NCVER

Future skill needs:

Projections and employers' views

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National Institute of Labour Studies,
Flinders University

Program 1:
The nature of future labour market demand

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

CONSORTIUM RESEARCH PROGRAM

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Publisher's note

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About the research

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

To assist the vocational education and training (VET) sector respond to changes in the skills required in the Australian workforce, the National Centre for Vocational Education Research (NCVER) commissioned a program of research from the National Institute of Labour Studies, Flinders University, and the Centre for Post-compulsory Education and Lifelong Learning, University of Melbourne.

This report examines one of the central questions in this research area: how can the VET sector adapt to the fluid environment of the workplace when the dynamic nature of the labour market makes it impossible to predict with any certainty future skills needs?

In tackling this question, the authors had to take into account the growing complexity of the skills being demanded of workers. They did this by adopting the notion of cognitive skills (for example, compiling, analysing, coordinating), interactive skills (for example, serving, supervising, mentoring) and motor skills (for example, handling, driving, precision working), rather than using indirect measures (or proxies) of skill such as qualification or occupation. They concentrated their research on those industries expected to have the main employment growth to 2011: property and business services; health and community services; retail; construction; accommodation, cafes and restaurants.

Key messages

- Proxies for skill such as 'qualifications' and 'earnings' do not always capture the actual skill requirements of jobs because many people with a qualification do not use that qualification directly in their work and others without formal qualifications have the skills to do their job.
- The demand for interactive and cognitive skills is projected to grow, whereas the demand for motor skills is likely to fall. Employers interviewed for this study considered interactive skills to be the key skills required over the next decade.
- A process of 'skill deepening' is occurring as increasing job complexity requires workers to move up the interactive and cognitive skill hierarchies.
- To accommodate the demand for interactive and cognitive skills, training packages and curriculum design need to incorporate consideration of worker functions contained within the interactive and cognitive skill sets.

For a synthesis of the consortium's entire program of work, see *A well-skilled future* by Sue Richardson and Richard Teese.

Tom Karmel
Managing Director, NCVER

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Executive summary

This report is from a research program entitled *A well-skilled future: Tailoring VET to the emerging labour market*. This research program examines the evolving labour market and changing work organisation and management in the context of the vocational education and training (VET) sector and its role in the development of the appropriate levels, types and quantities of skills required to satisfy the future demands of Australian industry. The research reports have been produced by a consortium comprised 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 central question guiding this report is: how will the demand for vocational skills change in the years to 2011? Definitions of skill have changed in recent times and are likely to continue to change as work and the employment relationship continues to evolve.

In attempting to determine skill needs over the mid-term, we explore how global and technological change have impacted on the structure of desired skills. We adopt first an 'industry approach' to projecting skill demand based on employment growth in what are predicted to be the most rapidly growing industries. We also use an alternative 'occupation approach', whereby we project skill demand in relevant VET-intensive occupations based on the projected increase in employment in each of the occupations. In addition to quantitative analyses, we consulted with employer groups and a large national recruitment firm to determine what they see as the key future skills required, and what can and cannot be expected from the public vocational education system.

To date published Australian studies of changes in the demand for skills are retrospective studies based on historical data. This means that key factors affecting the demand for skills could be identified, analysed and, to some degree, quantified. The focus of this study however involves projecting the future demand for skills and is thus prospective rather than retrospective. This report is also a conceptual departure from traditional studies on skills needs. Rather than focus on proxies of skill such as 'qualification', 'earnings' or 'nominal occupation', a heterogenous conception of skill is used, involving the use of a task-oriented approach to skill based on cognitive, interactive and motor skills. This approach applies a framework derived from the United States Department of Labor's Dictionary of Occupational Titles. This framework involved applying a calculated skills scale score according to the dimensions of cognitive, interactive and motor skills.

The main findings from both the 'industry approach' and 'occupation approach' suggest that the demand for interactive and cognitive skills will grow over the next six years and the demand for motor skills is likely to fall. Employers interviewed in this study all strongly agreed that interactive and cognitive skills would be the skill dimensions in highest demand over the coming decade. The findings suggest that the changing nature of the workplace in terms of technological and social changes has led to an increased emphasis on interactive and cognitive skills. Consequently a process of 'skill deepening' is occurring as increasing job complexity requires workers to move up the interactive and cognitive skill hierarchies.

Employers interviewed in this study also commented that VET needed to be more flexible and responsive to the needs of industry. Employers commented that more consultation with industry would improve VET offerings and ensure that VET kept pace with the changing needs of industry. The results of the quantitative analysis in this study show that these types of industry statements are more than simple catch phrases—industry needs are changing. Employers interviewed expressed a

desire for active partnerships with VET in the design of curriculum and delivery of training, and that restructuring existing qualifications into an elective or modular structure may improve the flexibility of offerings.

The implications for VET are that curriculum design needs to incorporate consideration of the worker functions contained within the interactive and cognitive skill sets. For example, training in the hospitality sectors needs to emphasise the specific interactive skills required in particular jobs. This goes beyond simple customer-focused training characterised by scripted interaction, to a more in-depth treatment of higher-level interactive skills, such as persuasion and negotiation. This notion of 'ascending the skill hierarchy' is an important aspect of skill deepening. This type of 'targeted curriculum' approach to accommodating deeper levels of skills would need to incorporate an appropriate examination of each level of qualification, since each of the skill dimensions is likely to hold varying significance at different levels of study.

Introduction

The purpose of this study is to project future demand for the types of skills provided by the Australian vocational education and training (VET) sector. The main question guiding our projections is: what will be the demand for vocational skills over the next five to ten years? In the course of projecting skill needs across certain industries and occupations, we assess how global and technological change have impacted on the structure of desired skills. In addition to quantitative analyses, this study involved consultation with employers, employer groups and a large national recruitment firm to determine what they see as the key future skills required, and what can and cannot be expected from the public vocational education system.

A contested issue in the literature on skills is whether skill levels in the labour market are generally rising or falling. Controversy over this issue was sparked over three decades ago with Braverman's 'technology as deskilling' thesis (Braverman 1974). While some theorists ascribe to such pessimistic accounts of overall deskilling (see for example, Thompson 1989; Ritzer 1998), other writers such as Castells (1999*),* Frenkel et al. (1999*)* and De Laigne et al. (2000) argue that the increased complexity of work is reducing the demand for lower-skilled jobs and increasing the demand for jobs with higher skill competencies. While the early upskilling and deskilling theses were empirically informed, they lacked the advantage of representative aggregate data (Gallie 1991). A UK study by Penn et al. (1994) attempted to rectify this deficit. Their study indicated that, rather than a mass move to either upskilling or deskilling, a pattern of skill polarisation existed in the UK, a pattern which benefited already skilled workers (Penn et al. 1994). It was argued that jobs at the bottom end of the labour market were not being deskilled, but this was only because they already called for so little skill (Rose et al. 1994). Other theorists such as Shah and Burke (2003) posit that current and future skill levels are the result of the interaction between exposure to globalisation and new technologies, while Buchanan et al. (2004, p.188) deconstruct this further by suggesting that there are different skill *ecosystems* resulting from the 'interlocking networks of firms, markets and institutions, conceived as a form of interdependence'.

Against this background of competing views of the required future levels of skills and the different impacts of trade and technology on skills, it is generally acknowledged that definitions of skill have changed in recent times, and indeed continue to change as work and the employment relationship is restructured over time (see for example, Spenner 1990; Gallie et al. 1998; Warhurst & Nickson 2001; Buchanan et al. 2001; Grugulis, Warhust & Keep 2004; Bolton 2004, Marchington et al. 2005). It is argued here that in order to understand the types of skills that will be needed in the future, we need a firmer understanding of the concept of 'skill' itself, and this unpacking of the concept of skill forms the starting point for this paper.

This report is organised into three remaining chapters. The next section of this chapter explores the concept of 'skill' and how this is changing, the impact of global and technological change on the structure of skills, and the problematic nature of projecting skill demand. We suggest that traditional measures such as 'qualification' and 'earnings' have inherent weaknesses as proxies for skill, and argue for a more 'task-centred' typology of skill. In the following chapter we present 'industry and 'occupation' approaches to projecting skill demand, ending the chapter with a comparison of these approaches, while the following chapter reports on consultations with employers and a large recruitment firm. Their views about key future skill requirements and what can and cannot be expected from the VET system are reported. Finally, conclusions are given by drawing together the material from the previous chapters.

Unpacking the concept of skill

Skills: a changing target

In this section the changing concept of skill is explored, since how 'skill' is conceptualised and defined has implications for the projections of skills required, and for the resultant nature of vocational training design and provision.

The notion of 'skill' is an elusive and difficult concept to define. The broad body of literature on skills reveals different types of approaches to defining 'skill' (see for example, Becker 1964; Littler 1982; Spenner 1990; Noon & Blyton 2002). One approach is adopted predominantly by economists, and involves the view that 'skill' is something that resides in the worker. The assumption is that enhancing workers' human capital through increasing their skill levels positively impacts on the productivity of firms. The second approach, sociological in orientation, involves the skill that is required of the job. This includes contextual job aspects beyond the task at hand, factors such as examination of job design and forms of control, as well as the nature of the employment relationship. The third approach (also sociological in its orientation) views skill as a social construction. This approach sees that the notion of 'skill' arises from negotiations between economic actors, collectively or as individuals. This social construction of skill takes place within and outside the workplace, and could be to the benefit of certain groups (including groups based on profession, craft, or gender).

While these approaches to skill are of academic interest, at first glance they are not immediately useful in the realm of policy-making. As Grugulis et al. (2004, pp.1–2) note, the pragmatics that drive policy-makers privilege definitions of skill that can be more readily achieved or measured. Activity within the vocational education and training (VET) system that cannot easily be judged by its ability to generate numerical outcomes (qualifications or parts thereof) is generally considered as highly problematic.

Since skill is not easy to quantify, substitutes are used, most notably 'qualifications' and 'earnings'. Qualifications however, are not skills, but a proxy for skill (Attewell 1990; Steiger 1993). As a convenient form of short hand included in almost every definition of skill, they can assist employers identify appropriate workers, provide individuals with portable credentials, and give occupational groups bargaining power. Yet, each of these advantages arises from the skills that qualifications are *assumed* to certify, not from the fact that qualifications exist. This is not to denigrate the value of accreditation, for there is little doubt that qualifications enable workers and employers to locate one another, thus assisting the labour market to function efficiently. The point is that it is problematic to assume a more skilled workforce on the basis of greater participation in education and the accumulation of qualifications, since the possession of skills, or more accurately their proxies, rather than their use in the workplace starts to take precedence. In simple terms, proxies are not always reasonable signifiers for the skills they are intended to represent. Level of education or certification does not necessarily capture the actual skill requirements of jobs, and rapid growth in educational attainment may have as much to do with credentialism as skill attainment.

Alongside the problematic nature of defining and measuring skill has been the emergent tendency to rate what has traditionally been regarded as character traits, personal characteristics, predispositions and attitudes to be as important as skills. Examples include motivation, empathy,

inquisitiveness, a sense of humour, enthusiasm, personal presentation, punctuality, positive self-esteem, and perseverance (Field 2001). These types of attributes are also sometimes referred to as generic skills, employability skills and unobservable skills. The rationale underlying the importance of such attributes is that they *underpin* more traditionally defined skills such as communication, learning, project management and systems skills (this last skill including working with and understanding organisational, technological, information and product/service systems).

The landscape of generic skills is a contested terrain, even at a simple, pragmatic level. For example, from conducting a number of case studies, Grugulis and Vincent (2005) identify that different 'soft' skills (equating to the personality traits and attitudes mentioned above) are required in different organisations. Grugulis and Vincent found that in some organisations, loyalty and commitment were more highly prized over customer orientation and service, while in other organisations customer service skills were paramount above all else. From this perspective then, 'generic' skills are far more firm-specific than is assumed. Moreover, the question has been raised as to how the gamut of desired new generic skills is distinguishable from the more simple *old* 'skill' of discipline. For example Lafer (2004) describes how in the US a growing number of companies have turned to prison labour as a labour pool. One of the central objectives of the corrections system program is to enable inmates to develop desirable work habits such as teamwork and learning how to follow directions. Lafer cites a prison-based IBM supplier who declared that the productivity and quality of the prison-based workforce was as good, if not better, than any other workforce he'd dealt with. For Lafer (2004, p.117), this raises the following issue:

> If private employers find the motivation and work ethic they need in prison, it suggests that the interactive skills, teamwork and emotional intelligence they seek are not a matter of *skill*, but rather of *will*. Anyone, it seems, can be a good team member, if they are only desperate enough for the job or institutionally deprived of the means to resist.

Lafer (2004) goes on to argue that the extent to which soft, generic skills are a matter of will rather than skill is further evident in the power of good wages to produce effects that training programs 'seem incapable of providing' (p.117). He refers to a study conducted by Moss and Tilly (1996), where two distribution warehouses in the same neighbourhood in Los Angeles employed large numbers of current and past gang members. In the first warehouse, managers complained about the laziness of the workers and their propensity for theft, and the struggle to retain the workers with turnover exceeding 25%. The second warehouse drew on the same labour force, but paid the entry-level workers several dollars an hour more than their competitor. At this warehouse, managers had few complaints about their workers, and the turnover rate was just 2%. Lafer (2004) uses results such as these to suggest that 'soft' or 'generic' skills are not 'skills' that either one possesses or lacks; they are 'measures of commitment that one chooses to give or withhold based on the conditions of work offered' (p.118).

Beyond what is necessary to make projections on the types of skills required over the next five years, the debate on what constitutes 'generic', 'employability' or 'unobservable' skills will not be entered into here, since a vast body of discussion on issues related to this matter has already been addressed elsewhere overseas and in Australia (see for example, Gibb 2004; Kearns 2001; Dawe 2002; Allen Consulting Group 2004; Callan 2003; Virgona et al. 2003a; Virgona et al. 2003b; Lafer 2004). Moreover, we believe it is important to distinguish between the talents, capacities and abilities that that people bring to jobs from the *skills that jobs require* (Spenner 1990).

Mournier (2001) adopts a novel and interesting approach to the question of what constitutes skill. He argues that any 'skill' is a heterogenous quality of labour, comprised of three dimensions or what he calls 'logics'. Mournier defines a 'logic' as a social force acting in a given direction, it is a result of interaction between social actors, institutions and social value and norms. Mournier (2001, p.34) thus argues that the three logics of skill include the following:

- ✧ Technical skills, related to the exercise of labour power, and determined by equipment and production methods;

- ✧ Behavioural skills, related to the subordination aspects and interpersonal factors in employment relationships;
- ✧ Cognitive skills, related to the level and kind of general education and training undertaken by a population to help it understand and act in the world

Mournier (2001, p.34) goes on to suggest that:

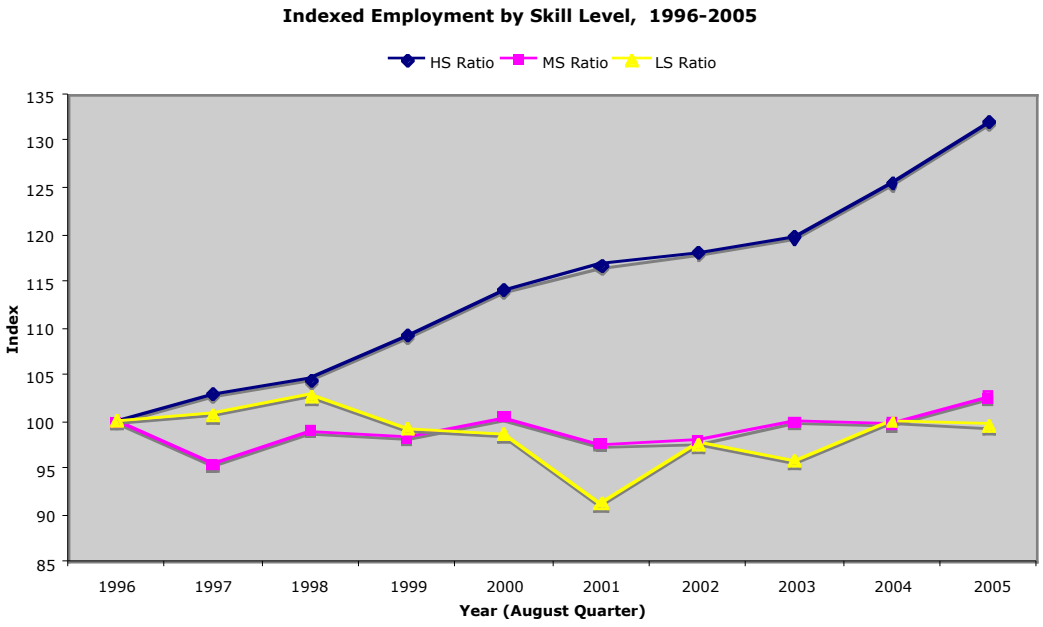
> In searching for a homogenous and substantive definition of skills, most attempts have only looked for one single logic, which has led them to neglect the social process of defining skills and to assume that skills could be compared through time and space … [yet] a given combination of the three logics in defining skills is time and space specific, because those logics are embedded in labour relationships and broader social structures.

Mournier's (2001) conception is interesting since it identifies essential components of 'skill' yet allows for different emphases of each component (or 'logic'). His work is not directly used here, however, the framework used in this report adopts the same philosophy of the heterogeneity of skill, and follows a similar structural conception of skill. We will return to conceptual problems regarding the definition and measurement of skill. Before doing so, however, some discussion on skill sets (however defined or measured) is required.

Impact of global and technological change on skills

In many countries, there has been a reported increased demand for skilled workers and a pronounced shedding of low-skill workers over the last two decades (see for example, Colecchia & Papconstantinou 1996; Autor, Levy & Murnane 2003). As figure 1 shows, Australia is no exception.

Figure 1 Comparison of demand for high, medium and low skilled labour in Australia (full-time workers) 1996–2005



Source: ABS Labour Force Surveys (various)

Figure 1 shows that since 1996, that has been just over a 30% increase in the demand for high-skilled labour, while the demand for middle and low-skilled labour[1] has undergone some shifts but now is more or less at the same level since 1996.

The two main causes to explain the shift in demand towards high-skilled workers are first, the global change associated with rising levels of international trade, and second, skill-biased technological change. The trade hypothesis predicts that increased trade opportunities with developing countries induce a shift away from labour-intensive manufacturing industries in industrialised countries, which lowers the relative demand for unskilled labour. The trade hypothesis thus focuses on structural shifts between industries. By contrast, the emphasis of the skill-biased technology change hypothesis is on changes taking place within industries. It posits that if technological change is biased toward high-skilled workers, their productivity will increase relative to that of other workers. Employers will respond to this by altering their skill mix in favour of high-skilled workers. Under this hypothesis, no between-industry reallocation of labour needs to occur for the economy-wide share of high-skilled workers to increase.

A caveat is in order here. The distinction between trade and technological change effects is analytically convenient, but may not be wholly accurate since the two explanations could plausibly be causally linked. Increased pressure from international competition could cause some producers to adopt more technology intensive production methods within the same industry or in other sector of the economy. On the other hand, technology can stimulate trade (De Laine et al. 2000).

A useful typology using the *combined* effects of globalisation and technological change has been developed by Shah and Burke (2003). Their analysis is based on classifying occupations according to whether they are advantaged by globalisation and technological change or relatively insulated or vulnerable. Globally advantaged occupations include professionals and associate professionals in business related occupations, who have the capacity to interact directly or through corporations with the global knowledge economy. The insulated occupations include many of the 'in-person service' professional occupations but also some skilled and low-skill occupations for which overseas workers or products cannot be readily substituted. The vulnerable occupations include those whose services, or the products they make, are most subject to substitution from abroad or by new technology and include many manufacturing workers and some groups of white collar workers (Shah & Burke 2003, p.iii). Table 1 shows a summary of Shah and Burke's (2003) typology.

Shah and Burke's (2003) research indicates that four out of every five jobs that are generated because of growth in employment are projected to be in the globally advantaged occupations or in the insulated occupations.

While global trade factors are assumed to be of relevance, empirical evidence lends more credence to the impact of technology as determining changes in skill, rather than factors related to global change. Replicating a US study by Wolff (1995), Pappas (1998) has shown that the contribution of trade to changes in skills in Australia between 1976 and 1991 were very small. Studies that have explored the impact of technology on skills, however, reveal a high degree of complementarity between skill and technology (Wolff 1995; Pappas 1998; Kelly & Lewis 2003, 2004). The main argument is that recent technological change, especially the intensification of information and communications technologies (ICT) in the economy, has complemented skilled and highly skilled labour in production. Table 2 shows business use of selected IT items for all businesses between 1994 and 2004. Overall the growth of businesses with ICT usage is dramatic, with a 39% increase in computer use since 1994, and an annual growth rate of 5.8% per annum since 1998. Internet access increased from 29% in 1998 to 74% in 2004, with the largest increase between 1998 and 2000 (27%) at a growth rate of 46.5 per annum.

[1] For purposes here low-skilled labour included all occupations at ASCO Levels 8 and 9, medium-skilled labour was all occupations at ASCO Levels 4 to 7, and high-skilled labour was all other occupations at ASCO level 1 to 3.

Table 1 Shah and Burke's (2003) classification of occupations according to impact of globalisation and technological change

Occupation type	Examples
Globally advantaged occupations	1 Conceptual occupations, eg. Managers, financial dealers, various professional groups such as scientists, media and arts occupations
	2 Technical occupations, such as most technicians and other associate professional occupations
Insulated occupations	1 In-person professionals such as medical practitioners and school teachers
	2 In-person skilled workers such as real estate workers, community service workers and police officers
	3 In-person low-skill workers such as waiters, bus drivers, elementary sales and service workers
Vulnerable occupations	1 Advanced skills such as skilled tradespersons
	2 White-collar clerical such as various clerks, secretarial and word-processing jobs
	3 Blue-collar operative such as machine operators
	4 Manual low skill, including production assemblers and process workers

Source: Shah and Burke (2003)

Information and communication technologies can change the composition of skills in a number of different ways. The direct substitution of easily automated labour-intensive jobs by computer-based technologies will change the composition of skills. Change in skills may also eventuate from the organisational complementarity that exists between computer-based technologies and managerial and professional jobs. ICT allow organisational structures to vary from traditional hierarchical forms; they enable lateral communication and coordination and a degree of increased autonomy, a changed mode of supervision which requires different skills. People skills (or interactive skills) are crucial to this process (Kelly & Lewis 2004).

Table 2 Business use of selected technologies in Australia, 1994–2004, per cent[(a)]

	1994	1998	2000	2001	2002	2003[(b)]	2004
Businesses with computers	49	63	76	84	84	83	85
Business with internet access	na	29	56	69	71	71	74
Businesses with web presence	na	6	16	22	24	23	25

Notes: (a) Proportions are of all businesses
(b) Changed survey frame due to The New Tax System (TNTS), some caution required against making comparisons between 2003 and subsequent estimates.

Source: ABS (2005) cat.no.81290.0

Having looked at the impact of global and technological change on the structure of skill demand, attention will now turn to projections of future skill needs.

Conceptual framework for this report

The problematic nature of projecting *future* demand for skills

To date, published Australian studies of changes in the demand for skills are retrospective studies based on historical data (see for example, the work of Pappas 1998; Cully 1999; Wooden 2000; Kelly & Lewis 2003, 2004). This means that data exist on the key factors, such as industry growth rates and the occupational structures of industries that have contributed to changes in skill demand. This means that analysis can be performed on the relative contribution of such factors to changes in skill demand. The focus of this study, however, is to project the future demand for skill and is thus prospective rather than retrospective.

The main factors that may contribute to changes in skill demand can be identified as: a) changes in the skill composition of occupations; b) changes in the occupational composition of industries; and c) differences in the growth rates of industries. In turn, the factors underlying these changes are a complex set of interactions between market forces (for example, globalisation), technological change, changes in productivity, and changes in the nature of the employment relationship.

While these factors and interactions can be identified, as with any exercise in projection, predicting and forecasting the demand for skills involves making the best use of historical data.

We are generally of the view that forecasts of the nature, extent and outcomes of technological, economic and social developments need to be treated with some caution. As Fine (1999, p.3) neatly articulates:

> The social sciences, at the best of times, are hard put accounting for and explaining the present. Despite the demand for knowledge of the future, respectable academic social scientists have taken a generally conservative approach to the issue of long-term forecasting, qualifying their conclusions as projections rather than predictions or forecasts or have focused on broad, generally abstract generalisations.

We believe it is simply not possible to predict or forecast the multitude of different skills that will be required in the future, and as discussed above the use of proxies for skill such as qualifications, earnings, or nominal occupation as a means of supplying useful projections has inherent limitations. In this study we have adopted a non-traditional approach to the projection of future skill needs. Underlying our approach is the view that the concept of 'skill' is most usefully understood as being 'task-based'. We thus adopt a taxonomic view that skills are composed of qualitatively different classifiable tasks and dimensions, and believe this potentially allows for the formulation of 'skill profiles' for a given occupation and perhaps even industries (depending on the homogeneity of occupational composition).

The first part of our analysis is industry-based. We apply our taxonomy of skill dimensions to occupational clusters against the background of projections of occupational demand due to changes in industry growth rates. This involves the assumption that the skill composition of occupations and the occupational composition of industries remain constant over the period of our projections. We acknowledge these are contestable assumptions; nevertheless we are of the view that projected industry growth provides some clues as to which occupations and associated skill dimensions may be in future demand.

To provide an alternative approach for comparison, we also investigate the demand for skill dimensions based directly on the projected growth rates of a range of VET-related occupations (196 ASCO 4-digit occupations under 20 ASCO 2-digit categories). The growth of a particular occupation will depend on the growth in the share of that occupation within the industries in which it is present and the growth rates of those industries. Thus, changes in the demand for skill dimensions estimated in our taxonomy of skill dimensions will reflect both industry growth rates and changes in the occupational composition of industries (while still assuming that the skill composition of occupations remains constant).

The extent to which the industry and occupation approach projections of future demand for skills differ from one another is an *indication* of the extent to which changes in the demand for skills are driven by changes in the occupational composition of industries rather than industry growth alone. An important caveat here is that since single occupations do exist in multiple industries, the differences between the growth of skills between the two approaches may not necessarily reflect the changes in the demand for skills demand due to changing occupational composition in industries.

Our projections of future skill requirements in this report are based on the use of a number of different sources. For the industry-based approach we have used DEWR (2005) data to determine which industries are likely to experience the most employment growth over the next five years, and within these industries, their occupational composition. We then determined the skill profile of

each occupation in each of the growth industries by allocating scores for the three skill dimensions, as detailed below. For the occupation-based approach we again used DEWR (2005) data. The numbers of persons employed in each 4-digit ASCO (VET intensive) occupations for 2005 were projected to 2011 using five year annualised augmented growth rates. In this case the number of occupations was greater than in the industry-based approach, and additional skill dimension scores were allocated.

The level of uncertainty of our projections is dependent on the accuracy of the DEWR projections of industry and occupation growth, the extent to which the skill composition of occupations change over time, and more critically on the accuracy of our calculated skill dimension scores for each occupation. Subjectivity in the assigning of skill scores was minimised by using ASCO task definitions for each occupation (at the 3 or 4-digit level), and an experienced and trained job analyst conducted the assigning of skill scores. It is noted, however, that in most cases the ASCO task descriptors are brief and this may impact on the accuracy of the scores.

Skill dimension typology

The framework adopted here focuses on the skill attributes required by *jobs* as distinct from personality attributes required from the *individual*, as defined in the US Department of Labour's (USDOL) Dictionary of Occupational Titles (DOT).[2] At the finest level of occupational detail the following descriptions of tasks and their associated score are given. In DOT jobs are classified as requiring workers to function to some degree in relation to data (cognitive skills), people (interactive skills), and things (motor skills). As can be seen from Table 3, the dimensions are similar to the three 'logics' of skill highlighted by Mournier (2003), but differ in the sense that they are potentially measurable. Table 3 below outlines the tasks and scale for each skill dimension in descending order of complexity.

Table 3 Scale of complexity for skill categories

Cognitive skills ('data')	Interactive skills ('people')	Motor skills ('things')
0 Synthesising	0 Mentoring	0 Setting up
1 Coordinating	1 Negotiating	1 Precision working
2 Analysing	2 Instructing	2 Operating – controlling
3 Compiling	3 Supervising	3 Driving – operating
4 Computing	4 Diverting	4 Manipulating
5 Copying	5 Persuading	5 Tending
6 Comparing	6 Speaking – signalling	6 Feeding
	7 Serving	7 Handling
	8 Taking Instructions – helping	

Tasks involving more complex judgement and responsibility are given lower numbers for each category, and the less complicated have higher numbers. For example, for people who handle data, 'analysing' is considered a more complex task than 'computing'. The same applies to tasks in the 'things' category. 'Precision working' involves greater complexity than 'tending'. A complete list of definitions of the workers' functions against the scale provided in Table 1 can be found at <http://www.oalj.dol.gov/public/dot/refrnc/dotappb.htm> (USDOL 2000).

[2] The Dictionary of Occupational Titles (DOT) dates back to the 1930s and was last published in 1991. It was developed in an industrial economy during an era that focused on 'blue-collar' occupations. It has been argued that its utility has been reduced with the increased emphasis on service-based and knowledge-based economies. In recent times the 'O-NET' has been developed (on the foundations of DOT), providing detailed information in approximately 1120 occupations and is periodically updated to reflect the changing nature of employment. At the time of preparing this study, the authors were unaware of the O-NET, hence it has not been used in this study.

By way of example, the distinction between analysing and compiling in the 'Data' column in Table 3 according to the DOT scheme, is as follows:

- ✧ Synthesising (level 1 skills) is the integrating analyses of data to discover facts and/or develop knowledge concepts or interpretations, whereas
- ✧ Compiling (level 3 skills) involves the gathering, collating, or classifying information about data, people, or things. Reporting and/or carrying out a prescribed action in relation to the information is frequently involved.

(USDOL 2000)

Similarly, the distinction between negotiating and persuading in the 'People' column in Table 3 according to the DOT scheme, is as follows:

- ✧ Negotiating (level 1 skills) is the exchanging of ideas, information, and opinions with others to formulate policies and programs and/or arrive jointly at decisions, conclusions, or solutions, whereas
- ✧ Persuading ((level 5 skills) is the influencing of others in favour of a product, service, or point of view.

(USDOL 2000)

It should be noted that the scales relate to an ordering of the complexity of tasks typically undertaken in an occupation, but do not indicate the intensity of use of those skills.

Spenner (1990, p.402) lends some support to this organising scheme, while at the same time highlighting an area not pursued in this study:

> The thrust of empirical research suggests at least two dimensions of job skills: substantive complexity and autonomy control. Substantive complexity refers to the level, scope, and integration of mental, manipulative, and interpersonal tasks in a job. The subdimensions of mental, interpersonal and manipulative refer to the classic functional foci of 'data, people, and things' as dimensions of interface between a person and a task. *The level, scope and integration of these substantive dimensions capture important empirical variations in the chemistry of the dimensions as they are found in jobs.* (italics added)

By using the DOT worker functions framework in this study, we have focused on the substantive complexity of jobs but have not included any analysis of autonomy control. Autonomy control refers to the discretion available in a job to control the manner (content and speed) in which tasks are executed. The extent to which autonomy control can be considered a dimension of skill is arguable. It depends on a range of complex mitigating factors associated with the nature of the employment relationship and the structure of power relations within contemporary capitalism. For the purpose of this study and in keeping with Form (1987), we are of the view that autonomy control is not a dimension of skill, rather it is a function of the broader contextual and hierarchical dimension of jobs.

Returning to the DOT, we note that it is not without its critics. Spenner (1990) outlines the following points of caution when using the DOT as a source of occupational data:

1. The DOT is not a probability sample of jobs in the (US) economy, and in general, manufacturing jobs are oversampled compared to professional, clerical and service jobs;
2. Use of the DOT variables at the level of occupations involves a degree of aggregation over person-instances of the job, for example, across companies, jobs within an occupation and so on. There is thus some measurement error in the DOT variables to the extent that they fail to capture these contexts and are relevant to the problem under study;
3. Estimates of (interrater) reliability for the DOT worker function variables of 'data' (cognitive skills) and 'people' (interactive skills) are generally acceptable (.63 to .70), however the ratings for levels of involvement with 'things' (motor skills) are below acceptable social science standards.

4 Questions have been raised as to the validity of the DOT constructs, particularly in relation to gender bias. While some studies argue that aspects of the DOT are lacking in validity (see for example, Miller et al. 1980), other studies lend confidence to the use of the DOT variables (Karasek 1979; Spenner 1980).

We do not see Point 1 above as posing a serious problem for the purposes of this study. While service sector occupations have grown, the occupation group of 'professionals' forms only a small proportion of VET-related occupations. The measurement error described in Point 2 above is difficult to escape, and we would argue that some degree of measurement error will always be in place for a concept as layered and complex as skill. Point 3 above is likely to be related to uneven technological change, and poor reliability for this variable can be understood against the background of uneven technological advancement, implementation and distribution. Point 4 above does not relate to work functions as presented here and is not problematic for purposes of this study. Hence, despite the caveats associated with the DOT, we believe the focus on the 'worker functions' component of the DOT has distinct advantages for our study of future skill demand and the implications for VET. The DOT provides a comprehensive, direct measure expert system, one that is broad in scope, yet parsimonious.

The division of skills into the dimensions of cognitive, interactive and motor skills forms the framework for the remainder of the paper. In the next section, projections of future skill requirements are made, using the skill dimension typology as a means of constructing a future skills profile.

Industry and occupation approaches to projecting future skill needs

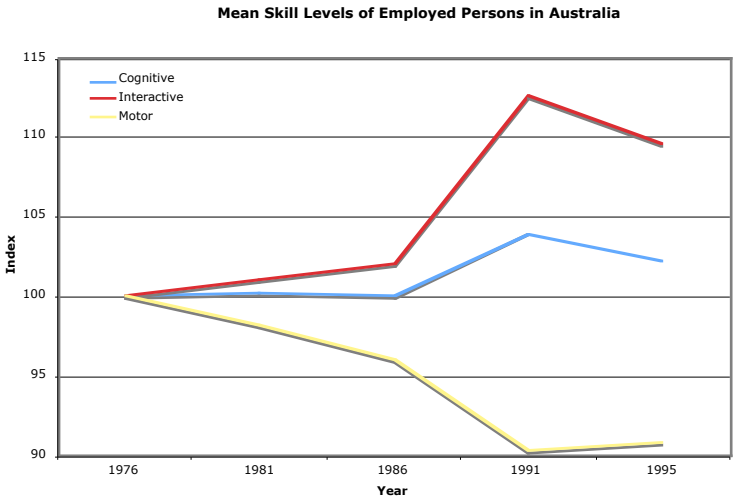
Industry approach

This section develops our 'industry approach' to projecting skill demand based on the skill dimensions approach discussed above. The projections are based on forecasts of industry employment growth produced by the Department of Employment and Workplace Relations (DEWR 2005). Before exploring our projections, it is useful to look at relevant research which may place our study in context.

Historical view

Pappas (1998) mapped skills trends over time from 1975 to 1995. His findings are revealed in Figure 2 and are included here since they potentially provide a useful context for the findings in this study. From Figure 2 we can see an accelerated growth in the use of cognitive and interactive skills since the mid-1980s, and a marked decline in the use motor skills.

Figure 2 Mean skill levels of employed persons in Australia 1976–1995



Source: Pappas (1998)

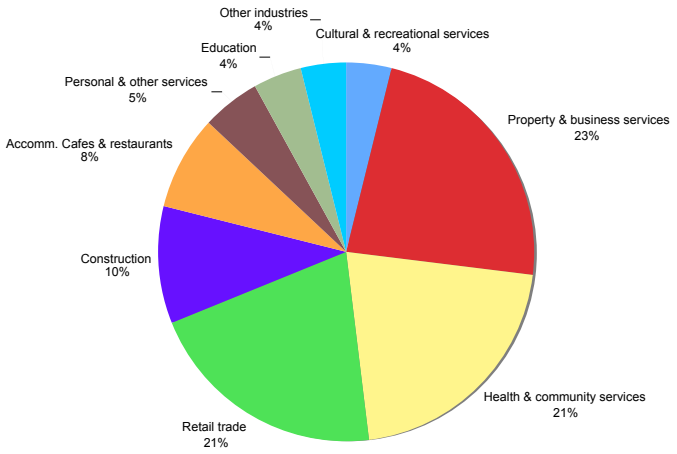
The changed grading structure of occupations since 1996 in the second edition of the Australian Standard Classification of Occupation poses a significant obstacle to extending the work of Pappas (1998) both to the current time and for the purpose of projections. Nevertheless, the trend profile revealed in Figure 2 gives us some idea of changes in skill dimensions and their likely trajectory.

Projections of employment growth

The industry approach to projecting the demand for skills focuses on the DEWR publication *Australian jobs 2005*, that is, top ten occupations (by numbers employed) in the top ten industries (by projected employment growth).

Figure 3 below shows DEWR's projected share of relative employment growth for all industries to 2009–10.

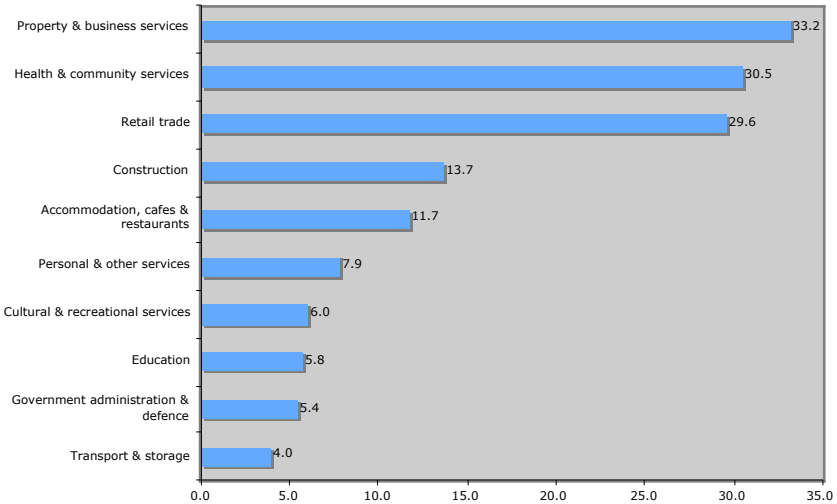
Figure 3 Projected employment growth to 2010 (industry % share)



Source: DEWR (2005)

Figure 3 portrays the share of industry growth. Both share and absolute analyses are important for the concept of industry growth rate. According to the DEWR forecasts (DEWR 2005), five industries are expected to provide more than 80% of Australia's new jobs over the next five years (see Figure 4). Property and business services and health and community services are expected to experience the largest jobs growth. These industries are expected to increase their employment by 2.7% and 2.8% per annum respectively. This means that, on average, more than 30 000 new jobs will be created in each of these industries every year for the next five years. Large numbers of new jobs are also expected to be created in retail trade with 1.9% growth per annum or almost 30 000 jobs per year till 2009–10, followed by construction with nearly 14 000 new jobs per year, and accommodation, cafés and restaurants with nearly 12 000 new jobs over the next five years. The occupations in these employment growth industries bear a strong resemblance to the globally advantaged and insulated occupations identified by Shah and Burke's (2003).

Figure 4 Projected employment growth to 2010 top 10 industries ('000 per annum)



Source: DEWR (2005)

Property and business services for example is expected to create around 166 000 new jobs over the next five years. This is a diverse industry providing real estate, business and legal services, scientific research and machinery and equipment leasing. Consequently, it employs a range of skill levels and types, but most of the occupations do fall into the globally advantaged or insulated categories in Shah and Burke's (2003) typology. Likewise, health and community services, currently the fourth largest employer of Australians is expecting strong employment growth. It is a high-skilled industry and again occupations within it fall into the globally advantaged and insulated categories. Similarly, employment growth in retail, construction, and accommodation, cafés and restaurants support the occupational employment growth projections made by Shah and Burke (2003).

Having identified the industries in which the main employment growth is expected to occur, attention will now turn to an examination of the future skills required in occupations within those five high growth industries.

Methodology: Projecting skills, the industry approach

Choosing industries and occupations

The industry approach uses projected industry-level growth rates in employment in the five industries that DEWR projects to have the highest employment growth from February 2005 to 2010. These industries are:

1 Property and business services
2 Health and community services
3 Retail trade
4 Construction
5 Accommodation, cafés and restaurants.

In addition, industries 1, 2, 3 and 5 were each further disaggregated into two sub-groupings of occupations in order to achieve relatively homogenous skill dimension scores within each group see Appendix 2 in the support document). DEWR provides numbers of persons employed for each industry. For the purposes of this study some occupations, mainly managerial in character, were removed because these are not VET-trained occupations. The list of included occupations is provided in Appendix 2, classified by industry. Each occupation name is followed by its ASCO 1-digit classification and occupations are allocated into an industry grouping (with either a '1' or '2' suffix if necessary) on the basis of this value.

Assigning skill dimension scores

The next step in the method was to apply skill dimension scores to each occupation. Again a full listing is provided in Appendix 2 in the support document. The measures of skill used in this study were constructed using data and information from Australian occupational task descriptions contained in the Australian Standard Classification of Occupations (2nd edition) (ASCO), industry employment share matrices and the scale of skill complexity developed by the USDOL for the three skill dimensions (cognitive, interactive, and motor skills) outlined earlier in this report. The methodology broadly resembles that used by Pappas (1998) and Kelly and Lewis (2004). In order to derive the occupational skill scores, the measures presented in Table 3 were inverted, that is, the least complex tasks were given the lowest score. Following this, all scores were converted to a common scale of 0 to 10.[3] To derive the scores used for occupations, the ASCO task descriptions for the top ten occupations in each growth industry were examined and a score assigned for each

[3] Where the common scale = 10 –(new range/old range)*new score). This keeps the order and relative distance intact and inverts the scale, such that higher levels of skill correspond with higher numerical values. Sensitivity tests on this scaling method undertaken in previous studies (see for example, Kelly & Lewis 2004) have shown no negative effects of extending the range of the scale in this way.

skill dimension. The basis for assigning a score to an occupation was to determine and assess the most complex task undertaken in that occupation for each skill dimension. The skill scores derived in this way are provided in Appendix 1 in the support document.

In order to check the validity of the skill scores allocated in this study, a sample of occupations were selected and were checked against the scores contained in the Dictionary of Occupational Titles (DOT) (refer to Appendix 4 in the support document).

Calculating industry and aggregate weighted average skill dimension scores

With the skill dimension scores for each occupation assigned, the next step is to calculate weighted averages of skill dimensions for each industry. These are calculated from the skill dimension scores for each occupation and weighting these by the numbers of employed persons in each occupational category for 2005. The aggregate skill dimension scores are the weighted average of the industry weighted averages. Again, these are given in Appendix 2.

Projecting the skill dimensions

To calculate the skill dimension scores for 2011 the numbers of employed persons in each occupation were projected using a straight line trend, with the annual growth rate being the projected rate from DEWR of employment growth for each industry. This means that the weighted average of skill dimension scores for 2010 are equal to those for 2010 because the growth rates applied to each occupation are the same (that is, the industry-level project employment growth rate). On the basis of the projected numbers of employed persons in each occupational category the aggregate skill dimension scores for 2010 are calculated using the method described above, except using the 2010 number of persons employment as the weights.

The percentage changes indicate that the demand for interactive skills is likely to increase, the demand for cognitive skills to remain relatively constant, and the demand for motor skills is likely to fall.

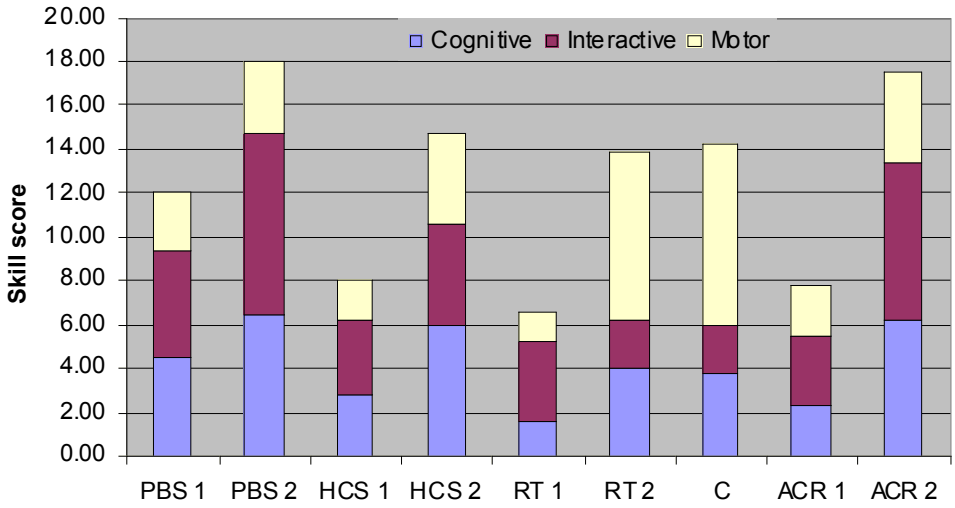
Table 4 Industry skill dimension estimates, aggregate (weighted average) skill dimensions scores and percentage change

	Cognitive	Interactive	Motor
Property and Business Services 1	4.57	4.82	2.66
Property and Business Services 2	6.47	8.30	3.23
Health and Community Services 1	2.86	3.32	1.84
Health and Community Services 2	5.93	4.74	4.10
Retail Trade 1	1.53	3.74	1.22
Retail Trade 2	3.99	2.22	7.69
Construction	3.74	2.26	8.16
Accommodation, Cafés and Restaurants 1	2.30	3.22	2.28
Accommodation, Cafés and Restaurants 2	6.26	7.10	4.13
All industries above			
Weighted average 2005	3.13	3.88	3.30
Weighted average 2010	3.14	3.90	3.28
Percentage change 2005–2010	0.46	0.42	-0.41

In Figure 5, the skill dimension scores for each industry grouping are illustrated. It is clear from this figure that there are differences in the skill dimension profiles of the industry and sub-industry groupings. For example, 'Construction' has a relatively low level of interactive skills compared to other groupings (with the exception of 'Retail Trade 2', which consists of trades workers within retail). The figure also illustrates the variation within industry groupings of the total skill levels. Where industries have been divided into 1' and '2' sub-groupings the differences in skill profiles are clear.

Figure 5 Industry approach, aggregate skill dimension profiles, 2005

PBS 1	PROPERTY AND BUSINESS SERVICES 1
PBS 2	PROPERTY AND BUSINESS SERVICES 2
HCS 1	HEALTH AND COMMUNITY SERVICES 1
HCS 2	HEALTH AND COMMUNITY SERVICES 2
RT 1	RETAIL TRADE 1
RT 2	RETAIL TRADE 2
C	CONSTRUCTION 1
ACR 1	ACCOMMODATION, CAFÉS AND RESTAURANTS 1
ACR 2	ACCOMMODATION, CAFÉS AND RESTAURANTS 2



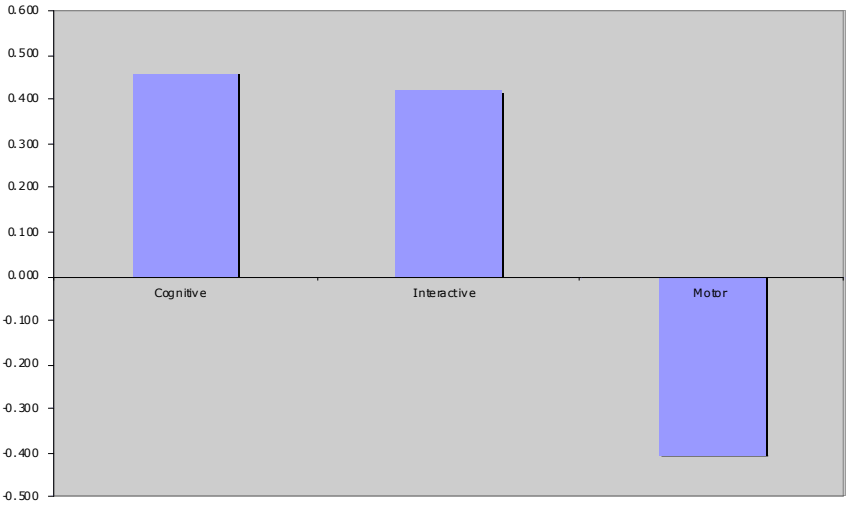
The fastest employment growth industry is property and business services. Our grouping, 'Property and Business Services 2' is made up of 'Accountants' and 'Real Estate Agents'. These occupations have high interactive skill scores and are driving the growth of the interactive component of the aggregate skill score for this industry.

Similarly, occupations in 'Health and Community Services 2' have a high cognitive skill component. This, together with the high growth of this industry is driving the projected increase in demand for cognitive skill in the aggregates for all industries.

Projection of future skills: Findings

Figure 6 below shows the percentage change in projected skills from 2005 to 2011. Overall, growth in interactive and cognitive skills is projected to dominate the change in demand for motor skills in the next six years. The profile shown below is not dissimilar to that provided by Pappas for the later years of his time series.

Figure 6 Projected change in demand for skill dimensions 2005 to 2010



Structural factors are likely to underpin the profile evident in Figure 6, particularly the fall in demand for motor skills. Service sector work dominates the economy and working in the service sector demands very different skills from those required in manufacturing. But such structural explanations veil the subtle dynamics underlying such shifts. It is likely that the dynamics underlying the profile in Figure 6 are the same as those identified by Pappas (1998) and by Kelly and Lewis (2004). Pappas found that changes in cognitive and interactive skill were strongly positively correlated to various indicators of technological change, suggesting that these skills complement new technology. He also found that change in motor skills is positively correlated to a general indicator of technological change, but negatively correlated with computerisation, suggesting that, while motor skills complement some technology, information technology reduces the demand for such skill. It is worth noting that Pappas (1998) drew these conclusions before the dramatic uptake of ICT revealed in table 2; hence, his findings take on a new and added significance. A recent study by Kelly and Lewis (2004) sheds more light on the importance of technology in reshaping skill requirements, finding that the sophistication and nature of IT has enabled it to replace skills that were once considered relatively skilled.

Moreover, their findings suggest that it is only some of the more creative and interpersonal characteristics required in the workplace that will be immune to automation. For many tasks, there will be a trade-off between the level of interaction that consumers desire and the efficiency with which tasks can be undertaken. Kelly and Lewis (2004, p.147) use the example of bank tellers to explain why the roles of some occupations are being transformed. Bank tellers have been removed from the role as information processor and have been transformed into sales oriented and customer assistance roles where the value added is higher.

Occupation approach to projecting future skill needs

In this section we project how the composition of the demand for skills in the workforce will change to 2011 using the 'Occupation Approach'. Skill scores of occupations were determined using the same technique as described earlier in this paper.

Data sources and method

Data on the absolute numbers of persons within each occupation at the ASCO 4-digit and 2-digit level were provided by DEWR (2005). A decision was made to excise certain VET-intensive occupations and further analysis was performed only on these. These 20 occupational classifications at the 2-digit level were selected to correspond with Tan and Richardson (2007).

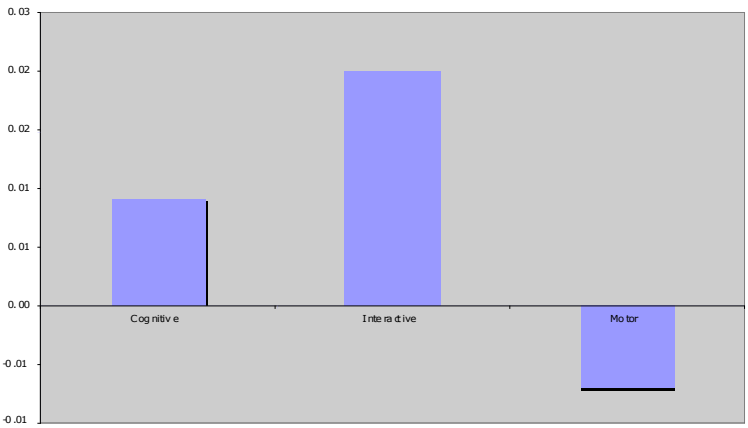
For each 4-digit occupation within those selected 2-digit classifications, a score was allocated for each of the three skill dimensions (cognitive, interactive and motor). These scores were then weighted using the number of persons within that 4-digit occupation to produce a weighted score at the 2-digit occupation level for the three (cognitive, interactive, motor) skills (refer to Appendix 3 for complete results). Once the weighted average for all 2-digit occupations had been calculated, a weighted average of these was constructed to derive a total score for the cognitive, interactive, motor skills in the baseline year.

Given that the number of people within an occupation is used as the weighting for cognitive, interactive and motor skills scores, determining the changing composition of the skill mix requires projections of the changes in worker numbers for each occupation. Projections were obtained from DEWR that incorporated a host of relevant factors in determining a five-year annualised growth rate by occupation. These projections are based on data provided by the Centre of Policy Studies (CoPS) at Monash University and augmented with input from various sources (see Appendix 3 for a listing of these sources). These growth rates from DEWR were then applied to the numbers of

workers in each 4-digit occupation at the last recorded date (May 2006), which produced the weights for the five-year projections. The weighted averages were automatically regenerated and recorded to produce a table of projected cognitive, interactive, motor skills scores.

Figure 7 shows the projected percentage change in skill mix for 2011. The percentage of expected change in interactive skills is projected to be the greatest, followed by cognitive skills with a decline projected for motor skills.

Figure 7 Skill profile by occupation to 2011

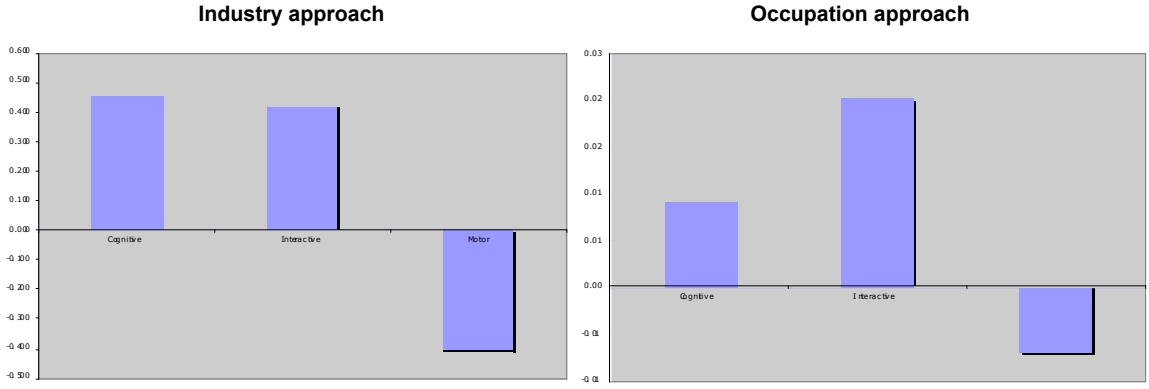


Comparison of industry and occupation approaches

For the aggregate (weighted average) skill dimension scores, both the industry approach and the occupation approach yield similar results, that is, the demand for interactive and cognitive skills will grow and the demand for motor skills is likely to decline. Since, under both methods, the growth in demand for interactive and cognitive skills is greater than the decline in motor skills, there is a demand for an overall increase in skill levels. The validity of comparisons beyond these is limited by the fact that the analyses are based on different samples and used different methods. It is also important to emphasise that the changes in skill demand analysed in this paper are those due to projected industry and occupational growth rates and an underlying assumption is that the skill composition of occupations does not change.

Clearly, the occupation approach projects that demand for interactive skills grows significantly faster than cognitive skills, whereas the industry approach projected that demand for interactive and cognitive skills would grow at about the same rate. As discussed earlier, the extent to which the industry and occupation approach projections of future demand for skills differ from each other is an *indication* of the extent to which changes in the demand for skills are driven by changes in the occupational composition of industries rather than industry growth alone. An important caveat here is that, since single occupations do exist in multiple industries, the differences between the growth of skills in the two approaches may not necessarily reflect the changes in the demand for skills demand due to changing occupational composition in industries. Keeping in mind this caveat, our projections suggest that the occupational structure of industries is changing in favour of occupations that are interactive-skill intensive.

Figure 8 Projected aggregate (weighted average) percentage change in skill dimensions, 2005–2011, industry approach and occupation approach



Future skill needs: Employers' views

Employers representative of three of the five growth industries, as well as a senior executive in a major national recruitment firm, were interviewed for this study. Questions were asked related to projected employment growth and occupation growth trends, reasons behind any stated trends, and future skill requirements. Each interviewee was briefed as to what constituted interactive, cognitive and motor skills in the context of this study, and each was asked to comment on the perceived relative importance of each skill dimension for their industry over the next decade.

In each case, our projections for employment growth (based on DEWR 2005) were seen to be as accurate as most other estimates available to the employers interviewed. Importantly, all interviewees indicated that interactive skills were the most valued and desired skills for the future. Cognitive skills were also seen as highly important and, in keeping with the projected skill profile for 2010, motor skills were perceived as necessary in certain occupations but overall of declining importance relative to the interactive and cognitive skill dimensions.

A point of interest was that all interviewees indicated some level of frustration that interactive skills were not formally recognised as being of equal worth as cognitive or motor skills. The resistance to acknowledging the validity of interactive skills was neatly put by an interviewee[4] representing the hospitality industry (part of the accommodation, cafés and restaurants grouping), who commented that 'we are really keen to get waiters acknowledged as having skills akin to a trade, but they're just not seen to be the same level as a trade level occupation'. Employers representing hospitality and retail industries were particularly adamant about the fundamental importance of interactive skill in their industries. The hospitality representative argued strongly that, while waiters (for example) may appear to be simply fetching and serving food or drinks, the reality of quality customer service means that skills of persuasion (rated somewhat higher than 'serving' on the list of interactive tasks, refer to Appendix 1), however subtle, are involved. The employer went on to argue that while some aspects of customer service and orientation may have as their outcome ongoing customer loyalty or brand loyalty, the ultimate *bottom-line* aim of customer interaction was effective persuasion resulting in a financial gain for the company or employer. This capability of persuasive activity, he argued, involved a higher level of skill than was given credence.

This same employer representative went on to argue that there was an intrinsic bias against the hospitality and service sector skill set for some occupations, and that this was due to trades being traditionally and historically seen as blue collar, masculine, 'dirty' work. It appears that the traditional social construction of 'skill' as activity that is viewable and tangible, may preclude skills that are more covert and intangible such as that found in the service sector. This point will be taken up again in the final section of this report.

Other main issues emerging from the interviews related to the impact of both technological and social change. Each of these is dealt with in turn.

[4] Mr Bill Healey, Secretary, Australian Hotels Association.

Technological change and skills: Employer views

The underlying dynamic of substitution by technology for replicable skills emerged as a familiar theme. For example, it was suggested that the increasing uptake of personal digital assistants (PDAs) and associated time-management software may lead to reduced or at least static numbers of secretaries and personal assistants. Additionally, the view was expressed that direct dialling facilities are replacing the traditional receptionist role, especially where intense productivity and efficiency gains are being sought.

In other cases, however, technology was not substituting replicable skills, rather it was observed to bring about an enlarged skill set. One employer commented on the case of the electrical trades and applied technologies associated with the 'smart house' concept. With the advent of 'smart houses' (the timed operation of appliances and security systems or remote operation of such systems in the household), electricians are increasingly being required to learn a variety of applied technologies, rather than engage in traditional 'wire jerker' trade skills. Interestingly, one employer commented that it was the social changes underlying the introduction of smart house technologies that have led to the changed skill set. For example, a general 'climate of fear' leading to personal security concerns, as well as a raised awareness of scarce resources such as power and water were considered by one employer to have led to the design and uptake of smart house technologies and the change in focus for a growing number of electricians in construction to learn advanced applied technologies. According to one of the employers interviewed, the applied technologies require greater cognitive skills, and the direct interface in the use of applied technologies (such as smart house technologies) with the customer means that interactive skills assume more importance. Whereas motor skills would have traditionally been a dominant part of the electrical trades skill set, the skill set is now constantly changing, with the comment made that 'the ability to gain a skill set, and then shed that as and when is necessary so as to learn a new skill set is a crucial part of being in the electrical trades'.[5] Underpinning this shifting and broadening of the skill set was the general move to wireless technologies.

The effect of technology and its impact on skills is being felt also in retail industries. New technology introduced to enhance supply chain responsiveness is leading some supermarket employers to re-think the skills required in their distribution centres and on the supermarket floor. Consumer preference for high-quality fresh food produce has led to a 'farm to fridge'[6] concept. The implications for skill in the supermarket industry in the retail sector are two-fold. First, there will be an increased need to up-skill employees in distribution centres in the relevant supply chain technology. This 'migration' of skills (from old to new) is currently taking place, and clearly shifts the skill set for this group of employees away from motor skills into a more cognitive and interactive domain. Second, the 'farm to fridge' concept means that the product is offloaded at the point of consumer purchase, meaning that staff once employed to shift stock from the back of stores or from a storeroom are now expected to seize opportunities to have more of a customer focus and heightened interaction with customers. Where traditionally there were two types of workers in supermarkets, 'stockers' on the one hand and customer-focused employees on the other, it is now increasingly expected that all employees engage in customer interaction. The shift toward interactive skills is again apparent.

Social change and skills: Employer views

It was mentioned above that social change associated with security concerns and scarce resources indirectly impacted on skills via the introduction of relevant technology. The recruitment firm

[5] Mr Peter Glynn, Chief Executive Officer, National Electrical and Communication Association

[6] Ms Mary Leighton, Organisational Capability Manager, Coles-Myer Institute.

representative we interviewed[7] highlighted how social change can lead to increased demand for some occupations, and more to the point, can lead to a changed skill set within occupations. He predicted a heightened demand for legal professionals as Australia increasingly adopts US litigation models, and also suggested that the current industrial relations reforms will lead to increased demand for legal consultation (at least in the mid-term). The point was also made that social and legislative changes resulting from the Enron, Arthur Anderson, and Worldcom scandals are impacting on the types of skills required. For example, there is considerable demand for accountants and financial controllers to bring their auditing skills in line to comply with the *Sarbanes-Oxley Act, 2002*.[8] The Act essentially means that accountants and financial controllers adopt regular stringent reporting procedures (in the form of monthly declarations). This requires not just sophisticated cognitive skills, but involves a significantly enhanced focus on interactive skills, since it is the provision of clear and detailed communication that underpins the *Sarbanes-Oxley Act*.

Employer perceptions of public VET

Employers were also asked general questions related to VET, mainly surrounding the usefulness of the VET system as it currently stands, and how it may respond to the future skill needs in each of the five different growth industries. All employers acknowledged the difficulty for the VET system in trying to cater to the diverse needs of different industry groups and resultant different skill sets. Nevertheless, the employers generally indicated a level of dissatisfaction with the VET system as it currently stands. A unanimous criticism essentially revolved around the inability of VET to be flexible and responsive to the needs of industry, especially as those needs change over time. Moreover, there was a perception that, in some cases, there was an actual mismatch between the training provided by VET and the skills that were required on the job. In other cases, employers commented that, while some of the training provided was useful, other training components within a package were not. They suggested an enhanced role for employers whereby they provide some input into VET curriculum design. This closer partnership role was considered to be more likely to lead to accurate skills identification and delivery of appropriate training. One of the employers interviewed for this study suggested that more electives or 'modules' would be a more effective means to match industry-training requirements with VET offerings.

[7] Mr Phil Morton, SA General Manager, Hudson (Global Resources & Human Capital Solutions)

[8] The *Sarbanes-Oxley Act 2002* involves significant changes to securities laws for all US listed organisations. The Act was passed in large part to protect investors by improving the accuracy and reliability of corporate disclosures made pursuant to the securities laws. One of the most significant provisions within Sarbanes-Oxley are the criminal and civil penalties that place executive management and the board of directors in the 'hot seat'. Specifically, under Section 404 of the *Sarbanes-Oxley Act*, executives need to certify and demonstrate that: 1) files containing accounting information have not been compromised; and 2) all significant technical controls, including security authorisations and critical configuration files have not been compromised. The Act thus has clear implications for the skill set of accountant and financial controllers.

Conclusion

The main aim of this report was to determine the types of skills that will be needed to 2011. We explored how global and technological change have impacted on the structure of desired skills, and then projected skill demand across certain employment growth industries and occupations. In addition to quantitative analyses, this study involved consultation with employer groups and a large national recruitment firm to determine what they see as the key future skills required, and what can and cannot be expected from the public vocational education system.

It was noted that definitions of skill have changed in recent times and are likely to continue to change as work and the employment relationship continue to be restructured. This report differs from most other investigations into changing skill requirements. The majority of studies into changing skill requirements have been retrospective, whereas this study is prospective. Additionally, rather than focus on proxies of skill such as 'qualification' or 'occupation', a task-oriented approach was adopted. This involved applying a framework derived from the US Department of Labour's (USDOL) Dictionary of Occupational Titles (DOT) to various occupations within five identified employment growth industries. This framework involved analysing occupations using the classification of skills according to the dimensions of cognitive, interactive and motor skills.

Previous research conducted in Australia in the 1990s showed that interactive skills and cognitive skills had taken precedence over motor skills (Pappas 1998), a finding that resembled the results of studies conducted in the United States (Wolff 1995). The aggregate emphasis on interactive and cognitive skills was also found to hold true in this study. It was found across the five main employment growth industries and well as through an analysis of occupational growth, that interactive and cognitive skills will be in high demand in the years to 2011.

There are significant variations in the relative importance of particular skill components for occupations in the high-growth industries in this study and in the aggregate (weighted average) of skill dimension scores between industries. For the aggregate weighted average skill dimension scores, both the industry approach and the occupation approach yielded similar results, that is, the demand for interactive and cognitive skills will increase, whereas the demand for motor skills is projected to decline. It is important to emphasise that the changes in skill demand analysed in this paper are those due to projected industry and occupational growth rates and an underlying assumption is that the skill composition of occupations does not change.

Given that our analysis indicates interactive and cognitive skills will increasingly be in demand, it is likely that the interactive and cognitive skill components of many, if not the majority, of occupations will grow due to this 'market pull' effect.

The increased demand for cognitive and interactive skills is likely to be associated with the interaction of global change and accompanying rising levels of international trade, as well as skill-biased technological change. For example, the increased demand for cognitive skills may reflect the rising complexity in jobs driven by increased technological complexity and higher levels of consumer choice. Increased demand for interactive skills is likely to reflect an increasingly networked economy and a heightened focus on the knowledge supply chain. The future success of workers in occupations that have traditionally been characterised by a low interactive skill requirement will increasingly depend on their proficiency with functions within the interactive skill set.

This result, based on our quantitative analysis, was mirrored in the qualitative input from industry interviews. For example, one interviewee expressed frustration that interactive skills were not formally recognised as having equal worth with cognitive and motor skills. Employers in the hospitality sector, for example, saw a clear link between the quality of their employees' interactive skills and the success of their businesses.

An example that clearly illustrates this skills shift in the trades is the changing role of electricians. Traditionally, an electrician was relatively narrowly focused on straightforward technical and motor tasks. Increasingly, they are required to inform, educate and negotiate with customers and suppliers, and deal with the rising complexity of domestic and industrial electrical and electronic technologies, including programmable logic controllers (PLCs), home security systems and home computer networks. This requires a different skill set, one more closely aligned with interactive worker functions.

Going back to the notion of a projected *aggregate* skills profile, employer interviews in combination with our quantitative findings indicate that interactive and cognitive skills will be the skill dimensions in highest demand over the coming decade. This is not to downplay the requirement for motor skills for which there are still obvious requirements. But it is clear that the changing nature of the workplace in terms of technological and social changes has led to an increased emphasis on interactive and cognitive skills.

The implications for VET are that curriculum design needs to incorporate consideration of the worker functions contained within the interactive and cognitive skill sets. For example, training in the hospitality sectors needs to emphasise the specific interactive skills required in particular jobs. This goes beyond simple customer focus training characterised by scripted interaction, to a more in-depth treatment of higher level interactive skills such as persuasion and negotiation. This notion of 'ascending the skill hierarchy' is an important aspect of skill deepening.

This type of 'targeted curriculum' approach would need to incorporate an appropriate examination of each level of qualification, since each of the skill dimensions is likely to hold varying significance at different levels of study.

Employers interviewed in this study also commented that VET needed to be more flexible and responsive to the needs of industry. Employers commented that more consultation with industry would improve VET offerings and ensure that VET kept pace with the changing needs of industry. The results of the quantitative analysis in this study show that these types of industry statements are more than simple catch phrases – industry needs *are* changing and appropriate responses are needed

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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 *Future skill needs: Projections and employers' views—Support document*. It can be accessed from NCVER's website <http://ncver.edu.au/publications/2004.html>. It contains data on skill dimensions and Dictionary of Occupation Titles scores.

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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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