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Looking forward: what skills will undergraduates need?

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An important function of the university sector is to equip graduates with a mix of employability skills that meet the needs of a rapidly changing economy and labour market. Unfortunately, discussions related to employability skills and its connection to the skills requirement of the Australian economy have failed to materialise. It is this deficiency that this paper addresses. We combine two databases with the Monash Forecasting System. The US Department of Labor introduced the Occupational Information Network (O*NET), a comprehensive database linking worker (or employability skills) with occupations in both qualitative and quantitative terms. In this paper, the O*NET is applied to the Monash Forecasting system to conduct 'employability skills' forecasts. 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. Finally, the application of such forecasts can further assist the university sector in three ways: to develop graduate attributes; to allocate education resources; and to prepare courses closely related to the employability skill needs of university students.

Keywords: employability skills, graduate attributes, forecasts.

Introduction

An important function of contemporary universities in Australia is to develop high level knowledge and skills in order to:

"...prepare a highly productive, professional labour force, alongside the vocational and education and training (VET) sector, appropriate to the needs and opportunities of the economy and its component industries and sectors..."
(DEEWR, 2008, p 2)

A mechanism to achieve the above goal has centred around employability skills, which has gained considerable interest 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 2007, DEST produced the report *Graduate Employability Skills*, to investigate, among other things, how universities develop and integrate employability skills into study programs. More recently, the Australian Government Review of Higher Education (2008)

highlighted the importance of employability skills as a key component of labour market and industry needs (Commonwealth of Australia, 2008, p. 210).

In the DEST reports, 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, p3). 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. Analysis of employability skills at various universities has shown that they can be considered as a subset of ‘graduate attributes’, which correspond to a set of “...the qualities, skills and understandings a university community expects its students to develop during their time at the institution...” (DEST, 2007, p2).

A striking feature of both DEST reports is their implicit contention that 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 reports argue 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 to the state of the economy. 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 settings’ (DEST, 2002, p11). The idea seems to be that the university and VET system should provide graduates 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 *information technology managers* or other IT technicians, but not as critical or important in terms of rapidity of change, innovation or up skilling as they would be in the case of a *shop assistant* who operates a computer in the course of her/his work. The Occupational Information Network (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, p9). 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 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, 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 *shop assistants* 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 those of *shop assistants* who are required to assist customers, and operate a computer or cash register, 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 *shop assistant*, than the other way around.

If it is thought that more *information technology managers* than *shop assistants* 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 in university degrees 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 (e.g. Neugart & Schomann, 2002) for a review). In Australia, the Centre of Policy Studies (CoPS) at Monash University has done so for more than ten years.

The position adopted in the *Employability Skills* and *Graduate Employability Skills* 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. The latest example of this can be seen in DEST (2007). The report argues that graduate attributes need to be regarded as a subset of employability skills, however the link between these is not clearly made. Industry representatives have commented that they are satisfied with the technical and discipline specific skills of graduates, however, the industry wide perception is that employability skills are under-developed (DEST, 2007, p2). One reason for this deficiency is that its connection to the state of the economy is not clearly made.

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.

Employability skills: a review

The motivation for developing employability skills has a historical background that goes back to the beginning of the 1980s (Allen Consulting, 2004; ACER, 2001; and 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 to meet new global demands. 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 Karmel Report (1985) stressed the requirement of the secondary school sector to support the attainment by graduates of educational standards that would lead to long term employability. In 1991, the Finn Review Committee reported on "... national curriculum principles designed to ... develop key competencies ..." (Finn Review, p2). The report stressed among other policy matters the inclusion of curriculum principles that supported the development of key competencies (DEST, 2002, p21) and recommended six key areas of competence (ACER, 2001, p13). In 1992, 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, p13). The committee recommended a set of seven competencies. An eighth competency was added later. The Committee 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, p22).

In 2002, DEST commissioned the 'Employability Skills for the Future Report', which provided advice on the following key areas: possible new requirements for generic employability competencies that industry requires; clear definitions of what Australian and leading business enterprises mean by 'employability' skills; a proposed suite of employability skills, including outlines of assessment, certification and reporting of performance options that suit both industry and education; and industry (small, medium and large business) reactions to the proposed suite and reporting options (DEST, 2002, p2). The report developed an "Employability Skills Framework" consisting of personal attributes, skills and elements.

The framework of the 'Employability Skills for the Future' 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' with the Mayer Competencies, and, thirdly, small, medium and large firms identify the same critical mix of skills as being necessary for employability and continued employment for employees.

Employability and graduate employability skills: some limitations

Although the 'Employability Skills' (DEST, 2002) and the 'Graduate Employability Skills' (DEST, 2007) reports framework provide good insights into what set of skills may be required by undergraduates and a changing workforce, a number of limitations emerge both in terms of the methodology employed and conclusions arrived at. Firstly, in trying to determine the 'Employability Skill' set, the researchers employed a qualitative approach that concentrated on gathering the views of key industry informants. This included interviews with key senior managers:

“...to determine the views of individual enterprises on necessary employability skills, approaches to developing, tracking and assessing employability skills and how educational providers could play a more effective role in developing employability skills” (DEST, 2002, p2).

Two crucial limitations become apparent. Firstly, the report only sought views from industry ‘experts’ neglecting the views of other stakeholders (e.g. trade unions, educators and employee representatives). The second is that it did not seek an understanding of the requirements of occupations and the human capital needs of employees. A study of occupations as conducted by O*NET can provide a more detailed and profound understanding of worker activities at work, while a study of human capital attributes of workers provides a more thorough understanding of the skill needs embodied in workers. Nevertheless, it is important to note that this omission can also be found in the international literature. Examples of these are detailed in ACER (2001, pp38–41).

The O*NET

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, its first 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.

O*NET skills

The approach taken by the O*NET to define skill is that of Mumford, Peterson & Childs (1999). They define skill as a set of general procedures that underlie the effective acquisition and application of knowledge in different areas of endeavour. 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. Esposto (2008) provides a detailed explanation of these. The results have been arranged to fit the employability skills categories as shown in Table 1.

The Monash Forecasting System and the O*NET interface

The demand for labour depends on many factors:

- the state of macroeconomic health of the domestic economy and of the economies of trading partners;
- the amount of capital investment and its allocation between industries;
- 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 (contributing 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 (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 to obtain specific employment forecasts for 340 occupations at the four-digit level of ASCO. A technical explanation of the operations and application of the MFS can be found in Dixon and Rimmer (2002). 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.

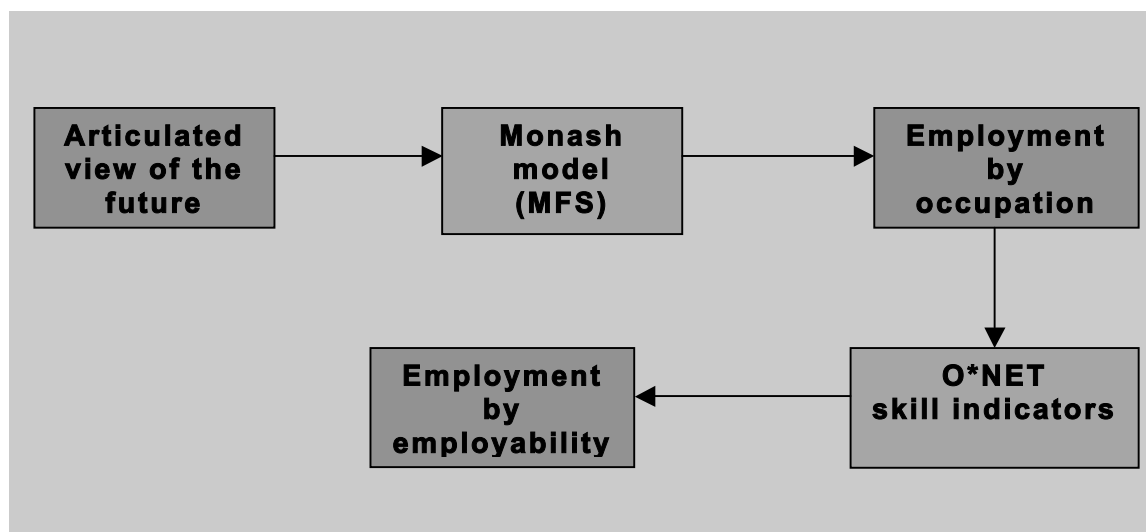


Figure 1: The Monash Forecasting System *Source:* Author design

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 annum for *601 Visioning* to 1.59 % for *703 Management of material resources*.

The average annual growth rate of 1.59 % for *Management of material resources* translates into a total average growth rate of 12.72 % 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 % in the base period).

Concluding remarks

The Australian economy is currently experiencing a period of economic hardship arising from the worldwide financial crisis. Furthermore, an ageing population means the future growth in labour supply is likely to be relatively slow. In these circumstances, the allocation of training resources, particularly in the university and 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. 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 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.

Table 1: Average annual growth rates of hours worked, O*NET Employability Skill Groups, Australia, Hours, % per annum *Source:* Authors calculations.

Skill group	Historical data	Total growth	Forecast	Total forecast
	1996–97 to 2004–05 (%)	1996–97 to 2004–05 (%)	2004–05 to 2012–13 (%)	2004–05 to 2012–13 (%)
Communication skills	1.59	12.74	1.14	9.10
Reading and comprehension	1.50	12.00	1.08	8.64
Active listening	1.61	12.88	1.11	8.88
Writing	1.58	12.64	1.16	9.28
Speaking	1.68	13.44	1.20	9.60
Team work skills	1.69	13.52	1.21	9.67
Social perceptiveness	1.68	13.44	1.20	9.60
Coordination	1.69	13.52	1.14	9.12
Persuasion	1.76	14.08	1.29	10.32
Negotiation	1.78	14.24	1.27	10.16
Instructing	1.62	12.96	1.23	9.84
Service orientation	1.61	12.88	1.12	8.96
Problem-solving skills	1.61	12.91	1.16	9.27
Problem identification	1.59	12.72	1.14	9.12
Information gathering	1.58	12.64	1.14	9.12
Information organisation	1.46	11.68	1.06	8.48
Synthesis/Reorganisation	1.63	13.04	1.17	9.36
Idea generation	1.70	13.60	1.21	9.68
Idea evaluation	1.66	13.28	1.18	9.44
Implementation planning	1.67	13.36	1.20	9.60
Solution appraisal	1.62	12.96	1.17	9.36
Self-management skills	2.20	17.60	1.53	12.24
Time management	2.20	17.60	1.53	12.24
Planning and organising skills	2.11	16.85	1.41	11.31
Management of financial resources	1.99	15.92	1.35	10.80
Management of material resources	2.34	18.72	1.59	12.72
Management of personnel resources	1.99	15.92	1.30	10.40
Technology skills	1.38	11.02	0.93	7.42
Operations analysis	1.62	12.96	1.14	9.12
Technology design	1.46	11.68	0.97	7.76
Equipment selection	1.38	11.04	0.88	7.04
Installation	1.37	10.96	0.78	6.24
Programming	1.57	12.56	1.12	8.96
Testing	1.33	10.64	0.93	7.44
Operation monitoring	1.34	10.72	0.96	7.68
Operation and control	1.28	10.24	0.87	6.96
Product inspection	1.25	10.00	0.88	7.04
Equipment maintenance	1.38	11.04	0.97	7.76
Troubleshooting	1.11	8.88	0.62	4.96
Repairing	1.27	10.16	0.81	6.48
Maths	1.54	12.32	1.07	8.56
Science	1.38	11.04	0.98	7.84
Learning skills	1.65	13.22	1.20	9.58
Critical thinking	1.71	13.68	1.24	9.92
Active learning	1.70	13.60	1.23	9.84
Learning strategies	1.63	13.04	1.21	9.68
Monitoring	1.57	12.56	1.11	8.88
Initiative and enterprise skills	1.83	14.65	1.25	10.00
Visioning	1.10	8.80	0.57	4.56
Systems perception	1.95	15.60	1.38	11.04
Identifying downstream consequences	2.04	16.32	1.46	11.68
Identification of key causes	2.04	16.32	1.45	11.60
Judgement and decision making	1.93	15.44	1.34	10.72
Systems evaluation	1.93	15.44	1.30	10.40
All skill groups	1.63	13.04	1.14	9.12

One purpose of economic research is to develop analytical tools with which to furnish better information to economic policy makers. The modelling system described here 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 application of such forecasts can further assist the university sector to develop graduate attributes that are closely connected to the employability skills requirements of the labour force. Furthermore, the forecasts can also play two major roles: to assist university administrators to allocate resources to courses that meet the labour market needs of an expanding or contracting economy or sectors of the economy; and to assist academics in the preparation of courses that meet students' employability skills requirements of a rapidly changing labour market.

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