The future demand for employability skills and the implications for the VET system

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Abstract

An important function of the VET system is to equip the workforce with a mix of skills appropriate to the economic conditions required into the future. To that extent, the identification of desirable changes to the existing system, and any associated stresses and tensions, requires both an articulated view about the future of the economy and a methodology for translating that view into the skill categories addressed by the system. In recent years, there has been considerable interest in the role which 'employability' or generic skills play in meeting future skill requirements. However, these discussions typically fail to relate skill requirements to any detailed view of the future industrial and occupational structure of the economy. It is this deficiency the current paper addresses. In 1998, the US Department of Labor introduced the Occupational Information Network (O*NET), a comprehensive database linking worker attributes (or employability skills) with occupations in both qualitative and quantitative terms. For more than a decade, the Centre of Policy Studies at Monash University has been producing occupational employment forecasts consistent with, inter alia, the current macroeconomic forecasts of Access Economics. In this paper, the O*NET is used to extend the range of the Monash forecasts to include employability skills. The results suggest that the structural details of the future state of the economy do indeed have important implications for the relative demands for various types of employability skills, and that general qualitative considerations provide only an incomplete basis for allocating training resources between those skills.

1. Introduction

In recent years there has been considerable interest in employability skills, both in Australia and overseas. In 2001, the Australian Chamber of Commerce and Industry and the Business Council of Australia undertook a major research project designed to provide the Department of Education, Science and Training (DEST) with a detailed understanding of the employability skills needs of industry. The research was published by the Commonwealth of Australia in 2002 as the report *Employability Skills for the Future*.

In the report, employability skills are defined as 'skills required not only to gain employment, but also to progress within an enterprise to achieve one's potential and contribute successfully to enterprise strategic directions' (DEST, 2002, p. 3). The report also identifies an Employability Skills Framework which incorporates eight key skill groupings: communication skills, team work skills, problem-solving skills, initiative and enterprise skills, planning and organising skills, self-management skills, learning skills and technology skills. A striking feature of the report is its implicit contention that the employability skills required for the future can be determined in the absence of any detailed view of the industrial and occupational structure of the economy. Thus, the report argues that employability skills should equip the workforce

to meet the 'challenges facing Australian industry', especially insofar as those challenges have to do with 'globalisation and the knowledge economy', but no specific connections are made. Further, 'the required technical and job-specific skills, being subject to ongoing change, are not readily predictable. What is important, therefore, is the capacity to continually adapt and upgrade with the application of core or generic employability skills that can be transferred across different setting' (DEST, 2002, p. 11).

The idea seems to be that the VET system should provide workers with a set of generic skills which will enable them to move from one job to another as the need arises. But suppose that 'technical and job-specific skills' can be associated with the occupations of the Australian Standard Classification of Occupations (ASCO). While all eight skills in the Employability Skills Framework may be required to some extent in all ASCO occupations, some skills will be more relevant for some occupations than others. For example, *Technology skills* would seem to be very important for *1224 Information technology managers* or other IT technicians, but not as critical or important in terms of rapidity of change, innovation or upskilling as they would be in the case of *9932 Fast food cooks.*[1] The Occupational Information Network[2] (O*NET), for example, defines technical skills as 'developed capacities used to design, set-up, operate, and correct malfunctions involving application of machines or technological systems' (US Department of Labor, 1998). Similarly, the report *Employability skills for the Future* (DEST, 2002) defines technology skills as those 'that contribute to effective execution of tasks' (DEST, 2002, p. 9). The technology skills definition is also composed of five elements, namely, applying IT skills as a management tool, using IT to organise data, being willing to learn new IT skills, having the occupational health and safety knowledge to apply technology, and having the appropriate physical capacity.

The DEST definition, with its corresponding elements, is similar to that of the O*NET, but is limited in a number of areas. Firstly, technology skills seem to be the domain of IT, without taking into consideration other technical skills such as troubleshooting or the use of machinery (e.g. an excavating machine, a shovel, a pantograph or X-ray equipment). Secondly, the technology skills[3] definition lacks detail and is not as broadly inclusive as the O*NET's definition. For example, the O*NET definition consists of a taxonomy of 12 skills (see Table 1), something that is not present in the employability skills definition in the DEST report. This allows for comparability between the skill intensity of occupations, which cannot be done with the DEST definition. This is an important point to highlight because the DEST definition of technical skills appears to assume that the skills of *Fast food cooks* are at the same level as those of *Information technology managers.*

This limitation can also be found in terms of the other seven employability skills in the DEST report. For example, the technology skills of *information technology managers* who plan, direct and coordinate activities in such fields as electronic data processing, information systems, systems analysis and computer programming, and

[1] I make the distinction here between a fast food cook, a chef and a 'cordon bleu' chef.
[2] The O*NET is explained in more detail in section 3 of this paper.
[3] The Oxford Dictionary definition of technology is far too narrow and simplistic to be useful for the purposes of capturing the complexity of technology skills encapsulated in both the DEST report and the O*NET.

those of *fast food cooks* who are required to prepare and cook food with a menu limited to one or two basic items such as hamburgers, chicken, pizza or fish and chips, and normally involve operating large-volume single-purpose cooking equipment, are quite different in content, level of skill usage, knowledge of technology use and application of technology. Hence, given the difference of technical skills that the two occupations require, it is more likely that an IT technician can train within a short period to become a *fast food cook*, than the other way around.

Although both occupations require technical skills, the skill levels required to perform the occupation of an *information technology manager* are far higher than those of a *fast food cook*. The reason for this is quite obvious. The skill level, experience and time and monetary investment required to train an *information technology manager* is far greater than that required to train a *fast food cook*. Furthermore, in terms of technical skill transferability, it is easier for *information technology managers* to 'skill down' to the level of a *fast food cook* than it is for *fast food cooks* to 'skill up' to the level of an *information technology manager*. This same analogy can be applied to a nurse and a heart surgeon. Although both would have high levels of skills, including technical skills, it is a certainty that the success rates for heart operations would be far higher for heart surgeons than if the operations were performed by nurses.

If it is thought that more *information technology managers* than *fast food cooks* will be needed to meet the future challenges facing Australian industry, the training resources devoted to generic skills should be allocated appropriately. Generic employability skills may well be more transferable than job-specific skills, but not (or, at least, not obviously) to the extent that structural change can safely be ignored when determining future requirements. While it is certainly true that future employment by occupation is 'not readily predictable', it is not true that it cannot be predicted at all. Many industrialised countries routinely produce forecasts of employment by industry and occupation.[4] In Australia, the Centre of Policy Studies (CoPS) at Monash University has done so for more than ten years.

The position adopted in *Employability Skills for the Future* and similar reports would appear to owe more to necessity than to virtue. It seems likely that the link between the structure of the economy and the demand for particular generic skills is typically ignored, not because the link is thought to be unimportant, but because there has been no suitable analytical tool for its elaboration. It is this deficiency which the current paper seeks to redress. In 1998, the US Department of Labor introduced the Occupational Information Network. Commonly referred to as the O*NET, it is a comprehensive database linking worker attributes (or employability skills, in terms of the above discussion) and job characteristics (or job-specific skills). Moreover, the links are specified in both qualitative and quantitative terms. Esposto (2005) has adapted the O*NET to the Australian labour market and created a means whereby the Monash occupational forecasts can be extended to employability skills. The paper presents the first such forecasts and details the methodology involved.

2. Employability skills: a review

The motivation for developing, defining and identifying employability skills has a historical background that goes back to the beginning of the 1980s brought about by a

[4] See Neugart and Schomann (2002) for a recent survey.

desire by various industry groups, policy makers and educators to remain competitive and to gain ground in local and global markets (Allen Consulting Group, 2004; Australian Council for Educational Research, 2001; DEST, 2002). The need to compete internationally has forced industry and enterprises to adapt and change, while the skills, knowledge and abilities required by individuals to remain competitive in the labour market have had to be realigned in order to meet a new global competitive reality. Thus, the challenge for industry, the VET sector and other educational bodies and policy makers in Australia has been to identify the skill sets that make individuals employable in a rapidly changing economy and labour market. To date, the most important efforts to try to establish the skill sets that are required to enter or access and remain in the world of work have been the Karmel Report (1985), the Finn Report (1991), the Mayer Report (1992) and the Employability Skills for the Future Report (2002).

The Karmel Report stressed the requirement of the secondary school sector to support the attainment by graduates of educational standards that would lead to long-term employability. The Finn Review Committee was required to report on 'national curriculum principles designed to … develop key competencies (Australian Education Council, 1991, p. 2). The Mayer Committee 'used its own expertise, consulted with industry and with educators in the school and Vocational, Educational and Training (VET) sectors' (Australian Council for Educational Research, 2001, p. 13). The committee recommended a set of competencies and created three levels of performance for each 'which differentiated the levels of competency necessary to undertake the activity, manage the activity, or evaluate or revise an activity undertaken' (DEST, 2002, p. 22). In 2002, DEST commissioned the 'Employability Skills for the Future Report'. The report's framework is underpinned by a number of critical factors. Firstly, it is closely linked and builds on the Mayer Key competencies. Secondly, employers (regardless of enterprise size) recognise the link between 'employability skills' and the Mayer competencies. Thirdly, small, medium and large firms identify the same critical mix of skills as being necessary for employability and continued employment.

3. The O*NET

3.1 A suggested approach to defining and measuring skill

One way of achieving a good understanding of the skill needs of a changing economy and labour market is through the O*NET. Developed by a consortium led by the US Department of Labor, itsfirst version was launched in 1998 and was designed to replace the Dictionary of Occupational Titles. It is considered to be the most comprehensive standard source of occupational information in the US. An advantage of the O*NET is that it offers statistical information that can be applied to the Australian context to analyse labour market change.[5] It provides very detailed information on about 1,120 occupations and is continually updated to reflect the dynamic and ever-changing nature of employment. The framework that organises the O*NET data is called the Content Model (Peterson et al., 1999, p. 25). This classifies data into six domains that provide detailed information related to the attributes of occupations and to the characteristics required of people who actually do the job. It

[5] For example, Esposto (2005) used the O*NET to analyse labour market change, while Sheehan and Esposto (2001) used it to study the characteristics of Australian jobs.

includes the specific domains and elements in the O*NET database that might be used to describe jobs. These components are based on psychological and job analysis research carried out by the Department of Labor and contain over 300 job related descriptors.

*3.2 O*NET skills*

The approach taken by the O*NET to define skill is that of Mumford et al. (1999). They define skill as a set of general procedures that underlie the effective acquisition and application of knowledge in different areas of endeavour (ch. 3, p. 4). The implication of this definition is threefold. Firstly, skills are innately linked to knowledge, learning, practice, education and experience Secondly, skills can be seen as general procedures that are necessary for the performance of multiple tasks. Thirdly, skills are not constant attributes of individuals that remain unchanged over time.

Given the above, Mumford et al. argue that skills are not one-dimensional and require a variety of taxonomies. They provide a taxonomy of 46 O*NET skill descriptors encompassing two broad categories. The first are ten basic skills, and the second are 36 cross-functional skills. The ten *basic* skills are divided into two groups: content and process skills. The 36 *cross-functional* skills are further divided into five categories, namely social, problem solving, technological, systems, and resource management.

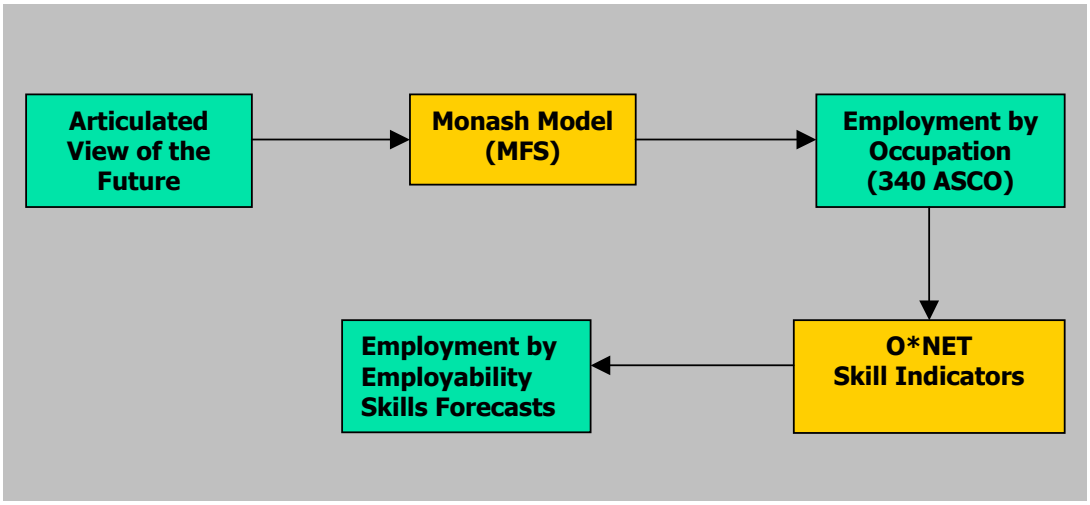
For these measures to be used to forecast the demand for skill, the most appropriate O*NET occupational code was assigned to its corresponding Australian occupation at the ASCO second edition four-digit code.[6]

4. The Monash Forecasting System and the O*NET interface

The demand for labour depends on many factors. It depends on the state of macroeconomic health of the domestic economy and of the economies of trading partners. It depends on the amount of capital investment and on its allocation between industries. It depends on the rate of technical change and on changes in government policy. Moreover, all these factors are interconnected. Developments in one industry affect the demand for labour in other industries. The Monash Forecasting System (MFS) incorporates all these factors in a set of formal economy-wide forecasts for labour demand. The sources of exogenous forecasts identified in Figure 1 are: the private forecasting agency Access Economics (which contributes information about the future state of the macro economy); the Australian Bureau of Agricultural and Resource Economics (ABARE) (export prices and volumes for primary products); the Tourism Forecasting Council (TFC) (prospects for tourism); the Productivity Commission (PC) (changes in protection implied by government industry policy); and the Centre of Policy Studies (CoPS) (changes in technology and consumer tastes).

[6] For a detailed explanation of this methodology, see Esposto (2005) and Sheehan and Esposto (2001).

Figure 1: The Monash Forecasting System



Source: Author design

In preparing forecasts for the Australian economy, we begin with the idea of requiring a view of the future in terms of employability skills. To do this we use the Monash model[7] to obtain specific employment forecasts for 340 occupations at the four-digit level of ASCO. These forecasts are then assigned or connected to the O*NET occupational classification in order to obtain employability skills forecasts or skill employment forecasts for the future. In following this method, MFS begins with a macroeconomic scenario derived from the Access Economics Macro Model (AEM). This econometric modelling takes a view of what is happening in the economy of our trading partners, by looking at the state of the global economy and by answering questions such as 'Will China continue to grow at current rates?' and 'Will the US economy continue to grow or will it slow down over the next economic cycle?'. This is then supplemented with industry-specific information obtained from ABARE and TFC. The MFS also uses information from the PC which models government policy in terms of variables used in our model. Finally, the MFS incorporates the Structure of Technical Change which is generated by CoPS. From here, Monash makes a labour market extension by providing employment forecasts for the 340 four-digit occupations of ASCO and is then connected to the O*NET to obtain employability skill forecasts or employability skills for the future as detailed in Table 1.

5. Forecasting employability skills

Table 1 presents the growth in demand for the 46 O*NET skill descriptors and for the seven areas of skill under consideration. All forecast values are lower than the historical values. The reason for this is that our aggregate employment growth, which is obtained from the Access Economics forecast, is forecast to grow at 1.14 per cent per annum. Thus, our forecasts reflect the aggregate forecast of employment growth as specified by Access Economics for the period 2004-05 to 2012-13. The forecasts of employment growth in hours range from 0.57 per cent per annum for *601 Visioning* to 1.59 per cent for *703 Management of material resources*.

[7] A technical explanation of the operations and application of the MFS can be found in Dixon and Rimmer (2002).

The average annual growth rate of 1.59 per cent for *Management of material resources* translates into a total growth rate of 13.45 per cent over the eight years of the forecast period. A substantial part of the hours spent performing the skill *Management of material resources* is contributed by workers belonging to the occupation *Managers and administrators* (19.7 per cent in the base period). Over the forecast period, the employment of *Managers and administrators* is forecast to increase more rapidly than average employment (18.74 per cent as compared to 9.52 per cent). Moreover, *Management of material resources* is forecast to increase its share of employment within the occupation *Managers and administrators* at the expense of other skill groups, contributing an additional (0.197 x 1.60) or 0.32 percentage points (the share effect). Because the O*NET 'importance' indicators are assumed to remain constant over time, the share effects for the 340 ASCO unit groups are zero. The share effects identified here reflect a change in the mix of unit groups within each major group.

When the occupational contributions are compared for the skill groups *Management of material resources* and *Visioning*, it is clear that the former owes its relatively good employment prospects to its concentration in the managerial and professional occupations, and the latter owes its relatively poor prospects to its concentration in the trades and labouring occupations[8].

Table 1: Average Annual Growth Rates, O*NET Skill Groups[9]
Australia, Hours, Per Cent Per Annum

	Skill Group	Historical Data	Forecast
		1996-97 to 2004-05	2004-05 to 2012-13
100	**Content Skills**	**1.56**	**1.11**
101	Reading and comprehension	1.50	1.08
102	Active listening	1.61	1.11
103	Writing	1.58	1.16
104	Speaking	1.68	1.20
105	Mathematics	1.54	1.07
106	Science	1.38	0.98
200	**Process Skills**	**1.65**	**1.19**
201	Critical thinking	1.71	1.24
202	Active learning	1.70	1.23
203	Learning strategies	1.63	1.21
204	Monitoring	1.57	1.11
300	**Social Skills**	**1.68**	**1.20**
301	Social perceptiveness	1.68	1.20
302	Coordination	1.69	1.14
303	Persuasion	1.76	1.29
304	Negotiation	1.78	1.27
305	Instructing	1.62	1.23
306	Service orientation	1.61	1.12
400	**Complex Problem Solving Skills**	**1.61**	**1.15**
401	Problem identification	1.59	1.14
402	Information gathering	1.58	1.14

[8] See for example Esposto (2005, pp. 195-202) for a detailed analysis of upskilling of the Australian labour force.
[9] These forecasts are based on a paper presented at the Economics Conference in 2006.

403	Information organisation	1.46	1.06
404	Synthesis/Reorganisation	1.63	1.17
405	Idea generation	1.70	1.21
406	Idea evaluation	1.66	1.18
407	Implementation planning	1.67	1.20
408	Solution appraisal	1.62	1.17
500	**Technical Skills**	**1.37**	**0.91**
501	Operations analysis	1.62	1.14
502	Technology design	1.46	0.97
503	Equipment selection	1.38	0.88
504	Installation	1.37	0.78
505	Programming	1.57	1.12
506	Testing	1.33	0.93
507	Operation monitoring	1.34	0.96
508	Operation and control	1.28	0.87
509	Product inspection	1.25	0.88
510	Equipment maintenance	1.38	0.97
511	Troubleshooting	1.11	0.62
512	Repairing	1.27	0.81
600	**Systems Skills**	**1.87**	**1.29**
601	Visioning	1.10	0.57
602	Systems perception	1.95	1.38
603	Identifying downstream consequences	2.04	1.46
604	Identification of key causes	2.04	1.45
605	Judgement and decision making	1.93	1.34
606	Systems evaluation	1.93	1.30
700	**Resource Management Skills**	**2.11**	**1.43**
701	Time management	2.20	1.53
702	Management of financial resources	1.99	1.35
703	Management of material resources	2.34	1.59
704	Management of personnel resources	1.99	1.30
9999	**All Skill Groups**	**1.63**	**1.14**

6. Concluding remarks

The Australian economy is currently experiencing a period of tight labour markets. Because of population ageing, the future growth in labour supply is likely to be relatively slow. In these circumstances, the allocation of training resources, particularly in the VET system, becomes particularly important. They should be allocated in favour of the skills, be they job-specific or generic, which are otherwise most likely to be in short supply.

Quantitative labour market forecasting is fraught with uncertainty. However, the question of allocation is in essence a quantitative question. Eventually, someone has to decide what courses should be provided and that decision, of its nature, should be informed by a view about the future. Qualitative analyses, such as the *Employability Skills for the Future* report, may inform such a view but eventually the qualitative ideas must be assigned concrete form. If the quantification of the allocation decision is not based on formal labour market forecasts, it will of necessity be based on informal or intuitive forecasts, and there is no reason to suppose the former will be more uncertain than the latter. Indeed, formal methods provide a framework for bringing large amounts of relevant information to bear in a coherent manner, an achievement that lies outside the range of informal methods. In any case, the two are not mutually exclusive, and a decision maker can consider quantitative forecasts as simply one of a number of information sources to be taken into account.

When it comes to generic or employability skills, the level of quantitative uncertainty increases. Generic skills are generally not as tightly defined as job-specific skills, and hence their economic role cannot be easily elicited by the usual method of surveying market participants. However, by surveying expert opinion, the O*NET purports to specify important quantitative aspects of that role in the form of the 'importance' and 'level' indicators it associates with its range of generic skills. As there is no alternative data source against which the O*NET assignments can be compared, their efficacy must be judged on the basis of the methodology adopted. The O*NET approach seems to be appropriate to the task and to have been thoroughly implemented. It can reasonably be argued, therefore, that the indicators embody important information with which to supplement the quite extensive qualitative discussion of employability skills in Australia and elsewhere.

One purpose of economic research is to develop analytical tools with which to furnish better information to economic policy makers. The modelling system described in the paper meets this criterion. The O*NET indicators have been interpreted in a way that is both in the spirit of their definition and allows existing Australian forecasts of employment by occupation to be extended to employability skills. The exercise suggests that the structural details of the future state of the economy do indeed have important implications for the relative demands for various types of employability skills, and that general qualitative considerations provide only an incomplete basis for allocating training resources between those skills. The forecasting methodology has been adapted from a US database but is amenable to future refinement to incorporate the views of relevant Australian experts.

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