‘VET qualifications ratio’ hereafter) are calculated from occupational employment and qualifications data collected in the ABS Education and Work Survey for 2003. The calculated ‘VET qualifications ratios’ for the five VET-intensive occupations are: 65% for ‘Trades’, 43% for ‘Advanced clerical and service workers’, 42% for ‘Intermediate clerical, sales and service workers’, 39% for ‘Associate professionals’, and 30% for ‘Managers and administrators’. Using the education clusters to assign ‘VET qualifications ratios’ to the projected employment in each of the five VET-intensive occupations, and maintaining ‘VET qualifications ratios’ at the 2003 rates, we calculate the number of employed persons in each occupation who will need to have a VET qualification if the qualifications ratio is not to fall.

Men and women have a very different pattern of employment in each of the five VET-intensive occupations, as observed in historic data (for example, Education and Work Survey in 2003). On average, males comprised 63% of workers with VET qualifications employed in these five occupations. They were concentrated in the occupations ‘Tradespersons’, ‘Managers and administrators’ and ‘Associate professionals’, comprising 93, 83 and 63%, respectively. In contrast, female employees with a VET qualification dominated the occupations ‘Advanced’ and ‘Intermediate clerical, sales and service workers’, making up 91 and 74%, respectively. By assigning the male/female proportions to the projected VET qualifications employed in each of the five VET-intensive occupations, we can compute the numbers of VET-qualified males and females.

The results of projected VET qualifications employed in the five occupations and disaggregated by sex are set out in table 4 in Appendix C. These estimates suggest the likely numbers and sex distribution of VET qualifications to be employed in the five VET-intensive occupations, if the distribution of educational attainment and occupational employment by sex in 2003 is to remain unchanged.

By 2020, the total number of people with VET qualifications to be employed in the five VET-intensive occupations is around 2.81 million, or almost half a million more than in 2004. Most of the increase will be for qualifications in the fields of ‘Intermediate clerical, sales or service work’

and ‘Associate professionals’, with women predominating in the former and men predominating in the latter. The smallest increases will be in the ‘Advanced clerical and service workers’ and the ‘Trades’. Overall, 60% of the additional VET qualifications will go to men.

Comparison of projections of employment with projections of qualifications: 1-digit level

We have measured the supply of vocational skills in two ways. The first is as the number of people who are employed in occupations that require vocational skills. The second is as the number of people who have vocational qualifications and are employed in occupations that require such skills. In this section, we compare the projections based on each method, to see if they are providing a consistent story. We focus here on projections at the high level of aggregation implied by the use of 1-digit ASCO occupational groupings, combined with the use of 5-year age groups for the population dynamics. Table 7 shows the average growth in vocational skills per annum, projected to occur between 2004 and 2020, by each method.

Table 7 Projected average growth per annum in the supply of vocational skills between 2004 and 2020, measured as growth in employment and as growth in qualifications

	Average growth p.a. in employment (%)	Average growth p.a. in qualifications (%)
Managers & administrators	1.9	2.9
Associate professionals	2.2	2.5
Advanced clerical & service workers	0.2	1.4
Tradespersons & related workers	0.5	0.6
Intermediate clerical, sales & service workers	1.0	2.5
Total	1.3	1.8

The table shows that supply will increase most rapidly in the occupations of ‘Associate professionals’ and ‘Managers and administrators’, and most slowly in the occupations of ‘Advanced clerical, sales and services’ and ‘Trades’. It also shows a more rapid increase in the supply of qualified people in each of the occupations than in the number employed. This suggests an increase in the degree to which workers in VET jobs have VET qualifications. The increase in the share with qualifications will arise from an increase in the proportion of the occupation that is in the prime ages of 25–49. In terms of absolute numbers, we expect the greatest increase in supply (around an additional 190 000 people in the next 15 years) to be for ‘Associate professionals’.

VET qualifications in 2-digit occupations

Overall patterns

This section provides projections of VET qualifications to be employed by age groups within each of the 20 sub-major groups of VET-intensive occupations over a 15-year period to 2020. The ABS will not release its labour force or other data at this level of disaggregation, because they believe that, in some cases, there are not enough people in the sample for analysis to be reliable. We are aware that there is considerable interest in having a more detailed picture of the VET-intensive occupations, so we present information based on the annual Household Income and Labour Dynamics in Australia (HILDA) survey. This survey is not conducted by the ABS, but the reliability problems that worry the ABS apply with full force to HILDA data. In recognition of this, we do not disaggregate by gender. Readers must be aware that the accuracy of our projections is limited by the small sample size on which they are based. They should be seen as indicative only.

We derived the 'VET qualifications ratio' for each 10-year age group within each 2-digit occupation. The ratios were computed by dividing the numbers of employed workers for each 10-year age group in each 2-digit occupation who have VET qualifications as their highest qualifications by the number of all employed persons in the same age group and occupation. The VET qualifications ratio was then applied to our projections of employment of the 2-digit occupations, in the same manner as for the earlier projections.

Estimates of future VET qualifications have been made by applying a constant ratio (based on 2004) of VET qualifications for each age group within a specific occupation, to employment projections for the next 15 years. The estimates thus identify the growth in VET qualifications needed to keep the 'VET qualifications ratio' constant. Table 8 presents the results of estimated total numbers and relative changes of VET qualifications in each VET-intensive occupation at 2-digit level among the overall VET qualifications.

VET qualifications are expected to be more concentrated in several occupations in the future. These occupations include 'Intermediate service workers', 'Intermediate sales and related workers', 'Construction', 'Electrical' and 'Mechanical' tradespersons. Each of these occupations accounted for more than 7% of the total employed VET qualifications in the five VET-intensive occupations. The concentration is mainly driven by a changing demographic mix.

Significant increases, in terms of both annual growth rates of absolute numbers and net percentage point changes of employment, are anticipated to occur in some Associate professional and Managerial occupations. The fastest growing employment of VET qualifications will be for 'Business and administration associate professionals', 'Generalist managers', and 'Managing supervisors'. These indicate that there will be a substantial shift of employment of VET qualifications in the occupational composition of the workforce. That is, there is a swing towards employment in occupations requiring higher skills, shifting from traditional VET occupations (for example, Trade and Advanced clerical occupations) to Associate professional and Managerial occupations.

More than two-thirds of the 20 sub-major occupation groups will contract, or at least not increase, the role of VET qualifications over the period 2004 to 2020: for one out of every five occupations there will be a decline. 'Farmers and farm managers', 'Electrical and electronics tradespersons', and 'Other advanced clerical and service workers' are among these occupations. 'Farmers and farm managers' is the largest one that will substantially lose VET skills, caused by the ageing of its workforce.

The dynamics of future vocational skills supply have important implications in terms of how the VET sector needs to respond. If people are to be able to obtain the types and numbers of VET qualifications that they want, the VET system will need to:

- ✧ Meet fast-growing skills demand in Associate professional and Managerial occupations: employed VET qualifications in 'Associate professionals' will make up more than half of the net growth of employment of VET qualifications in the five VET-intensive occupations. There will be an increasing demand for training to upgrade or enhance people's VET qualifications at higher levels (especially advanced diploma/diploma) and in the business/management disciplines.
- ✧ Adjust to the changing pattern of 'Trades' occupations, as there will be significant increases in some and decreases in others. 'Construction tradespersons' is the only occupation within 'Trades' that will have a net increase in the proportion of trade-qualified workers. All the other 'Trades' occupations will have negative or no change in proportions that are trade qualified. 'Electrical and electronics tradespersons' and 'Skilled agricultural and horticultural workers' will experience a reduction in absolute numbers of trade-qualified workers.
- ✧ While the Intermediate clerical occupations are not growing particularly fast, there will still be a sizeable need for courses in these fields.

Age distribution

There are considerable variations in the evolution of VET qualifications by age groups within occupations over the period 2004 to 2020 (see table 5 in appendix C). The changes in the VET qualification ratio in each age group is caused mostly by the movement of younger cohorts into older age groups, where the younger group has a higher or lower qualification ratio than the next older cohort. The changes that we describe therefore pick up the effect on the supply of VET qualifications (by occupation) caused by changes in the age structure of that occupation. There is a sharp contrast regarding the net changes of VET qualification numbers and the average annual growth rates of absolute numbers in the Managerial occupations. For ‘Specialist’ and ‘Generalist’ managers, most age groups, particularly those aged 35 years or over, are expected increasingly to possess VET qualifications. ‘Farmers and farm managers’ are likely to face a substantial drop in VET qualifications throughout all ages, in both absolute and relative terms, mainly caused by the rapid ageing of the workforce in this occupation.

A similar age distribution was found in ‘Science’ and ‘Health’ associate professionals. For people aged less than 45 years, VET qualifications will generally decline. In contrast, there is a large growth in VET qualifications concentrated in the ages between 45 and 64 years. Among all ages working as ‘Business and administration associate professionals’, and ‘Managing supervisors’ there will be substantial growth in VET qualifications in terms of both net growth and growth rates.

The ageing effect on most trade occupations is significant. In general, ages between 55 and 64 years throughout all trade occupations will increase their VET qualifications. ‘Construction tradespersons’ is the only occupation in which employment of VET skills of most age groups will rise significantly, despite a minor reduction in employment for ages between 45 and 54 years. There is a reverse pattern for both younger and older ages working as ‘Skilled agricultural and horticultural workers’, ‘Electrical’ and ‘Automotive’ tradespersons. Young people aged between 15 and 34 years will fall as a share of employment, while people aged over 35 years will increase. The fastest growth in VET qualifications tends to occur in the older ages (55 to 64 years).

Table 8 Projected VET qualifications in 2-digit VET-intensive occupations, 2004 to 2020

ASCO code	Occupations	2004		2020		Net increase in VET quals 2004 to 2020	Percentage point change in share 2004 to 2020	Avg. growth of VET quals p.a. 2004 to 2020
		Persons	% of total VET quals	Persons	% of total VET quals			
11	Generalist managers	58 894	2.8	99 783	4.1	40 889	1.3	3.4
12	Specialist managers	135 145	6.4	181 479	7.4	46 334	1.0	1.9
13	Farmers & farm managers	67 318	3.2	27 158	1.1	-40 160	-2.1	-5.5
31	Science, engineering & related associate professionals	77 544	3.7	87 990	3.6	10 446	-0.1	0.8
32	Business & administration associate professionals	133 389	6.4	232 663	9.5	99 274	3.2	3.5
33	Managing supervisors	145 730	6.9	202 304	8.3	56 574	1.3	2.1
34	Health & welfare associate professionals	50 782	2.4	56 085	2.3	5 303	-0.1	0.6
39	Other associate professionals	44 997	2.1	49 388	2.0	4 391	-0.1	0.6
41	Mechanical & fabrication engineering tradespersons	147 151	7.0	156 278	6.4	9 127	-0.6	0.4
42	Automotive tradespersons	82 946	4.0	96 171	3.9	13 225	0.0	0.9
43	Electrical & electronics tradespersons	149 927	7.1	145 940	6.0	-3 987	-1.2	-0.2
44	Construction tradespersons	164 924	7.9	213 450	8.7	48 526	0.9	1.6
45	Food tradespersons	26 958	1.3	31 831	1.3	4 873	0.0	1.0
46	Skilled agricultural & horticultural workers	55 386	2.6	55 082	2.3	-304	-0.4	0.0
49	Other tradespersons & related workers	143 395	6.8	148 519	6.1	5 124	-0.8	0.2
51	Secretaries & personal assistants	29 333	1.4	29 851	1.2	518	-0.2	0.1
59	Other advanced clerical & service workers	63 486	3.0	58 298	2.4	-5 188	-0.6	-0.5
61	Intermediate clerical workers	223 328	10.6	248 706	10.2	25 378	-0.5	0.7
62	Intermediate sales & related workers	39 595	1.9	62 791	2.6	23 196	0.7	2.9
63	Intermediate service workers	256 978	12.3	256 398	10.5	-580	-1.7	0.0
	<i>Total</i>	<i>2 097 206</i>	<i>100.0</i>	<i>2 440 165</i>	<i>100.0</i>	<i>342 959</i>	<i>0.0</i>	<i>1.0</i>

Data source: Authors' estimates; Figures for baseline year 2004 were derived from HILDA data in 2004.

A similar age pattern of VET qualifications is found between 'Advanced' and 'Intermediate' clerical and service occupations. People in younger (15 to 24 years) and middle (35 to 44 years) ages will have a fall in VET qualifications in both absolute and relative terms. This pattern is closely correlated with the gender distributions of employment in these occupations. Women are particularly found in 'Advanced' and 'Intermediate' clerical, sales and service workers, and 'Associate professionals'. For instance, in 2004, female employees were predominant as 'Secretaries and personal assistants' (almost 100%), 'Other advanced clerical and service workers' (81%), 'Intermediate service workers' (79%), and 'Health and welfare associate professionals' (73%). Women in the younger ages tend to be more involved in education and training. As they enter their family formation years, many of them usually undertake child-caring responsibilities before they return to work.

Flows of VET qualifications

Using synthetic cohort methods, we analyse the projected VET qualifications flows through people's tenure in occupations. The analysis provides some insights into skills supply of people at different life stages in an occupation. We take the number of people in a 10-year age cohort in an occupational group at one year (for example, 2005) and compare it with the number of people in the same cohort (now 10 years older) 10 years later (now 2015). This gives a sense of the minimum flows into or out of occupational groups although it cannot measure exactly how many entered an occupation due to some people leaving the occupation during the 10-year period, thereby reducing the total number in the occupation. The 'inflows' or 'outflows' are measured as the net addition or reduction in the number of people in each age cohort in specific occupations over the period from 2005 to 2015. For example, amongst the cohort aged 15 to 24 years in 2005, there will be 18 119 more 'Mechanical and fabrication engineering tradespersons' in 2015 (when they will be aged 25 to 34 years) than in 2005. Negative figures indicate a reduction in the numbers in a cohort in an occupation across the period specified. In this way, a spectrum across six years (from 2015 to 2020) of occupational flow patterns of VET skills can be captured.

People with VET qualifications enter 'Generalist' or 'Specialist' managerial occupations at a fairly steady rate until at least their mid-40s, and there is no net outflow until a cohort reaches the age of 55 for 'Generalist managers' or 45 for 'Specialist managers' (see table 6 in appendix C). A sharp contrast to this pattern is for people working as 'Farmers and farm managers'. Flows into this occupation are heavily concentrated at the beginning of their career until about age 25. They start to leave the occupation from their mid-twenties. This will result in two consequences. One is that the workforce in this occupation will be ageing more rapidly than other occupations. The other is the large anticipated loss of farmers or farm managers over the next 15 years. Flows into most of the Associate professional occupations show a similar pattern to those entering the 'Generalist' or 'Specialist' managerial occupations. 'Associate professionals' show no net outflows until their mid-40s. Like Managerial occupations, this is due to specific requirements for people to have higher skills and more working experience.

'Tradespeople' with VET qualifications follow a different pattern. Most people enter the sub-major groups of 'Automotive', 'Electrical', 'Food', and 'Other' tradespersons in their teens to mid-twenties. At age 25 there is a net outflow from the occupation and they continue to move out of these occupations at all subsequent ages. People enter the sub-major groups of 'Mechanical' and 'Construction' tradespersons by their mid-thirties, and then start to move out of these occupations at age 35. There is an exception for 'Skilled agricultural and horticultural workers'. There is no net outflow until people are aged 45 years.

Inflows to and outflows from occupations demonstrate that people with VET skills enter occupational groups in widely varying ways, and at different ages. Thus the age and stage in the life course of the student body will differ, according to the type of VET qualifications being sought. The major implication for the VET sector is that differentiated course modules and subjects need to be designed to meet the needs for skills of people at different ages.

Uncertainty in projections of employment and VET skills

The projections in this study reflect changing demographic patterns. Despite the fact that the projection approach used in this study is useful in highlighting the impacts of ageing on employment share changes, it unavoidably embodies some uncertainties for predictions over a projection horizon of 15 years. One of the uncertainties is that the size and structure of the population can vary by the interplay of two factors: the future paths of mortality and net immigration. The other uncertainty arises in translating population trends to labour force predictions and employment projections, which are the fundamental data sources upon which in-depth analyses and projections in this study build. Future trends in labour force participation rates and employment changes between and within occupations may not follow the paths that have been projected for them largely on the assumption of the persistence of recent trends. The composition of the labour/skills supply and changes in employment in occupations over the next 15 years may not exactly conform to our current outlook. Another uncertainty originates from data on actual employment in both aggregated and disaggregated occupations. For instance, the time spectrum for the available data and information on employment by occupation only spans a comparatively short period of ten years, from 1996 to 2005. This problem is mainly due to the non-comparability of occupational employment data collected by the ABS before and after 1996. The intrinsic reason is because of a significant change in the ASCO after 1996. Moreover, a considerable amount of training occurs informally on the job and many people take formal VET courses to complete particular units or modules rather than whole qualifications. Therefore, the analysis of highest qualifications utilised in this report, while important, does not capture the whole picture of vocational skills supply.

In this study, we projected the changes in the stock of employment and its distribution by age groups among and within occupations at both 1-digit and 2-digit levels. Of particular interest for the analysis are VET-intensive occupations. The analyses assumed that the economy is operating close to full capacity, at about the current unemployment rate. This assumption removes some of the complexity associated with changes in labour supply resulting from the long-run cycle of macro-economic growth or recession.

Some potential factors influencing future labour supply include technological change, regulatory policies, social values and attitudes. These factors are difficult to predict separately and even more problematic to factor into labour supply projections. Notwithstanding this, these factors can influence the patterns of labour supply. For instance, new technologies, especially computerisation, have been critical in shifting demand in favour of workers with high skills across different countries (Berman & Machin 2000; Machin 2001). In Australia, as elsewhere, technological advancement will continue to shape the labour market over the next 15 years, particularly in occupations that depend heavily on the supply of higher levels of skills. In addition, workers' choices about their labour supply are conditional on their perceived prospects in the labour market.

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Appendix 1: Skills consortium publications

The following is the complete list of titles produced by the National Institute of Labour Studies, Flinders University and the Centre for Post-compulsory Education and Lifelong Learning, University of Melbourne, through the research project, A well-skilled future: Tailoring VET to the emerging labour market.

Forecasting future demands: What we can and cannot know
Sue Richardson and Yan Tan

Future skill needs: Projections and employers' views
Diannah Lowry, Simon Molloy and Samuel McGlennon

Demographic impacts on the future supply of vocational skills
Yan Tan and Sue Richardson

Skill acquisition and use across the life course: Current trends, future prospects
Bill Martin

What is a skill shortage?
Sue Richardson

Changing forms of employment and their implications for the development of skills
Sue Richardson and Peng Liu

Changing work organisation and skill requirements
Bill Martin and Josh Healy

Social area differences in vocational education and training participation
Richard Teese and Anne Walstab

Participation in vocational education and training across Australia: A regional analysis
Anne Walstab and Stephen Lamb

Current vocational education and training strategies and responsiveness to emerging skill shortages and surpluses
Jack Keating

Matching supply and demand: International perspectives
Jack Keating

Impact of TAFE inclusiveness strategies
Veronica Volkoff, Kira Clarke and Anne Walstab

A well-skilled future
Sue Richardson and Richard Teese

Support document details

Additional information relating to this research is available in *Demographic impacts on the future supply of vocational skills: Support document*. It can be accessed from NCVET's website <<http://ncver.edu.au/publications/1995.html>>. It contains:

- ✧ Appendix A: Employment share projection: Growth curve fitting models
- ✧ Appendix B: Figures
- ✧ Appendix C: Projected VET-related occupational employment



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The consortium, *A well-skilled future: Tailoring vocational education and training to the emerging labour market*, comprises researchers from the National Institute of Labour Studies in South Australia and the Centre for Post-compulsory Education and Lifelong Learning in Victoria. Its program of research aims to investigate future work skill needs and work organisation arrangements, and their implications for vocational education and training.

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