

# **The VET System and the Demand for Skills: Implications for Australia's Workforce**

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*This paper outlines and discusses why some skill sets are more important than others in meeting the challenges of a changing labour market. It assesses the sets of skills required by the economy to grow and to compete effectively internationally. A method of achieving an understanding of skill requirements is through the Occupational Information Network (O\*NET), a comprehensive database linking worker attributes (or employability skills) with occupations in both qualitative and quantitative terms. To this end an interface of the O\*NET model together with Australian employment data is created to provide detailed forecasts of employability skills for Australia.*

**JEL Codes:** J11, J24, and J23

## **1. Introduction**

Today's dynamic work-place is characterised by technological advances, new management techniques and the emergence and disappearance of occupations and skills, which spell shifting requirements for workers, educators, industry, businesses and the community at large. In an effort to respond to these changes and pressures, Australian policy makers, educational and industry bodies have devoted considerable resources over the last two and a half decades to the concept of *employability skills* in order to bridge the gap between education and training and the world of work.

Whilst the concept of *employability skills* is a step forward in understanding the requirements of industry and occupations in the contemporary Australian economy, I believe that it requires a stronger connection to the needs of industry and Australian employees. One way of overcoming this limitation is by applying the Occupational Information Network (O\*NET). Unlike employability skills, the O\*NET provides a very detailed framework for describing jobs in terms that are capable of addressing the needs of workers and employers into the 21st century. Instead of relying on rigid task descriptions, it uses domains of worker and occupational characteristics such as abilities, work styles, generalised work activities and work context to describe each job.

Given these limitations and challenges, this paper discusses and analyses the following issues: section 2 presents the merits and limitations of the employability skills framework; section 3 discusses the O\*NET; section 4 presents the Monash Forecasting System and its interface with the O\*NET; section 5 explains the forecasting methodology; section 6 discusses the skill requirements of Australian occupations and findings; and section 7 presents a conclusion.

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### 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 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; ACER, 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, 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. 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 report stressed among other policy matters the inclusion of curriculum principles that supported the development of key competencies (DEST, 2002, p. 21) and recommended six key areas of competence: Language and Communication, Mathematics, Scientific and Technological Understanding, Cultural Understanding, Problem Solving and Personal and Interpersonal Skills (ACER, 2001, p. 13). The Mayer Committee “used its own expertise, consulted with industry and with educators in the school and Vocational, Educational and Training (VET) sectors and to a lesser extent with the higher education sector and, finally, undertook a validation exercise which involved further consultations with industry” (ACER, 2001, p. 13). The committee recommended a set of competencies which are detailed in Table 1. It created three levels of performance for each competency “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).

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**Table 1: List of Mayer Key Competencies**

Key competencies	Descriptors
1. Collecting, analysing and organising information	The capacity to locate information, sift and sort the information in order to select what is required and present it in a useful way, evaluate both the information itself and the sources and methods used to obtain it.
2. Communicating ideas and information	The capacity to communicate effectively with others using a whole range of spoken, written, graphic and other non-verbal means of expression.
3. Planning and organising activities	The capacity to plan and organise one's own work activities, including making good use of time and resources, sorting out priorities and monitoring performance.
4. Working with others and in teams	The capacity to interact effectively with other people both on a one-to-one basis and in groups, including understanding and responding to the needs of others and working effectively as a member of a team to achieve a shared goal.
5. Using mathematical ideas and techniques	The capacity to use mathematical ideas, such as number and space, and techniques, such as estimation and approximation, for practical purposes.
6. Solving problems	The capacity to apply problem solving strategies in purposeful ways, both in situations where the problem and the desired solution are clearly evident, and in situations requiring critical thinking and a creative approach to achieve an outcome.
7. Using technology	The capacity to apply technology, combining the physical and sensory skills needed to operate equipment with the understanding of scientific and technological principles needed to explore and adapt systems.

Source: Australian Education Council. Mayer Committee (1992, pp. 8-9).

In 2002, the Department of Education, Science and Training (DEST) commissioned the Employability Skills for the Future Report which provided advice on the following five key areas:

- possible new requirements for generic employability competencies that industry requires, or will require, in the foreseeable future, since the Mayer key competencies were developed;
- clear definitions of what Australian and leading business enterprises mean by 'employability' skills and the consistency or otherwise between the various terms similarly studied;
- a proposed suite of employability skills, including outlines of assessment, certification and reporting of performance options that suit both industry and education;

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- industry (small, medium and large business) reactions to the proposed suite and reporting options;
- a report on the case studies involving 13 large enterprises; and
- a report on focus group research with small and medium sized enterprises (DEST, 2002, p. 2).

The study was based upon a literature review by the Australian Council for Educational Research (ACER, 2001), case study research with large firms, and focus groups and interviews with small and medium firms. The report developed an Employability Skills Framework consisting of personal attributes, skills and elements. In trying to simplify the complexity surrounding the different and complex terminology regarding the concept of skill which is found in the literature, it presented its own working terminology and definition of employability skills:

skills required not only to gain employment, but also to progress within an enterprise so as to achieve one's potential and contribute successfully to enterprise strategic directions (p. 3).

The report includes three key terms that are described below and which reflect the views of employers operating in small, medium and large sized enterprises.

**Table 2: Terminology Used in Explaining the Employability Skills Framework**

Term	Explanation
Personal attributes	Term used to describe a set of non-skill-based behaviours and attributes that employers felt were as important as the employability skills and other technical job-specific skills.
Skills	Term used to describe the learned capacity of the individual. <i>Skills</i> has been used instead of <i>competencies</i> , reflecting the language of enterprises interviewed and to avoid any definitional confusion with the different ways <i>competencies</i> is used.
Elements	<ul style="list-style-type: none"> <li>• The <i>elements</i> are the facets of skill that employers identified as important.</li> <li>• The mix and priority of these elements would vary from job to job.</li> <li>• The list of elements is not exhaustive but rather reflects the information provided by the interviewees in this study.</li> <li>• The list of elements is indicative of the expectations of employers.</li> <li>• The level of sophistication in the application of the element will depend on the job level and requirements.</li> </ul>

Source: DEST (2002, p. 36).

The Employability Skills Framework in the Future Report 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

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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.

### 2.1 Limitations of Employability Skills

The DEST definition, with its corresponding elements, is similar to that of the O\*NET, but is limited in a number of areas. Firstly, technical skills seem to be the domain of IT, without taking into consideration others such as troubleshooting or the use of machinery (e.g., an excavating machine, a shovel, a pantograph or X-ray equipment). Secondly, the technical skills<sup>i</sup> 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 46 skills subsumed under seven broad skill categories (see Tables 4 and 3, respectively), 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 technical 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 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 be trained 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

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occupation.<sup>ii</sup> 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. Esposito (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.

### 3. The O\*NET

The Occupational Information Network (O\*NET) is an extensive and comprehensive database that describes the attributes and characteristics of occupations and workers. Its first version was launched in 1998 and the information detailed in this chapter refers to this version, also known as O\*NET 98. Designed to replace the Dictionary of Occupational Titles (DOT), the O\*NET is considered to be the most comprehensive standard source of occupational information in the US. It offers statistical information that can be applied to the Australian context to analyse labour market change. It was developed with the aim of becoming an information system consisting of a framework made up of a variety of components. Firstly, it possesses occupational information that allows jobs to be described in terms of more general descriptors that reflect the modern labour market. Secondly, the O\*NET is closely linked to labour market data which are updated continually. Although it was not originally intended for this purpose, one advantage is that the detailed data collected on worker characteristics and job requirements can be used to examine and analyse changes in the labour market. A further advantage is that it is updated every five years, whereas the DOT was updated only five times in 60 years. Data are gathered on over 200 occupations each year, with the aim of totally upgrading the database every five years (O\*NET Consortium, 2004). The latest upgrade occurred in 2010.

#### 3.1 The O\*NET Content Model

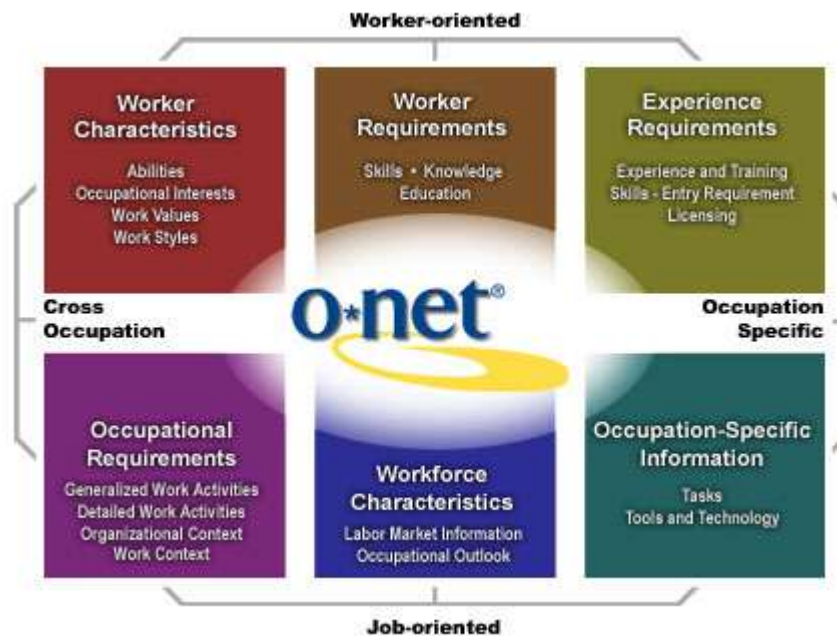
The Content Model is the conceptual foundation of the O\*NET. It was developed by Mumford and Peterson (1995) using research on job and organisational analysis and embodies a framework that reflects the character of occupations (i.e. using job-orientated descriptors) and people (i.e., using worker-orientated descriptors). The Content Model also allows occupational information to be applied across jobs, industry sectors (by using cross-occupational descriptors) and within occupations (using occupation-specific descriptors). It 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 includes the specific domains and elements in the O\*NET database that might be used to describe jobs. These

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components are based on psychological and job analysis research carried out by the O\*NET consortium.

Figure 1 summarises each of the six domains and their corresponding components. The six domains are Worker Characteristics, Worker Requirements, Experience Requirements, Occupational Requirements, Workforce Characteristics and Occupation-Specific Information. The organisation of the Content Model allows the user to concentrate on relevant information that details the attributes and characteristics of jobs and workers.

**Figure 1. Six Domains of the O\*NET Content Model**



Source: O\*NET Resource Centre (2012).

### 3.2 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 which offers statistical information that can be applied to the Australian context to analyse labour market change.<sup>iii</sup> 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 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.

### 3.3 O\*NET Skills

The approach taken by the O\*NET to define skill is that of Mumford et al. (1999) who define skill as a set of general procedures that underlie the effective acquisition and

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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, as detailed in Table 3.

**Table 3: Description of Skill Areas**

Label	Fuller description of skill taxonomy/area	Number of descriptors
<b>Basic Skills</b>		
Content Skills	Provides information on the background structures needed to work with and acquire more specific skills in a variety of domains	6
Process Skills	Lists the procedures that contribute to the more rapid acquisition of skill and knowledge across a variety of domains	4
<b>Cross-Functional Skills</b>		
Social Skills	Details the developed capacities used to work with people to achieve goals	6
Complex Problem Solving Skills	Provides information on the developed capacities used to solve novel, ill-defined problems in complex, real-world settings	6
Technical Skills	These skills relate to the developed capacities used to design, set up, operate and correct malfunctions involving application of machines or technological systems	12
Systems Skills	Provides information on the developed capacities used to understand, monitor and improve socio-technical systems	6
Resource Management Skills	Lists the developed capacities used to allocate resources efficiently	4

Source: Mumford et al. (1999).

### 3.4 Applications of the O\*NET in Labour Market Research

As noted, the O\*NET is an occupational database which offers an important resource that can be applied in the study of labour market change. Given its recent and continuing development a number of studies has used the O\*NET to study and analyse the labour market, to identify occupational skill requirements and to provide forecasts of short-term demand for skills.

One of the first studies to use the O\*NET database was conducted by the Minnesota Department of Economic Security (MDES). The report was titled *Minnesota's Most Marketable Skills* (1999). These were defined as those occupational requirements that are meant to be associated with high wages and/or employment growth. Out of 57 occupational skill requirements that measure the knowledge, ability and skill dimensions of an occupation, 18 were found to be extremely 'marketable'. The findings of this study were used by the State of Minnesota to apply to areas of policy related



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both to the labour market and to align the skill requirement of occupations to educational curricula.

In 2002, the MDES conducted a forecast of the demand for skills in the short term, using 46 skills, 52 abilities, 33 knowledge and 38 generalised work activity measures found in the O\*NET database. The report summarised research into the feasibility and appropriate methodology for developing short-term, skill-based forecasts in order to direct public resources more effectively. It concluded that the O\*NET was an effective data system that could be applied for the analysis of forecasts of short-term demand for skills. Drawing on earlier work by Sheehan and Esposito (2001), Esposito (2005) investigated labour market change in Australia using the O\*NET by addressing the following issues. Firstly, the study focused on how skill should best be measured in addressing the issue of skill-bias in the demand for labour; secondly, he showed that the Australian labour market had experienced a long-term process of skill-bias in the demand for labour; and thirdly, having confirmed skill-bias, the study showed using O\*NET measures of skill and knowledge evidence that this increasing relative demand for higher skill labour is an important explanatory factor in the rise in earnings inequality in Australia.

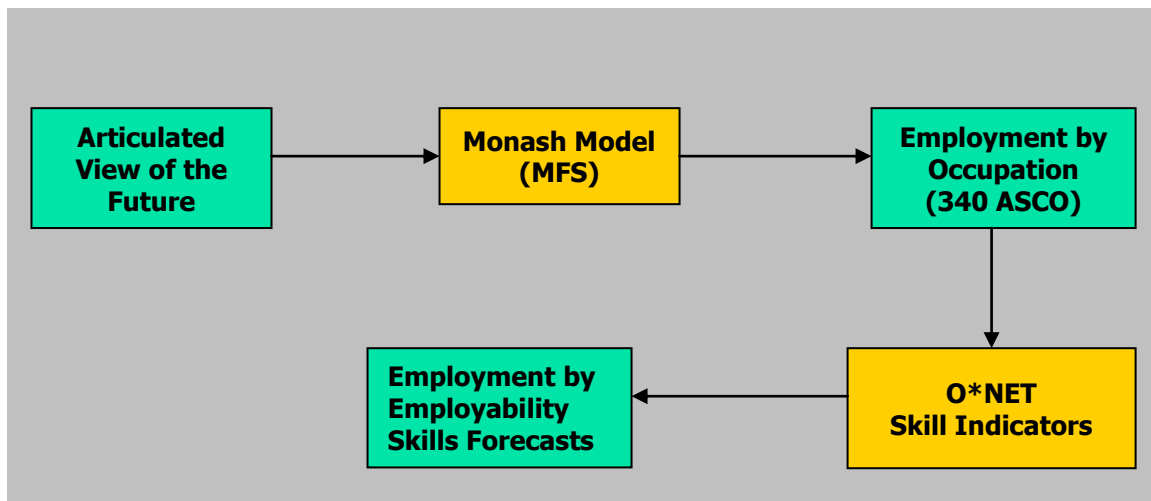
Using the O\*NET database, Rotundo and Sackett (2004) conducted a job-level evaluation of whether specific skills or abilities could be identified that were most strongly linked to wages or whether broad skill/ability factors accounted for a majority of wage variance. The authors found that a majority of the wage variance explainable by skills/abilities could be attributed to a general cognition factor. Esposito and Abbott (2011) and Esposito (2008) have used the O\*NET and Australian employment data interface to analyse the intensity of skill and knowledge in different types of employment in Australia and New Zealand. A major finding of this study using O\*NET measures of skill is that these human capital attributes are important components of the contemporary labour market in both countries and play an important role in the development of their economies.

### **4. The Monash Forecasting System and the O\*NET Interface<sup>iv</sup>**

The demand for labour depends on many factors: on the state of macro-economic health of the domestic economy and of the economies of trading partners; on the amount of capital investment and its allocation between industries; on the rate of technical change; and on changes in government policy. All these factors are interconnected, with developments in one industry affecting the demand for labour in others.

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Figure 1: The Monash Forecasting System



Source: Author design and Esposito and Meagher( 2006, p. 22).

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).

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<sup>Y</sup> to obtain specific employment forecasts for 340 occupations at the four-digit level of ASCO. These 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, the 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 the ABARE and TFC. The MFS also uses information from the PC which models government policy in terms of variables used in our model. Finally, it 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 4.

## 5. Forecasting Employability Skills

As adapted by Esposito, the O\*NET assigns an 'importance' indicator between 0 and 100 (inclusive) to each of 46 skill groups for each of 340 occupations (i.e., the ASCO

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unit groups). To extend the MFS forecasts of employment by occupation (measured in hours) to apply to the O\*NET skill groups, we assume that the number of hours worked in an occupation is distributed between the skill groups in proportion to the importance indicator for that occupation (see Esposito and Meagher, 2006):

$$\delta_2 \sum_i B_{ik} (\delta_1 A_{ik}) = W_k,$$

where  $W_k$  is total employment (measured in efficiency units) for occupation  $k$  and  $\delta_2$  is a scale factor. That is, employment of skill type  $i$  in occupation  $k$  is given by  $\delta_1 \delta_2 A_{ik} B_{ik}$  when measured in efficiency units.  $W_k$  might reasonably be set equal to the wage bill in occupation  $k$  but the size of an efficiency unit is essentially arbitrary. Clearly, the methodology for forecasting the demand for employability skills (as represented by the O\*NET skills) is somewhat less robust than that for the other variables of the MFS. In particular, the conversion of occupational forecasts into forecasts for employability skills is not based on specific information (such as that collected in the Labour Force Survey) about the relationship between the two, but on opinion (embodied in the O\*NET importance and levels indicators) about what that relationship might be. However, the method is plausible, the opinion involved is expert opinion, and there is no obvious alternative method by which it can be taken into account. Certainly, it is not possible convincingly to accommodate matrices of the size required (340 by 46 in the case of the O\*NET skills) by means of intuition.

Table 4 presents results for the 46 O\*NET skill groups. 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*. 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.

**Table 4: Average Annual Growth Rates, O\*NET Skills, Australia, Hours, Per Cent per Annum**

		Historical data	Forecast	Total historical data	Total forecast
	Skill Group	1996-97 to 2004-05	2004-05 to 2012-13	1996-97 to 2004-05	2004-05 to 2012-13
<b>100</b>	<b>Content Skills</b>	<b>1.56</b>	<b>1.11</b>	<b>12.48</b>	<b>8.88</b>
101	Reading and comprehension	1.5	1.08	12	8.64
102	Active listening	1.61	1.11	12.88	8.88
103	Writing	1.58	1.16	12.64	9.28
104	Speaking	1.68	1.2	13.44	9.6
105	Mathematics	1.54	1.07	12.32	8.56
106	Science	1.38	0.98	11.04	7.84
<b>200</b>	<b>Process Skills</b>	<b>1.65</b>	<b>1.19</b>	<b>13.2</b>	<b>9.52</b>
201	Critical thinking	1.71	1.24	13.68	9.92
202	Active learning	1.7	1.23	13.6	9.84
203	Learning strategies	1.63	1.21	13.04	9.68
204	Monitoring	1.57	1.11	12.56	8.88
<b>300</b>	<b>Social Skills</b>	<b>1.68</b>	<b>1.2</b>	<b>13.44</b>	<b>9.6</b>

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301	Social perceptiveness	1.68	1.2	13.44	9.6
302	Coordination	1.69	1.14	13.52	9.12
303	Persuasion	1.76	1.29	14.08	10.32
304	Negotiation	1.78	1.27	14.24	10.16
305	Instructing	1.62	1.23	12.96	9.84
306	Service orientation	1.61	1.12	12.88	8.96
<b>400</b>	<b>Complex Problem Solving Skills</b>	<b>1.61</b>	<b>1.15</b>	<b>12.88</b>	<b>9.2</b>
401	Problem identification	1.59	1.14	12.72	9.12
402	Information gathering	1.58	1.14	12.64	9.12
403	Information organisation	1.46	1.06	11.68	8.48
404	Synthesis/reorganisation	1.63	1.17	13.04	9.36
405	Idea generation	1.7	1.21	13.6	9.68
406	Idea evaluation	1.66	1.18	13.28	9.44
407	Implementation planning	1.67	1.2	13.36	9.6
408	Solution appraisal	1.62	1.17	12.96	9.36
<b>500</b>	<b>Technical Skills</b>	<b>1.37</b>	<b>0.91</b>	<b>10.96</b>	<b>7.28</b>
501	Operations analysis	1.62	1.14	12.96	9.12
502	Technology design	1.46	0.97	11.68	7.76
503	Equipment selection	1.38	0.88	11.04	7.04
504	Installation	1.37	0.78	10.96	6.24
505	Programming	1.57	1.12	12.56	8.96
506	Testing	1.33	0.93	10.64	7.44
507	Operation monitoring	1.34	0.96	10.72	7.68
508	Operation and control	1.28	0.87	10.24	6.96
509	Product inspection	1.25	0.88	10	7.04
510	Equipment maintenance	1.38	0.97	11.04	7.76
511	Troubleshooting	1.11	0.62	8.88	4.96
512	Repairing	1.27	0.81	10.16	6.48
<b>600</b>	<b>Systems Skills</b>	<b>1.87</b>	<b>1.29</b>	<b>14.96</b>	<b>10.32</b>
601	Visioning	1.1	0.57	8.8	4.56
602	Systems perception	1.95	1.38	15.6	11.04
603	Identifying downstream consequences	2.04	1.46	16.32	11.68
604	Identification of key causes	2.04	1.45	16.32	11.6
605	Judgement and decision making	1.93	1.34	15.44	10.72
606	Systems evaluation	1.93	1.3	15.44	10.4
<b>700</b>	<b>Resource Management Skills</b>	<b>2.11</b>	<b>1.43</b>	<b>16.88</b>	<b>11.44</b>
701	Time management	2.2	1.53	17.6	12.24
702	Management of financial resources	1.99	1.35	15.92	10.8
703	Management of material resources	2.34	1.59	18.72	12.72
704	Management of personnel resources	1.99	1.3	15.92	10.4
<b>9999</b>	<b>All Skill Groups</b>	<b>1.63</b>	<b>1.14</b>	<b>13.04</b>	<b>9.12</b>

Source: Esposito and Meagher (2006, pp. 40-1).

## 6. The Skill Requirements of Australian Occupations

A number of themes emerge from an analysis of the historical and forecast annual growth rates of skill for Australia detailed in Table 4 and Figure 2. To understand the effect of these changes, an analysis of the different types of skill requirements of Australian occupations is provided. This gives an indication of which particular areas of skill have increased in demand faster for the labour force, thus providing policy makers with valuable information in terms of which areas of training and education reform require more investment. To understand how the demand for skills is forecast to grow, seven areas of skill are examined.

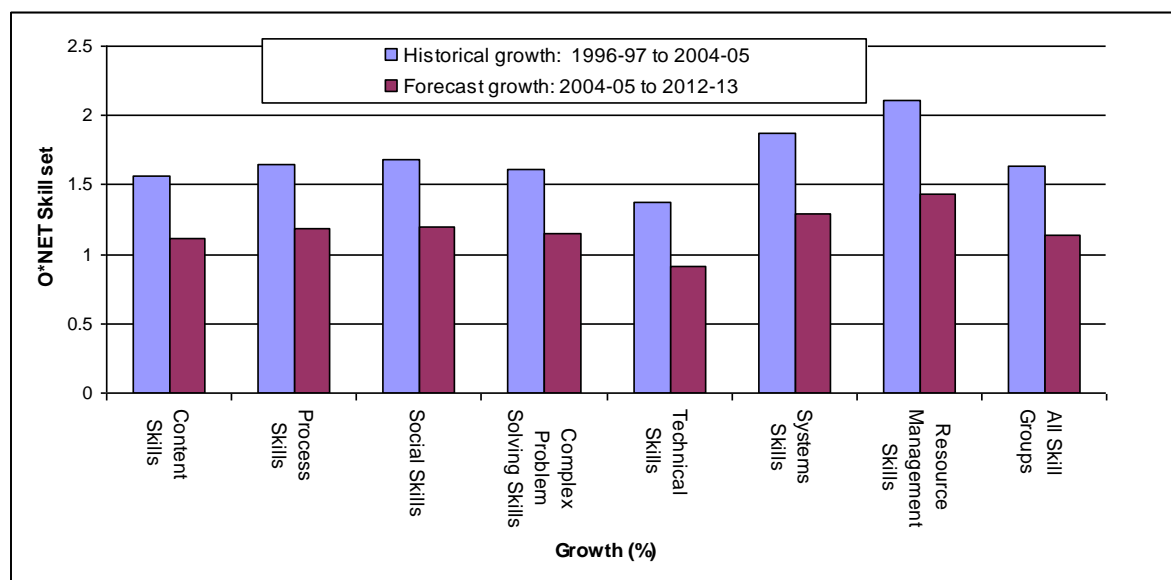
### 6.1 The Skill Requirement of Australian Occupations

Table 4 details the growth in demand for the 46 O\*NET skill descriptors and for the seven areas 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 expected to grow at 1.14 per cent per annum. Thus, our forecasts reflect the aggregate forecast of employment growth as specified by the predicted forecast for the period 2004-05 to 2012-13.

### 6.2 Australian Demand for Labour by O\*NET Employability Skill

All skill groups are expected to grow by 9.1 per cent, while the demand for skill in the seven O\*NET categories, as shown in Table 3 and illustrated in Figure 2, is forecast to grow by between 7.3 to 11.4 per cent over the eight year period.

**Figure 2: Growth in Demand for Skills, Australia, 2004-05 – 2012-13**



Source: Table 2.

The strongest demand growth is expected to occur in Resource Management skills, suggesting that the developed capacities used to allocate resources efficiently in the Australian labour market will continue to be important. These include skills in time management, management of financial and material resources and management of personnel resources. The increase in the demand for such skills suggests that

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employees require a set of skills that enable them to act in response to an increasingly complex and rapidly changing work environment, thus needing to adapt quickly to new situations and challenges and increasing competitiveness.

Systems skills will experience the second highest growth over the period. This skill area is concerned with the developed capacities used to understand, monitor and improve socio-technical systems. Socio-technical systems are an approach to complex organisational work design that recognises the interaction between people and technology in work-places. This type of skill requires employees to develop particular work systems and to find ways of improving them over time. They have to respond quickly to challenges such as identifying the work procedures that need to be changed in order to improve productivity, understanding the relative costs and benefits of actions taken or that need to be taken and constantly evaluating and upgrading the different mixes of systems performance indicators, while at the same time taking into account their accuracy and validity.

The demand for social skills is also expected to grow considerably. This area is concerned with the developed capacities used to work with people and needed to achieve goals in work-related situations. The large increases indicate that employees require a set of skills that are concerned with persuading colleagues to do things differently or take different approaches to work, negotiation skills required to bring employees together to reconcile differences or to solve work-related issues, coordination of colleagues' work, and teaching colleagues new work systems or procedures. Furthermore, it is important to note the continued growth in service-orientated skills, which are reliant on the provision and delivery of services. Finally, social skills also relate to communication both internally and externally, with organisations that may form part of the production and delivery of a variety of services and products.

Process skills, which form part of the basic skills classification, are also expected to be in high demand in Australian occupations. This area is expected to grow by 9.5 per cent and is concerned with the procedures that contribute to the acquisition of skill and knowledge in a variety of work situations, and with the application and use of a number of basic skills. These are critical thinking, the application of active learning strategies when learning or teaching new things to colleagues at work or the assessment of how well a particular job or task is being performed.

The expected increase in the demand for complex and problem solving skills indicates that this skill area is growing in importance and portrays the type of challenges people face in the modern world of work. This skill area is concerned with solving ill-defined problems in complex work settings, identifying, proposing and evaluating solutions to problems and observing and assessing the outcomes of a problem solution to identify the types of lesson learned for the future.

Content skill is concerned with the background structures that are needed for the successful completion of job tasks and the acquisition of new and more specific skills needed to operate effectively at work. It is made up of the following skills: reading and comprehension, active listening, writing, speaking, mathematics and science. The background structures needed for successful work performance are reading and listening, which represent the two major ways in which information is conveyed between individuals at work. These skills provide the necessary structures that assist

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in the acquisition of more specific skills and knowledge in different work situations. As the nature of Australian jobs changes and new technologies are introduced, these basic skills assist employees in adapting. The basic skills of reading, writing and mathematics are regarded as important in terms of contributing to the development of new and more complex skills valuable to the labour market.

Technical skills ranked the lowest in terms of demand growth. This skill area is concerned with the developed capacities used to design, set up, operate and correct malfunctions involving the use of machinery and technological systems. It includes technology design, equipment selection and installation, programming of computers for different purposes, testing of equipment, and product and equipment maintenance. The slow growth may reflect a long-term period of structural change from a manufacturing-based economy to the services sector and an over-reliance on resources, which is currently maintaining Australia's fragile economic growth.

## 7. Conclusion

The previous section highlighted in terms of O\*NET employability skills that the Australian economy demands a variety of skill sets and that these are becoming more intensive over time, indicating that worker activities are becoming more demanding in the Australian work-place. These results are also consistent with the work of Esposito and Abbott (2011) who find that there has been a change in the knowledge and skill intensity of employment in Australia over the longer term, namely, between 1971 and 2006. This analysis shows a steady and persistent forecast growth in the skill intensity of employment in Australia.

All skill sets grew strongly historically and were forecast to grow considerably over the 2004-05 to 2012-13 period. The most notable forecast increases were seen in Resource Management Skills and Systems. The former indicates the importance of managing new and existing resources, while the latter highlights the importance of the interaction between people at work and new technologies. It is important to note, however, that quantitative labour market forecasting is fraught with uncertainty and its results will vary as economic conditions change. The question of allocation is in essence a quantitative one. 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. Using the O\*NET and MFS interface methodology provides valuable information for the purposes of training and retraining of the work-force and for an understanding of the future demand for skills of an economy such as that of Australia and others, particularly at a time of increasing competitive pressures. Finally, a contribution of this research is that, unlike the employability skills framework, the O\*NET-Monash Model interface has provided a detailed forecast of skills and supports the results of other work in the area.

## Endnotes

<sup>i</sup> The Oxford Dictionary definition of technology is far too narrow and simplistic to be useful for the purposes of capturing the complexity of technical skills encapsulated in both the DEST report and the O\*NET.

<sup>ii</sup> See Neugart and Schomann (2002) for a survey.

<sup>iii</sup> For example, Esposito (2005) used the O\*NET to analyse labour market change, while Sheehan and Esposito (2001) used it to study the characteristics of Australian jobs.

<sup>iv</sup> The Monash Forecasting System is a Dynamic General Equilibrium model used for forecasting and policy and analysis. The scope of this paper does not allow me to go into the specifications. For details of this model and its applications, see Dixon and Rimmer (2002) and Dixon et al. (1982).

<sup>v</sup> A technical explanation of the operations and application of the MFS can be found in Dixon, P. B. and Rimmer, M. T., 2002, *Explaining a Dynamic CGE Simulation with a Trade-Focused Back-of-the-Envelope Analysis: The Effects of eCommerce on Australia*, Centre of Policy Studies/IMPACT Centre, Monash University, Melbourne.

## References

- ACER, 2001, *Employment Skills for Australian Industry: Literature Review and Framework Development*, Australian Council for Educational Research, Melbourne.
- Allen Consulting Group, 2004, *Employability Skills: Development of a Strategy to Support the Universal Recognition and Recording of Employability Skills: A Skills Portfolio Approach*, report prepared for Australian National Training Authority.
- Australian Education Council. Finn Review Committee, 1991, *Young People's Participation in Post-Compulsory Education and Training*, Australian Government Publishing Service, Canberra.
- Australian Education Council. Mayer Committee, 1992, *Putting General Education to Work: The Key Competencies Report*, Australian Government Publishing Service, Canberra.
- DEST, 2002, *Employability Skills for the Future*, Department of Education, Science and Training, Canberra.
- Dixon, PB and Rimmer, MT 2002, *Dynamic General Equilibrium Modelling for Forecasting and Policy: A Practical Guide and Documentation of MONASH*, Elsevier, Boston.
- Dixon, PB, Parmenter, BR, Sutton, J and Vincent, DP 1982, *ORANI: A Multisectoral Model of the Australian Economy*, North-Holland, Amsterdam.
- Esposito, A 2005, *Dimensions of Earnings Inequality in Australia*, PhD thesis, Victoria University of Technology, Melbourne.
- Esposito, A 2008, *Dimensions of Earnings Inequality in the Labour Market: The Australia Experience*, VDM Verlag Dr Müller, Saarbrücken, Germany.
- Esposito, A and Meagher, GA 2006, *The Future Demand for Employability Skills: A New Dimension to Labor Market Forecasting in Australia*, paper presented to 35th Australian Conference of Economists, Curtin University of Technology, Perth, 28-26 Sept., [http://www.cbs.curtin.edu.au/files/Esposito\\_Meagher.pdf](http://www.cbs.curtin.edu.au/files/Esposito_Meagher.pdf).
- Esposito, A and Abbott, M 2011, 'A Look at the Long-Term Accumulation of Human Capital and Knowledge Intensity of Work in Australia', *Economic Papers*, vol. 30, no. 3, pp. 414-430.



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- Mumford, M and Peterson, N 1995, 'Introduction', in N. Peterson, M. Mumford, W. Borman, P. Jeanneret and E. Fleishman (eds), *Development of Prototype Occupational Information Network (O\*NET) Content Models*, vols 1 and 2, Utah Department of Employment Security, Salt Lake City.
- Mumford, M, Peterson, N and Childs, R 1999, 'Basic and Cross-Functional Skills', in Peterson, N., Mumford, M., Borman, W., Jeanneret, P. and Fleishman, E. (eds), *An Occupational Information System for the 21st Century: The Development of the O\*NET*, Utah Department of Employment Security, Salt Lake City.
- Neugart, M and Schomann, K (eds), 2002, *Forecasting Labour Markets in OECD Countries*, Edward Elgar, Cheltenham, UK.
- Peterson, N, Mumford, M, Borman, W, Jeanneret, P and Fleishman, E (eds), 1999, *An Occupational Information System for the 21st Century: The Development of the O\*NET*, Utah Department of Employment Security, Salt Lake City.
- Rotundo, M and Sackett, P 2004, 'Specific Versus General Skills and Abilities: A Job Level Examination of Relationships with Wage', *Journal of Occupational and Organizational Psychology*, vol. 77, pp. 127-48.
- Sheehan, P and Esposito, A 2001, 'Technology, Skills and Earnings Inequality: A New Approach to Understanding the Characteristics of Jobs', in Borland, J., Gregory, B. and Sheehan, P. (eds), *Work Rich, Work Poor: Inequality and Economic Change in Australia*, Centre for Strategic Economic Studies, Victoria University, Melbourne.
- US Department of Labor, 2012, 'O\*NET Research Centre: The O\*NET Content Model', <http://www.onetcenter.org/content.html>, accessed 5 May 2012.