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Skills shortages: concepts, measurement and implications

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Executive summary

Skill shortages are frequently highlighted in the media with comments from governments, employers and unions. Reports on shortages of information technology and communication (ICT) skills featured regularly until quite recently, while those on trade skills seem to be perennial. Similarly, shortages of teachers and nurses have been in the news.

The Department of Employment and Workplace Relations (DEWR) publishes a list of professional and trade occupations in which skill shortages are assessed annually (DEWR 2003b). Skills shortages in the ICT sector are assessed every six months.

If the numbers of workers required in particular skilled jobs exceeds the number available for work a shortage occurs. This shortage can be caused by an expansion in the numbers demanded or a contraction in the numbers available for work. There is a range of causes of changes in demand for skilled labour: new products; new technology, new workplace arrangements and shifts in the composition of industry associated with globalisation. Supply of skills can change for reasons such as the ageing of the workforce, changed attractiveness of particular employment, and changes in the numbers entering and completing training.

Shortages therefore can be caused or removed by changes in a number of factors affecting supply and demand, one of which is training. The appropriateness of changing the level of provision of training as a response to a shortage depends on the type of shortage, the level of its severity and the factors causing it.

Skills imbalances lead to sub-optimal production and, depending on the technology, may substantially inhibit production. Shortages may also make a country less competitive in a fast moving global economy.

Shortages are one of the issues that public training authorities are concerned with when considering the provision of training. In conjunction with their broader aims for the education and training system, they are concerned to help reduce labour shortage or surplus problems. To fulfil this role, they need to be able to identify current and predict future skills imbalances, both in quantity and quality, and often by geographical regions. The question is how do we know when there is a shortage of a particular occupational skill, and what does the government do about it? While initially it may appear that government action is needed to deal with a shortage, it may not always be the best first option. Often the market will take sufficient corrective actions to alleviate shortages. Government intervention may be counterproductive if its effect is too late or it over-corrects the problem.

Despite its wide publicity and common usage, the concept of skills shortage has different meaning to different people depending on their perspective. Understanding the different concepts of skills shortages, their measurement and the causes of skill shortages is important if sound policies are to be developed in the areas of employment, education, training and skill formation.

This paper aims to contribute to an understanding of the issues. It provides a context for the study by considering recent reviews of skill needs and an overview

of the meaning of skills with particular attention to generic skills as well as more vocational skills.

Definitions

There are different meanings attached to the term skills shortages. A distinction is made between the concepts of skills shortages with skills gaps and recruitment difficulties.

A shortage occurs when the demand for workers for a particular occupation is greater than the supply of workers who are qualified, available and willing to work under existing market conditions, and if the supply is greater than demand then there is a surplus. Over time, the market might adjust in a number of ways, including price and/or quantity adjustment, and the imbalance clears.

A skills gap refers to a situation where employers are hiring workers whom they consider under-skilled or that their existing workforce is under-skilled relative to some desired level.

Recruitment difficulties refer to the situation when employers cannot fill vacancies in spite of an adequate supply of workers. The reasons for this may be varied. They could include such things as relatively low remuneration being offered, poor working conditions or image of the industry, unsatisfactory working hours, commuting difficulties, ineffective recruitment effort by the firm or skills needs that are very specific to the firm.

Causes

If it is assumed that demand for and supply of labour are very responsive to changes in wages and that wages are very flexible then shortages should not persist for very long. It is clear that these assumptions do not hold, for example, where the technology of production requires particular forms of skilled labour, where that labour takes considerable time to train and where for various reasons wages may not be very flexible.

The paper explores ways in which shifts in demand can give rise to shortages that may persist for a considerable time. It outlines how an enterprise may respond with changes in overtime, an increase in casual employment or an increase in ongoing employment. An increase in output especially in the short term will often lead to an increase in costs including recruitment costs and increases in wages.

Wages are not always flexible for various reasons including the time taken by employers to deal with the problem, the implications for the wages of existing staff and the industrial relations arrangements. The flexibility varies across occupations and industries. While the relative earnings of computer professionals in the period from 1996 to 2002 clearly increased, in a number of trade occupations which have experienced persistent shortages there is little evidence of any increase in relative earnings.

Supply may not adjust quickly to increases in wages or other inducements to enter an occupation. Supply of labour to an occupation is affected by retention of workers, which can alter with the attractiveness of the work, other opportunities and the ageing of the workforce. There is a lag in the time training institutions take to recognise a shortage and adjust the available training places. There may be a

further lag or lack of response from students to enter particular forms of training. The recruitment of apprentices is affected by employers' willingness to take on apprentices and the willingness of individuals to apply for any new positions.

In the process of adjustment, a key factor is information: for employers, employees, for governments and training authorities. Often information about shortages or available supply of labour is localised. The challenge for public authorities is to try to improve its dissemination.

Identification of skills shortages

Skills shortages are mainly identified through well-constructed employer surveys and other economic data. Ad hoc employer surveys, which often give inconsistent results, are another source of information that is also used.

Employer-based surveys are commonly used to assess skills shortages. They rely on employers' perceptions of skills imbalances, which often show a misunderstanding of the concepts of skills shortages, recruitment difficulties and skills gaps. The very careful construction of the DEWR survey is notable and discussed below. The information from these surveys, in conjunction with other economic indicators, should be used to identify skills shortages.

Vacancy or hard-to-fill vacancy rates are sometimes used to assess the tightness in the labour market. A situation with a large number of vacancies, especially hard-to-fill vacancies, is indicative of a skills shortage. Vacancy statistics tend to overestimate market needs because of job-to-job turnover of workers within and across occupations. If both vacancy and unemployment statistics are available, then the unemployment-vacancy (UV) technique of analysis is often used to study the nexus between unemployment and vacancies at the aggregate level. At any point in time, unemployment and vacancies co-exist largely because of labour turnover and not necessarily because of deficiencies in the job matching process.

Changes in relative wages can be used to study occupational labour market imbalances. As the market slowly adjusts to the shortages for particular skills by increasing wages, this trend will be observed as changing wage differentials over time.

Other measures that give additional information on the tightening of a labour market and the actual or potential imbalances include: hours and intensity of work (i.e. overtime, short-time etc); production levels; employment levels; flows of new entrants and leavers; training expenditure by firms; levels of subcontracting; hiring standards; and levels of immigration by skill group.

Market-wide structural models of supply and demand can be used to assess the effects of shocks on the current and future labour market. Many models of this type are for occupational labour demand. The models offer the potential for a more rigorous study of imbalances because of their strong theoretical underpinning. The large amount of data required to estimate the models is often a barrier to their more widespread use.

A holistic approach that considers a raft of measures for a group of related occupations is more likely to provide robust information on imbalances. This approach includes not only all available indicators in a coherent framework in both time series and cross section modes, but also new data generated through additional surveys and through meetings of the interested partners. Information should also

be gathered on the workings of the relevant labour market together with demographic and educational characteristics of the employees.

Selected Australian studies

The paper provides a short overview of some recent Australian studies of skill shortages.

In Australia, the only agency that monitors skills shortages and recruitment difficulties across a wide range of skilled occupations is the DEWR. It has developed it owns methodology to collect data on these issues. The technique has been in use over a number of years. The methodology distinguishes between skills shortages and recruitment difficulties. DEWR also augments information on skills shortages with information on other areas of the labour market, including future job prospects in all occupations. Assessment of future job prospects is based on forecasts of occupational growth and job turnover.

The skills shortage list released in 2003 contained 14 professional and 20 trade occupations with a national skills shortage. Skills shortages ICT had almost disappeared. They remained only in certain specialisations. Registered nurse shortages were across a large number of specialisations but secondary teacher shortages were in just a few specialisations. Some occupations had shortages only in certain geographic locations.

The Victorian government publication, *ICT Skills Snapshot*, also provides labour market information but only in the ICT sector. It uses the DEWR list of occupations in shortage but also includes a variety of other state-level economic indicators. The information is regularly updated.

A number of other in-depth studies on shortages in ICT and trade occupations have been published in the last few years. All these studies reflect the situation at one point in time and therefore may not be a reflection of the current situation. The studies vary in the breadth and depth of analysis presented. A number of them are for ICT and an illustration is provided of the differences in approaches and the time lag in recognising the change from shortage to surplus in a number of skill areas.

Policy responses

The paper provides an overview of policy responses to skills shortages. Many shortages will resolve themselves or are the responsibility of employers to provide incentives to recruit and retain workers. The public responses can include:

- improving the information system on skill needs such as the work of DEWR;
- supporting mobility of workers in a range of ways including national recognition of qualifications supported under the Australian Quality Training Framework;
- targeting immigration to skills in demand as undertaken by the Department of Immigration, Multicultural and Indigenous Affairs (DIMIA);
- supporting a range of activities to encourage employers to provide more training; and
- adjusting the size and pattern of publicly supported training.

Summing up

Economic theory suggests that some skills imbalances are a feature of a competitive market. Without major hindrances to the market adjustment process, these imbalances resolve over time and may not require intervention. The main drivers of the changing skills requirements are demographic, organisational, social and technological. Adjustment usually takes time because of the speed at which the information about the changes in the market gets dissipated and the time it takes an individual to acquire new skills.

However, real-world decentralised labour markets are seldom perfect and may not lead to optimal allocation of resources. Government action to correct the market may be justified if there is strong evidence showing sub-optimality. Before any effective policy is designed and implemented, it is important to understand the operation of the current market and to investigate reasons for its failure. Lack of good empirical knowledge of how markets adjust, and the time lag between an imbalance being observed and the impact of a policy makes effective intervention difficult in practice.

1. Introduction

The problem of skill shortages is regularly highlighted in the media with comments from, governments, employers and unions. Reports of shortages are more likely during times of economic boom. Surpluses are more likely during recessions, but they do not attract the same degree of media attention as shortages, even though they may be important from a public policy perspective. Reports on shortages of information technology and communication (ICT) skills featured regularly until quite recently, while those on trade skills seem to be perennial. Similarly, shortages of teachers and nurses have been in the news.

The Department of Employment and Workplace Relations (DEWR) publishes a list of professional and trade occupations in which skill shortages have been assessed on an annual basis (DEWR 2003b). Other countries assess skill shortages as well. For example, European Commission (2000) identified labour shortages across a range of sectors and occupations (from ICT to agriculture and retail). It considered these shortages as the main bottleneck to growth in a number of European countries.

If the numbers of workers required in particular skilled jobs exceeds the number available for work a shortage occurs. This shortage can be caused by an expansion in the numbers demanded or a contraction in the numbers available for work. There can be a range of causes of changes in demand for skilled labour: new products; new technology; new workplace arrangements; and shifts in the composition of industry associated with globalisation. Supply of skills can change for reasons such as the ageing of the workforce, changed attractiveness of particular employment, and changes in the numbers entering and completing training.

Shortages therefore can be caused or removed by changes in a number of factors affecting supply and demand, one of which is training. Whether changes in the provision of training, is the appropriate response to a shortage depends on the type of shortage, the level of its severity and the factors causing it.

Senker (1992) contends that those who argue that skill imbalances are unimportant because they are usually short-lived, volatile and difficult to assess, do not understand the problem. Skills imbalances lead to sub-optimal production. If employers were to react to skills shortages by bidding up wages in ways that do not match productivity growth then higher inflation could result. Another effect of bidding up wages in times of shortages is that the existing supply of workers circulates more quickly between employers, thus making retention more difficult and the employees involved less productive. Valuable management time is also taken up in less productive recruitment and retention activities (Bosworth & Pearson 1992). Shortages can also make a country less competitive in a fast moving global economy.

Public training authorities often see their function as that of adjusting the provision of training so that labour shortage or surplus problems in the economy are minimised. To fulfil this role, they need to be able to identify current and predict future skills imbalances, both in quantity and quality, and often by geographical regions. The difficulty of this task is often misunderstood. How do we know when there is a shortage of a particular occupational skill, and what does the government

do about it? While initially it may appear that government action is called for to do something about the shortage, it may not always be the best first option. Often the market will take sufficient corrective actions to alleviate shortages. Government intervention may be counterproductive if its effect is too late or it over-corrects the problem.

Despite its wide publicity and common usage, the concept of skills shortage has different meaning to different people depending on their status as an economic agent. Understanding the different concepts of skills shortages, their causes and its measurement is important for policy analysts in education and training, employers, employees and labour market intermediaries, if sound policies are to be developed in the areas of employment, education, training and skill formation.

This paper aims to contribute to an understanding of the issues. Section 2 of the paper provides an overview on skills needs. Section 3 considers the definition and causes of skills shortages, while section 4 reviews the various ways skills shortages can be identified and measured. Selected studies of skills shortages in Australia are considered in section 5 and some of the policy implications in section 6.

2. Context

The consideration of shortages has to be placed in the broader context of the supply and demand for skilled labour. There is broad agreement that increased levels of skills in the workforce and the associated investment in education and training are important for enhanced economic performance. Human capital has been widely recognised as the prime mover for economic growth and the spread of the knowledge economy (OECD 2000). Its importance in the production process is as important, if not more so, as physical capital. Globalisation is making physical capital a lot more mobile and complementary development of human capital is becoming crucial for international competitiveness. A more critical issue than just knowing the importance of education and training is that of the nature of skills that are required to make a difference and ways to develop them (OECD 2001). Evidence of occupational shortages or surpluses provides some guidance for policy.

The continual flux of the economy with ebbs and flows of shortages and surpluses gives seemingly conflicting messages. The development of a knowledge economy with a highly skilled and educated workforce that is able to respond quickly to ever more technological advances and organisational changes has had increasing emphasis. At the same time, analyses of employment patterns suggest bimodal demand patterns (Maglen & Shah 1999; Shah & Burke 2003a). On the one hand a shift towards high-skilled jobs and technological and organisational changes point to demand for higher skills, but on the other hand, employment in occupations requiring lesser skills has been rising substantially too. Furthermore, predictions have been made of technical change leading to deskilling of some parts of the workforce.

The overall assessment of skill needs in Australia is to be addressed in a series of annual reports by the Australian National Training Authority (ANTA) National Skills Forum. The first of these reports, *National Skills Report*, was released recently (ANTA National Skills Forum 2003). The report states three aims:

- provide a general overview of the state of play of industry skill needs, including identifying where there are pressing areas of skill shortage now and where there are common problems across industry;
- outline the drivers of industry demand for skills, so we can anticipate future skills needs; and
- identify what priority areas need to be addressed at a national or policy level to ensure future industry skill needs are met, with a particular focus on what training response is needed.

It outlines the main drivers of industry demand for skills. Worker attraction and retention were considered major drivers affecting all industries. Other major drivers identified as affecting skill needs are technological advancement, globalisation, health and safety issues, consumer and customer service demands, and regulatory compliance.

This first report does not identify areas of skill shortage or the priority areas need to be addressed to ensure industry skill needs. It does include a discussion of the future employment outlook and employment trends by industry sectors. For

example, employment growth over the decade to 2012 is anticipated to average 1.1 per cent per annum. However job growth provides less than half the opportunities for new entrant and hence the demand for training job openings for new entrants as result of net turnover (replacement needs) are expected to average over two per cent per year (Shah & Burke 2001).

There has also been a stream of government reports, at both the state and federal levels, on this issue of skills. In 2001, the New South Wales government released *Beyond Flexibility: Skills and Work in the Future* (Buchanan et al. 2001). The following year, Minister Lynne Kosky in Victoria released a statement, *Knowledge & Skills For the Knowledge Economy* (Kosky 2002). The statement was accompanied by studies on key factors affecting the future demand for skills (Shah et al. 2002) and supply of skills for future needs (NCVER 2002). In 2003, the South Australian government released *Skills for the Future* (Government of South Australia 2003).

It is against this background of the ongoing concern for skills and the appropriate policy responses that this paper reviews the issues relating to skills shortages.

3. Definition and causes of skills shortage

Employers, employees and policy analysts have varying perspectives on what skills shortages mean. The lack of a common understanding of the concept often obscures analyses of problems, their causes and possible solutions for them. According to Arrow and Capron (1959) some proposals for solving shortage problems stem from a misunderstanding of the causes of shortages as well as from an exaggeration of the evidence. It is important to be clear about the various usage of the concept and isolate the circumstances in which employers, for example, will complain of shortages.

A number of studies provide a theoretical framework explaining the concept of skills imbalance, its measurement and the associated practical problems. Some recent ones include Bosworth, Dutton and Lewis (1992), Roy, Henson and Lavoie (1996), Borghans, de Grip and van Smoorenburg (1998), Veneri (1999) and Frogner (2002). This section contains a discussion on:

- what skills are;
- various meanings of skills shortage; and
- the causes of skills shortage.

3.1 What are skills?

A skill is an ability to perform a productive task at certain level of competence. As a skill is associated with a particular task, a person who does not possess such a skill is unlikely to be able to carry out this task or will be less productive than somebody who does possess this skill. Skills are often associated with a qualification and its acquisition through formal education and training. However, an individual can acquire skills in other ways, including various forms of informal learning and on-the-job experience. A hierarchical structure for skills is often used with each skill's placing determined by the level of knowledge needed and the autonomy of decision-making involved in completing the set of tasks. Most occupational classifications also have a hierarchical structure. The definition of an occupation has two dimensions—the set of tasks done by a person occupied in it and the bundle of skills a person in the occupation should possess.

The classification of skills is often general or specific although the boundary between the two is often blurred. General skills are transferable or portable across a range of different occupations. General skills include those that are now known as generic including basic literacy and numeracy, but increasingly computer literacy. These are the basic generic skills. Other skills such as 'employability skills', are often considered generic in nature. These include interpersonal skills, reliability and punctuality and working with others and in teams. The analysis of *Employer Manpower and Skills Survey* in Britain by Green, Machin and Wilkinson (1998)

showed some employers valued motivational and attitudinal skills very highly and indicated a deficiency of these skills among their employees. More advanced skills are often difficult to develop without a good grounding in generic skills, in particular the basic generic skills.

Employers loathe paying employees to acquire basic generic skills because they perceive employees to be the main beneficiaries of the returns to these skills. The public usually pays for either the total cost or else a very significant part of the cost of providing generic skills. Benefits of generic skills extend beyond the labour market. They play a part in developing social capital. Individuals with a good grounding of generic skills are more likely to partake in civic life of society.

Vocational skills transferable across employers are also referred to as general skills, as distinct from those useful only to a particular employer. According to Becker (1962), firms will not pay for the training for general skills, but in practice, many do (Long et al. 2000). If the skill is very firm-specific, or transferable across only a small number of firms, then employee wages may not rise as much as the productivity of the trained worker, and hence the firm can appropriate some of the returns to these skills. In such cases, the firm has a greater incentive to invest in an employee acquiring the skill.

According to Bosworth, Dutton and Lewis (1992), the term skill may be open to a number of interpretations by employers. For some it may refer to the ability to learn tasks rather than an acquired skill. Other employers may place a higher value on behavioural skills exhibited at an interview rather than on certified skills. This can happen when a particular certified skill is common among many applicants or its quality is in doubt. It may also happen that the recruiter is looking for a particular type of person, perhaps in his or her own image, rather than for the skills necessary to undertake a particular job.

Over time, old skills may disappear, and because of technological and organisational changes, new ones may be developed. In times of very rapid technological changes, the shelf life of some skills diminishes quickly and skill obsolescence becomes a problem.

This discussion of the nature of skills has been included because as will be seen below some notions of skills shortage are to do with the absence of particular skills among current employees in a firm rather than a shortage of numbers of people available for work.

3.2 Meanings of skills shortage

This section considers the different meanings attached to the term skills shortages and the way they arise in the internal and external labour markets. In practice, the term skills shortage describes a variety of situations, some of which are not synonymous with what would be considered an actual market shortage. The discussion contrasts the concepts of *skills shortages* with *skills gaps* and *recruitment difficulties*.

Skills shortage

A shortage occurs when the demand for workers for a particular occupation is greater than the supply of workers who are qualified, available and willing to work under existing market conditions, and if the supply is greater than demand then there is a surplus. A shortage may be evident only in particular specialisations in an occupation, it does not have to be across the whole occupation. Furthermore, it may be restricted to particular geographical locations. Over time, the market might adjust in a number of ways, including price and/or quantity adjustment, and the imbalance clears.

In practical work, shortages have always been interpreted or even defined directly, in terms of difficulties in filling vacancies. In general, a shortage in an occupation is the aggregation of *hard-to-fill* vacancies across firms. These vacancies are those that remain unfilled after a certain time in spite of all reasonable efforts by the firm.

Employers may report shortages of particular workers, or difficulties in filling vacancies, either because there are not enough of them or else those who are available do not possess skills now deemed necessary by employers, such as computer literacy. Shortages of the first type are quantitative while those of the second type are qualitative. If in a tight labour market employers accept applicants whose skills do not match the 'ideal', then from the employers' perspective a shortage exists but from a market perspective the positions were filled and hence no shortage exists. Conversely, in a slack labour market if over-qualified people fill positions then the market may not show an imbalance. For example, in Victoria in the second half of 2002, in a majority of ICT positions that were filled, the candidates had a higher qualification than was required for the job (Department of Infrastructure 2003).

Shortages in the internal and external labour markets

It is important to distinguish between skills shortage in the *internal* labour market of the firm and the *external* labour market. The external labour market is the aggregation of all firms' demands and individuals' supplies of a specific skill at a given time in a given geographical location and under average market conditions. The internal labour market is an individual firm's own labour force, which can be reallocated within the firm. The internal market interacts with the external market in varying degrees when it loses or recruits workers from outside the firm.

The following brief discussion of the internal labour market follows the presentation in Bosworth and Warren (1992). It will help understanding of the remainder of the paper. The following factor demand model can represent the current production activities of a firm:

$$Y = f(K, U, H, E), \qquad (1)$$

where Y denotes the current output, K is the capital stock, U is the proportionate utilisation of capital stock, E is the total number of employees and H is the hours of work per employee (Nadiri & Rosen 1969)). All factors inputs are imperfect substitutes although additional capital stock and greater utilisation of existing capital are close substitutes, and so are the number of employees and hours worked per employee. An increase in product demand will create a gap in the current and desired factor demands. A gap can also occur because of a reduction in the normal hours of work or a loss of employees due to wastage.

In the short run, firms may react to an increase in the product demand with a range of coping mechanisms that may involve reallocation of resources within the internal labour market because of the time lags involved in recruitment from the external market:

- they may increase hours of work per employee by reducing short time or increasing overtime and/or by offering to convert part-time contracts to full-time; this may also increase capital utilisation;
- changing the incentive system could increase worker effort and thus improve efficiency (Akerlof & Yellen 1986; Solow 1979); and
- employers may retrain existing staff to meet new skills demand.

The employer responses are to counteract anticipated (ex-ante) skills shortages. Hence, actual (ex-post) shortages are often lower than the anticipated shortages.

The empirical literature suggests hours and capital utilisation are quickest to adjust, followed by employment and lastly stock of capital. When a firm attempts to adjust employment to meet new product demand then its response shifts to interaction with the external labour market.

The hiring costs increase disproportionately with the time required to make appointments. In a tight labour market, a firm may conclude that it has skills shortages if the costs of making an appointment within a certain time are excessive. If the expansion in product demand is unsustainable, then additional costs in terms of firing costs will be involved. Therefore, in such a situation, the firm may only hire new labour on a casual basis, and only when there is more certainty in the demand for the product sustaining will it begin to put the new employees on ongoing contracts.

Thus, in the first instance, a firm is likely to rely on its internal labour market and failing that will seek recruits from the external labour market provided it is more cost effective. Both routes raise costs at the margin. A firm may thus equate the rising labour and hiring costs with the existence of a skills shortage. In a competitive market where the firm has to sell its product at the going price, it may not be profitable for it to meet the whole of the potential increase in the demand for its product. Only expansion in output by other existing firms can meet the increased product demand. Each firm would see this as a shortage situation because the higher output would be profitable if they had sufficient employees working at 'normal' hours, levels of wages and effort.

In the longer term, with continuing shortages, a firm may judge it less expensive to use less or differently qualified workers in the areas of skill shortage. This may involve the recruitment or redeployment of less skilled workers, work reorganisation and an increase in training whether internal or purchased from a training provider[1].

[1] Bosworth and Warren (1992) also discuss shortages arising from disjunction in the continuum of flows up career ladders within a heterogenous internal labour market of a firm. Disproportionate wastage at the top could result in insufficient numbers at lower levels able to fill the gaps created. This may mean a quality gap if those available to take the positions are not experienced enough to take on the role. Resorting to the external labour market to fill the vacancies in such cases is more complex because of the need for the applicant to have significant amount of firm-specific experience and training. It also has the potential to disrupt the general ethos of internal opportunity and promotion.

Skills gaps

Employers may express concerns about skills when an actual shortage, in terms of the number of workers available and willing to work, does not exist but they are hiring workers they consider under-skilled or that their existing workforce is under-skilled relative to some desired level. Green, Machin and Wilkinson (1998) refer to this case as that of a *skills deficiency* while DEWR and others refer to it simply as a *skills gap*.

Skills gaps do not simply relate to formal qualifications. Employees in a particular trade may possess the necessary vocational qualification relevant to their occupation, but may lack generic skills such as computer literacy, customer relations or inter-personal communication skills. For example, a group of motor mechanics employed in a garage may all possess appropriate trade certificates but some may lack communication skills, thus preventing them from contributing optimally to meeting the business's objectives.

Another aspect of a skills gap is one that Roy, Henson and Lavoie (1996) call the *normative* skills gap. It is the gap between *what is* and *what should be*. For example, government target of particular registered nurse/patient ratio in public hospitals is a benchmark against which to assess skills shortages. Another example relates to a government's desire to establish a particular industry in the country for strategic reasons, for example, the ICT industry in the 1980s and 1990s and currently the biotechnology industry. In such cases, it may manage the short-term supply and demand to enable the industry to get a longer-term foothold in the global economy. Particular employment targets are set against which skill shortages are assessed.

In some instances skills gap may be latent. This can occur when employers do not perceive there is a problem because they are not fully aware of skills needed for optimal production.

Recruitment difficulties

Employers may face other recruitment difficulties when they cannot fill vacancies in spite of an adequate supply of workers. The reasons for this may be varied. They could include such things as relatively low remuneration being offered, poor working conditions, poor image of the industry, unsatisfactory working hours, location hard to commute to, ineffective recruitment effort by the firm or skills needs that are very specific to the firm. Recruitment difficulties are often not experienced by sufficient number of firms to translate into a difficulty or a shortage at the market level.

In practical terms, recruitment difficulties are also hard-to-fill vacancies but they are experienced by a limited number of firms only, and thus do not amount to a market-wide shortage.

The above definition of recruitment difficulties is one adopted by DEWR who makes the distinction between recruitment difficulties and skills shortage. In the UK however, the National Skills Task Force (2000) call these *other recruitment difficulties*, while the term *recruitment difficulty* is used in a broader sense and encompasses both the skills shortage and recruitment difficulty as defined above.

Employers' perspective

Green, Machin and Wilkinson (1998) ask the question: What do employers mean when they say that they face a skills shortage? It matters what they mean because often they are the main, if not the only, source of data allowing judgements to be made about the existence of a skills imbalance in the market. Employers' views affect the general perceptions of the adequacy, or otherwise, of skills supply. This issue becomes of significance in a system where employers' influence on skills development is dominant. In Australia, the trend over the past decade and half has been for increasing employer influence on vocational education and training policies, and therefore, the above questions are important.

The analysis of an employer-based survey of skills and skills shortages by Green, Machin and Wilkinson show that although many employers equate skills shortages with hard-to-fill vacancies, a substantial number do not. The analysis showed that some employers' views of skills shortages overlapped with that of skills deficiency (gap) or recruitment difficulties. This means that one has to be careful in drawing conclusions about skills shortage solely based on ad-hoc employer-based surveys.

Union perspective

Skill is central to the bargaining between labour and management over wages (Rainbird 1992). Thus, it is expected that the views of unions on skills shortages, in terms of quantity and quality, would be at variance with those of employers. Unions generally want to improve the skill level of their members because higher skills increase their bargaining power in wage negotiations. Employers may consider themselves as facing a shortage at the original wage, but be unwilling to employ additional workers at the higher wage. Some unions' insistence on a small or no wage differential between specialisations can be a cause of shortages. The union perspectives on skills shortages, however, are not uniform and depend on the union's strength and the nature of the labour market in which they operate.

In occupations with strong union representation, such as nursing and teaching where demand is set against some desired staffing standards, it would appear to be in the interest of the union to over state the extent of current and future skills shortages because it helps push up the wages of new entrants and increase union membership. It is hoped that there would be a wages flow-on for the benefit of already employed members. However, this may not be their only objective. Often their perspective of shortages is based on their desire to offer better quality services. For example, when nursing unions talk about shortages they may actually be a referring to normative skills gap, because their calculation of nurse needs is often based on a certain desired nurse/patient ratio that will help deliver better quality care. Similarly, teacher unions may base their calculation of teacher needs on a desired teacher/pupil ratio.

The organisation and monopoly power of some unions or professional associations assist in creating scarcity of skills. Through certification and lengthy periods of training, entry into the union and the occupation is controlled. For example, some medical specialist groups have significant powers over who will be admitted for training and the numbers that will be trained (Borland 2002; Seldon, Jung & Cavazos 1998; Friedman & Kuznets 1945).

3.3 Causes of skills shortages

Changes in the supply of and demand for occupational skills are normal features of market economies. Some component of the variation is always random while other components may be determined by a number of factors and may include trend and/or cyclic components. The trend components of demand may be apparent over the long term only. They may be a result of changes in technology, work organisation, shifts in consumer tastes, commodity price changes or demographic shifts.

Changes in supply may be due to factors such as changes in education and training provision and changes in preferences for various forms of work and to demographic changes including ageing and emigration and immigration.

The adjustments to these changes by firms and by suppliers of skills take time and are often costly. Therefore, at any given time and geographical location, there will be an imbalance between the supply of and demand for particular skills at the current wage level.

In a competitive economy, with price and wage flexibility, these imbalances can be expected to resolve and the market to clear over time. The supply of workers will increase in areas of skills in shortage as wages and the number of unfilled vacancies starts to rise. As wages rise or the shortage persists, employers may react by revising down their hiring intentions or they may try to increase capital utilisation or use other types of labour. During the adjustment process, employers will report shortages, skills gaps and recruitment difficulties. The duration of this process depends on the characteristics of the labour market, the magnitude of the changes and the speed of the adjustments. Changes in both the price (wages) and quantity play a part in the resolution of the imbalance.

Slowness in the adjustment of wages

Much of the theory about defining and identifying occupational shortages developed from research that focussed on wage movements (Blank & Stigler 1957; Arrow & Capron 1959). Veneri (1999) provides a good but short review of the literature on this. The following description of the concepts follows from an excellent report by Human Resources Development Canada (HRDC) (Roy, Henson & Lavoie 1996).

The price response to shifts in the supply or demand for certain skills may not ensue, and even if it does, it may be slow, thus resulting in skills imbalance. Some of the factors that tend to reduce the market clearing function of wage adjustments and increase its stickiness are institutional and regulatory arrangements, such as contracts of employment between employers and employees, imperfect product market competition, lack of transparency of the market, wage controls and social welfare provisions (OECD 1994).

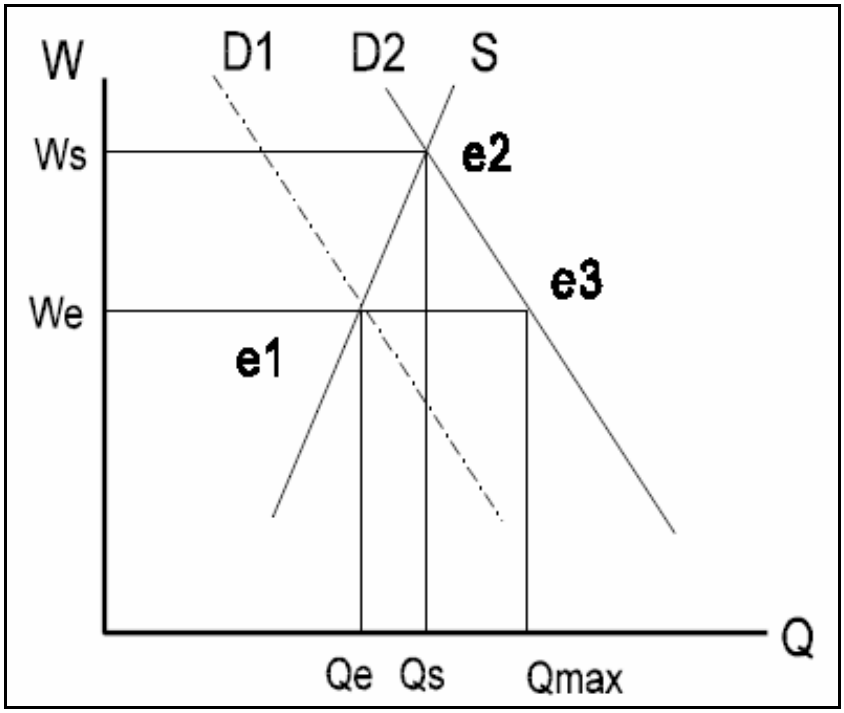
The classical price-quantity graph in Figure 1 provides a useful way to explain the role of wage adjustment in the dynamics of skills imbalance. It shows the initial demand curve for a particular skill at D1 and the supply curve at S. The market is at equilibrium at point e1 with wages We and supply of skills at Qe. Suppose the demand for the skill increases from D1 to D2, say because of some external shock. In this case, unless the wages adjust instantaneously to the new equilibrium value of

Ws, which in reality it is unlikely to at least in the short term, the quantity of skills supplied will be less than quantity demanded by the amount that is the difference between Qmax and Qe. Hence, under current market conditions, employers will be unable to hire workers with these skills and an imbalance in skills will exist.

Arrow and Capron (1959) introduced the concept of a *dynamic shortage* in which demand for a skill grows faster than supply. They explained the cause of dynamic shortage to be rapid and persistent rise in demand, low elasticity of supply and a slow market 'reaction speed'. They define reaction speed as the ratio of the rate of wage rise to the excess of demand over supply. Slow reaction time stems from a number of factors. Firstly, it takes time for firms to recognise the existence of a shortage at the current wage rate. If the initial recruitment effort fails, they often try the strategy of increasing advertising expenditure in the hope of attracting suitable applicants. This strategy is likely to fail if the equilibrium wage has indeed increased. Secondly, it takes time for the firm to decide on the level for a new wage rate and the number of employees to hire at the new rate. Thirdly, the time taken for information flow to workers regarding new opportunities and the time taken by them to take advantage of those opportunities adds to the time lag. The slow reaction time also takes account of the supply-side lags in terms of the slow recognition of opportunities by potential entrants to the occupation and training institutions.

Another impediment to wages adjusting may be the existence of a wages agreement within the firm, industry or the whole economy such as the 'Accords' in Australia in the 1980s and early 1990s. Employers' reluctance to offer higher wages to attract new recruits stems from a fear that higher salaries for new recruits will have a flow on effect on salaries of existing staff. In such situations, the firm might provide in-house training to either lesser skilled employees in the firm or new hires without the required skills to prevent wage inflation.

Figure 1 Market with increasing demand for a particular skill

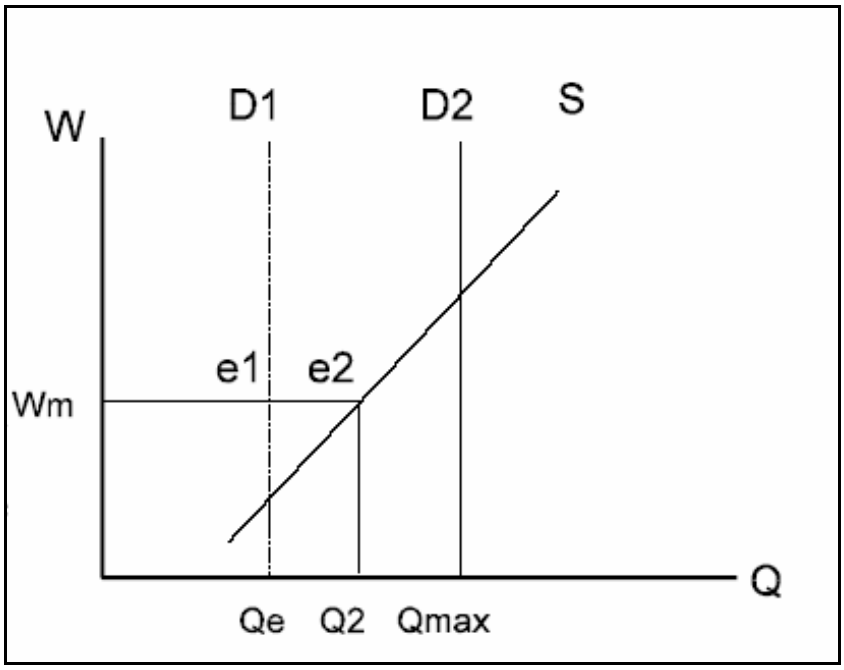


Source: Roy, Henson & Lavoie (1996)

In some sectors, the government influence on the supply of and demand for skills is significant, and the management of the market is more direct. Education and health are two examples where the government has significant influence on the management of the market. For example, for pedagogic reasons a predetermined ratio of the number of students per teacher may determine more or less, the number of teachers employed in government schools. In such a case, achievement of market equilibrium may not be possible because wage adjustments may respond very slowly to changes in demand or supply. Wage controls, imperfect competition (monopoly or monopsony) or regulatory and institutional arrangements could be the cause of these rigidities. The term 'social demand model' often refers to this type of model. In contrast to a dynamic model, this is an example of a *static* model. However for budgetary reasons sudden cuts can and do occur to the 'pedagogically predetermined ratios', as it happened in Victorian government schools in the early 1990s, which led to a sharp reduction in demand for teachers and a temporary surplus.

In Figure 2, the market is in managed equilibrium at e1. The government has set the wage at Wm, which is above the market clearing value. The demand curve is vertical because the employment of labour, Qe, is determined without reference to wages, but rather based on other criteria. If demand shifts to D2, then the equilibrium wage will rise above the set wage of Wm. Since the wage has already been set, the result will be a shortage equivalent to the difference between Qmax and Q2. The existence of another smaller buyer in the market, for example, private schools, adds some complexity to the model. However, as long as the minor player is able to offer a higher wage or better conditions than the government it is less likely to suffer a shortage.

Figure 2 Market in managed equilibrium

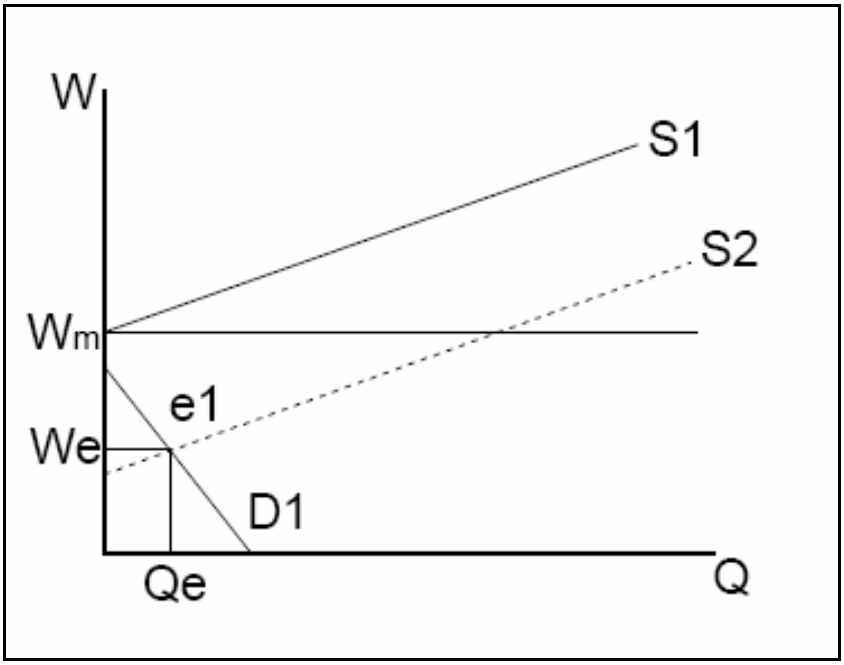


Source: Roy, Henson & Lavoie (1996)

Another cause of skills shortages is when the equilibrium wage for a particular skill is below some minimum level. Here the minimum wage could correspond to the wage equivalent of public welfare benefits payments (Roy, Henson & Lavoie 1996).

Figure 3 depicts one of these situations, typically encountered in low-skilled occupations. Initially, the equilibrium wage is We with demand D1, but no worker is willing to work at this wage because it is below the 'socially acceptable minimum wage' of Wm. Under this situation, employers will report skills shortages or recruitment difficulties. In some countries, when employers hire temporary or permanent workers from other countries the supply curve shifts to S2, and equilibrium is achieved at e1 but only if the socially acceptable minimum wage is inapplicable to the immigrant workers.

Figure 3 Market with equilibrium wage below a certain minimum



Source: Roy, Henson & Lavoie (1996)

Slowness in the adjustment of supply

As discussed in the previous section, if wages do not adjust, or adjust rather slowly, then market imbalances are likely. In a highly competitive market with small margins to play with, firms may initially try to offset shortages through non-wage adjustments because at first increased product demand may be considered temporary. Initially, and in the short term, the firm may rely on the internal labour market for a solution. Earlier we discussed some employer responses in this regard. They include adjustment to the hours of work per employee and capital utilisation intensity. Firms may also relax minimum qualifications and shift demand towards another lesser-skilled occupation where workers are available, or they may reorganise work so that workers from another occupation (perhaps with some additional training) can do some of the work of another occupation. For example, in the U.S, in response to shortage of registered nurses in the 1980s, hospitals asked existing staff to work more overtime and restructured work to make more use of nursing aides and other hospital workers (Veneri 1999). One can argue that in this case the substitution of workers was less in response to registered nurse shortage and more to do with cutting costs, particularly in private hospitals. Shortages

resulting from an inflexible supply occur in occupations for which demand and wage adjustments fail to attract sufficient jobseekers.

In Australia, good data on earnings by detailed occupation groups are not regularly available and then only with a time lag. The Australian Bureau of Statistics (ABS) survey of earnings and hours provides data for employees in 81 three-digit occupations. Between May 1996 to May 2002 there was a clear upward shift in relative earnings for professional and associate professional occupations in general, but particularly so for computer professionals (ABS 1996; 2002). However, in the area of trades, where persistent shortages are reported, there is no indication of an increase in relative earnings. It may be, as indicated in some examples reported recently that earnings have moved up in 2003 with tightening of the job market and new projects coming on stream, for example, for welders on the North West Shelf and in the automotive areas (Priest 2003). Whether these examples allow generalisation across the national market or not needs further investigation, preferably with more comprehensive data.

A decrease in the supply can also occur when individuals trained in a given area have other more attractive employment alternatives available to them. For example, nursing which is a highly feminised occupation, has had the potential pool from which to draw recruits diminish because of the large number of alternative career options that have become available to women. Men are yet to take up nursing in substantial numbers to offset this. Another occupation in which a similar problem can occur is teaching. If teachers are on a common pay structure, regardless of the subject they teach, then some schools will have difficulties competing for, say, maths graduates, with employers in private sector who are able to offer them higher salaries.

To insure against leakage of potential workers to other occupations or employers, some employers offer bonded contracts to students in training. For a long period up to the early 1970s, state governments in Australia provided financial support for fees and living expenses to student teachers if in return they promised to teach in government schools for some minimum period.

Apparent shortages can arise from an employer's preference for employees from a certain demographic or ethnic group (for example, the preference for employing young people in the ICT industry in the 1990s). They can also arise from the *two-year experience* syndrome among some employers who are reluctant to hire employees without experience.

Adjustment of training: numbers and content

There are several reasons why the adjustment of the numbers and mix of training in education institutions may be slow.

Quite often education and training requirements take a long time to complete. Examples are those for doctors, nurses and teachers and tradespersons where training of three or more years is required.

Educational institutions may be slow to adjust the number of places available for particular courses. The time taken for training authorities to recognise a particular need, the internal budgetary processes in public vocational education and training (VET) and higher education institutions and the current staffing patterns may mean that the number of places provided in areas that are in shortage may adjust slowly over the years. For example, an expansion of teacher education courses in the early

2000s has occurred but its speed and size has been limited by the willingness of universities to increase the share of their government funds allocated to education faculties.

The expansion of publicly funded places is not the only factor affecting the numbers. Students must be attracted to take up the new places, and in the case of apprenticeships secure a contract with an employer.

In the area of trades, DEWR has reported shortages persisting over a long period. For example in December 1998 there were national shortages reported for most of the metal trades and all the automotive trades (DEWRSB 1999). The list was almost the same in December 2002 (DEWR 2003b). Toner (2003) has drawn attention to the lower rate since the early 1990s of apprentices in training in these trades compared to tradespersons employed. The sharp reduction in apprenticeship training in the public sector is a notable feature. There has been a revival in the training rate in the automotive trades in the last few years, but not in the metals areas where it has further declined.

Institutional barriers, such as registration requirements also increase the time taken for quantity to adjust in response to increase in demand. For example, the power of doctors controlling registration and training was seen to restrict the numbers in training in the United States (Seldon, Jung & Cavazos 1998).

Many of the reforms to the training system of the last 15 years have been directed at improving the responsiveness to the training market. This has included making a proportion of public funds contestable especially in relation to the delivery of apprenticeships and traineeships. It also meant changes in the content of courses to reflect the workplace requirements more closely. It is not possible though to estimate how much this has lessened the problems of shortage.

Net replacement of workers who leave the occupation

Workers leaving an occupation are a factor reducing supply. The rate of turnover of workers varies by age and sex and across occupational groups. The net rate—the number leaving an occupation net of re-entrants to it—tends to be lower in the professional and more skilled occupations than in lower skilled occupations. Recent analysis of occupational net replacement needs suggest it is relatively high among the automotive trades and for hairdressing, but around average for the metals area and below average for refrigeration and air-conditioning mechanics (Shah & Burke 2003b). It was very low indeed among computing professionals who tend be very job mobile but most of the mobility is within the occupation.

Net immigration affects net replacement and can vary over time with changes in migration and the relative opportunities in Australia and overseas. In the area of trades, Toner (2003) reports that in the last half of the 1990s net migration contributed the equivalent of about 17 per cent of the total apprenticeship completions in Australia. The Department of Immigration, Multicultural and Indigenous Affairs' (DIMIA) current *Migration Occupations in Demand List* (MODL), which attract additional points for migration requirements to Australia, includes mainly nursing and health professional occupations, and (in the VET training areas) only chefs, refrigeration and air-conditioning mechanics and hairdressers (DIMIA 2003).

Lack of labour market information

Lack of reliable labour market information can hamper the speed of the market adjustment process and therefore the duration of shortages or surpluses. The availability of good quality labour market information to firms, households and education and curriculum planners is the *life-blood* of an efficient market. The information must relate to not just a particular market but across all markets. It must be available on current wage rates, rates of return, unemployment rate, job openings and supply of workers in different sub-markets. Heijke and Borghans (1998) argue that efficient training and education decision-making require transparency in the links between education and training courses and labour market opportunities.

Producing quality information is expensive, which in turn raises issues of optimal level and the level of aggregation of the information. Public provision of such information can be justified on the basis that it is a public good with many beneficiaries. In Australia, DEWR is the source of the most detailed national information on the labour market and it is made widely available from its website and other media. DEWR's information on shortages is discussed in section 5.

4. Identifying and measuring skills shortages

To develop policy responses to skills imbalance between supply and demand, it is necessary to have an indication of the size of the imbalance between supply and demand, the causes of the imbalance, the extent to which the imbalance affects production and whether, on current trends and policy settings, will it diminish rapidly.

This section considers a range of measures that provide indication of skills imbalance. As will be seen, it is rarely possible to provide an unambiguous single measure of this and it is necessary to use a range of measures to indicate the existence and possible size of an imbalance.

Approaches to identifying shortages and estimating their extent are varied. To a certain degree, this depends on whether the measurement is economy-wide or in a particular occupation. In general, the measures fall in two broad classes (Roy, Henson & Lavoie 1996).

The first class of measures includes market economic indicators, such as vacancy, hiring and separation rates, relative wage movements and employment and unemployment changes to infer imbalances for particular occupation groups. These measures provide a market-wide perspective and identify shortages only if there are insufficient number of appropriately skilled people in the market to fill vacancies at the going wage rates and employment conditions.

The second class utilises employer-based surveys, interviews and focus groups in the main to make inference on imbalances. Typically, this involves collecting and collating individual employer's experience in hiring workers with specific skills in particular occupations. In this approach, a high degree of recruitment difficulty is often associated with a shortage. A further difficulty with data from these surveys lies in attempting to discriminate between anticipated and actual shortages. The employer-based approach, described here, consists of ad-hoc collections of employers' perspectives on shortages. It is not to be confused with information generated from a well-designed establishment-based survey within the framework of an economic indicators approach.

The economic indicators approach tends to have more objectivity associated with it as it avoids the subjectivity of the employer and the analyst in the ad-hoc employer-based surveys and interviews. On the other hand, the economic indicator approach may be inadequate in analysing regulated markets such as those of teachers and nurses. From a public policy perspective, the assessment of skills imbalances should be more reliant on market indicators than ad hoc employer-based surveys, though well-constructed employer surveys will provide essential information.

4.1 Initial issues

Irrespective of the approach taken—economic indicator or ad-hoc employer-based—to find evidence of skills shortages, the results depend critically on the practical definition of skills shortage adopted, including its aggregation, time and geographical dimensions. In the case of the indicator approach, the choice of the indicators is important, and an understanding of the functioning of the particular labour market should guide their selection. Even when an ad-hoc employer-based approach is taken, an understanding of the workings of the firm should always be borne in mind in any analysis. In practice, however, two factors will more or less determine the choice—availability and reliability of the data.

Classification of occupational skills and aggregation

A well-defined and widely understood system of classifying occupational skills is imperative in any analysis of skills shortages. Skills needs in occupations are not fixed over time, and therefore any fixed classification system, even one that is skills-based, will be to a certain extent out of date by the time it has been implemented. In practice, however, intermediation between those who supply and those who demand skills necessitates, and actually uses, the available classification system. In Australia, this classification is the ABS developed *Australian Standard Classification of Occupations* (ASCO).

In studies of skills imbalances, the level of occupational aggregation depends very much on the reliability and availability of data. In almost all countries, the scope of the studies is constrained by a lack of time series data and the small size of most surveys. The appropriate level of aggregation will be a function of the objectives of a particular study. In general, a high degree of aggregation is sufficient when producing broad information on the labour market or for vocational and educational guidance. In contrast, for specific publicly supported programs aimed at increasing the supply of particular skills in shortage, or the writing of curriculum for education and training programs, too high a level of aggregation of the data on skills imbalance may not be of much practical use (Roy, Henson & Lavoie 1996).

There is a need to balance, on one hand, the limits of the data and, on the other hand, the demand from users for more occupational detail. It is worth noting, however, that the likelihood of finding market imbalances is higher when the data are highly disaggregated. This is because imbalances tend to offset each other in aggregated data.

Time dimension

The time it takes for a market to adjust to shocks varies considerably and depends on a number of factors, including the competition in the market, the period of training required and the structure of employment in the occupational group. The period chosen for the analysis is likely to affect the results of any study of skills imbalances. For example, it may happen that the situation for a particular skill may oscillate from being in surplus to shortage, but over the period of a business cycle, no imbalance may be evident. Similarly, in occupations where the demand is very

seasonal, analysis by seasons will show a shortage or a surplus, but if it is over a year then no imbalance may be evident.

The characteristic of the occupational group should guide the choice of the period for analysis of imbalances. The choice also depends on whether one is interested in the short-run fluctuations or the long-run fundamental structural imbalances. It is also important that the results of the analysis should be in the context of the period chosen because this type of information is critical in any policy designed to alleviate imbalances. The analysis should be in the context of the general economic cycle within which the data are situated.

Spatial dimension

The performance of a labour market varies across regions. One aspect of this geographical disparity could be that while some regions may have shortages of particular skills other regions may have surpluses. In some countries, the spatial imbalance is more persistent than other countries because of the differences in wage flexibility and adjustment costs in terms of geographic mobility (OECD 1994).

Inclusion of spatial dimension to the analysis can be important, as internal migration sometimes becomes part of the solution to the problem of skills imbalances. Its inclusion in the analysis, however, should consider the rate of internal migration within the occupation under investigation. A high rate of internal migration within the occupation suggests a national dimension for analysis to be sufficient. A low rate of internal migration indicates a spatial dimension may be useful. Since financial costs of moving relative to expected earnings are lower for a higher skilled worker than a lower skilled one, and training costs increase with skill level, relocation would be a more viable solution for higher skilled workers. Hence, one would expect a higher rate of internal mobility with a national scope in higher skilled occupations, and a low rate with a regional or local scope in lower skilled occupations (Roy, Henson & Lavoie 1996). For example, the labour markets for shop assistants are highly localised and it makes little sense for a shop assistant to move, or given assistance to move, from one region to another.

Spatial analysis of imbalances adds further pressure on the detail required in the data, especially if it is to be at a disaggregated level. Thus, quality of the analysis will very much depend on the reliability and availability of the data.

4.2 Indicators of skills imbalance

Since a single indicator of skills imbalance does not exist, a suite of indicators is used to assess job market conditions. Based on these indicators and judgement a view is then formed on the likelihood of a shortage or a surplus. Often these indicators have to be observed over time before firm conclusions could be drawn on the existence of an imbalance. A number of these indicators are discussed below.

Vacancy rates

Unfilled vacancy rates are sometimes used to assess the tightness in the labour market. A situation with a large number of unfilled vacancies that are hard-to-fill is indicative of a skills shortage. There are, however, problems in interpreting unfilled vacancy statistics from ad-hoc employer-based surveys. These problems are mainly to do with the inconsistent interpretation of various aspects of skills shortages by employers in self-reported surveys (Green, Machin & Wilkinson 1998). For example, of the 560 000 vacancies estimated in England from the *Employers Skills Survey* in 1999, 255 000 were hard-to-fill, but on closer analysis only 110 000 of these were 'genuine' market shortages, the rest were due to other recruitment difficulties (National Skills Task Force 2000).

A properly constructed and regularly conducted interview-based survey in which employers are presented with precise concepts of skills shortages may overcome some of the problems. These types of surveys are costly and complicated to design. Finally, vacancy statistics tend to overestimate market needs because of job-to-job turnover of workers within and across occupations the 'normal' vacancy rates for various occupational groups has to be determined.

Unemployment rates

Occupational unemployment rates can provide indications of skills imbalances, a high unemployment rate indicating a surplus and a low rate indicating a shortage. However, it would be naïve to think that any positive unemployment rate is an indication of a surplus. There are numerous reasons why the observed and equilibrium occupational unemployment rates are never zero. The challenge with this type of analysis is in determining what is the normal (equilibrium) unemployment rate, above which would be considered a surplus situation. However, with the available data it is very difficult, at the individual occupational level, to determine this normal rate.

The method of collecting information on the unemployed can be problematic. The usual unemployment data record an unemployed person's occupation in their last job. This may not always be the occupation that a person is qualified for or the occupation that a person is actively looking for work in. The unemployed include among them some who are voluntarily unemployed and others who may not be qualified to work in the occupation, and thus overestimate the supply. It is also possible that the number of unemployed under represent supply. For example, a person who is qualified to work in this occupation but who is temporarily employed in another occupation is not counted.

Net vacancies

If both vacancy and unemployment statistics are available, then the unemployment-vacancy (UV) technique can be used to assess skills shortages (Roy, Henson & Lavoie 1996). A simple interpretation would be that if the number of vacancies is larger (smaller) than the number of unemployed persons then a shortage (surplus) could be said to exist.

A number of assumptions underlie this technique. First, it has to be assumed that vacancies and the unemployed represent unmet demand and supply under current

market conditions. This assumption may not hold because as discussed above unemployment rate may somewhat exaggerate supply. Therefore, if vacancies reflected true unmet demand, then the UV analysis is likely to bias results towards an absence of a shortage.

The UV analysis is often used to study the nexus between unemployment and vacancies at the aggregate level. It tells us that any point in time, unemployment and presence of vacancies co-exist largely because of labour turnover, and not necessarily because of deficiencies in the job matching process. The UV relationship is sensitive to the economic cycle, with large numbers of unfilled vacancies during periods of high economic activity and high unemployment during periods of economic decline. Again, while this analysis is possible at an aggregate level for the economy it is very difficult to get the data to do it for each occupation.

Wages

In a market economy, where wages and prices moved freely, occupational labour imbalance would translate to changes in relative labour remuneration, including wages and salaries. A shortage should push relative remuneration up while a surplus should push it down. Changes in relative wages, taken to indicate total remuneration, have therefore been used to study occupational labour market imbalances. As the market slowly adjusts to the shortage for particular skills by increasing wages, this trend will be observed as increasing wage differential over time.

There are, however, practical problems in interpreting the wage differential data because a proper analysis requires knowing supply and demand elasticities, that is, how much supply and demand will change in response to a change in wages. For example, if supply and demand is highly inelastic (large change in wages result in a small change in supply) then wage-based estimates of imbalances will be higher than quantity-based estimates. The opposite will be true if the supply and demand is highly elastic (a small change in wages results in a large change in supply), and this case, other things being equal, employers are more likely to be complaining about shortages.

Another practical problem with interpreting wages data arises when institutional factors rather than increased demand drive wages up. For example, anti-discrimination or minimum wage legislation may drive up wages in a certain occupation group. Real wages could also reflect the power of the union representing the workers rather than a skills shortage in the occupation. A further difficulty is related to the lack of reliable data for recently hired workers. Wage information on the newly hired is preferred because the normally available average or median occupational wage data can vary because of quality or quantity shifts within the occupational group.

OECD (1994) provides cross-country evidence suggesting wages are relatively inflexible and do not respond strongly to current market conditions. They contend this to be the main reason for wide dispersion in unemployment rates across occupational groups. Thus with an inflexible wage structure, shocks will result in persistent imbalances which will tend to clear through inter-occupational mobility rather than wage adjustments (Roy, Henson & Lavoie 1996).

Other labour market indicators

Other indicators, besides the abovementioned, have proved useful in analysing skills imbalances. Their potential usefulness once again depends on data reliability and its careful interpretation. Some of these indicators are:

- hours and intensity of work (i.e. overtime, short-time etc);
- production levels;
- employment levels;
- flows of new entrants and leavers;
- training expenditure by firms;
- levels of subcontracting;
- hiring standards; and
- levels of immigration.

Employer-based surveys

Employer-based surveys are commonly used to assess skills shortages but hardly ever to assess skills surpluses. They very much rely on employers' perceptions of skills shortages. Laslett (1992), based on his wide experience in assessing engineering skills in the UK, concluded that skill shortages identified from *ad-hoc* employer surveys often disappeared when the problem was followed up. Furthermore, he concluded that it is always possible to elicit positive responses to questions about skills shortages.

Green, Machin and Wilkinson (1998) investigated these perceptions employer perceptions of skill shortages using the *Employer Manpower and Skills Practices Survey* for England. In this survey, employers were asked in entirely separate questions about their experience 1) of skills shortages; 2) in filling vacancies; and 3) of skills gap amongst their current workforce. Green et al. found that employers' experience of a skills shortage only partially overlaps with the experience of a hard-to-fill vacancy or a skills gap. They concluded that the term skills shortage means, to employers, something wider or different from hard-to-fill vacancy. This was not because employers cannot interpret questions on skills shortage, but it was just that their interpretation was not uniform. In addition, a number of employers seem to give quite inconsistent responses. This study underscores the importance of careful design and implementation of any employer-based survey of shortages.

In spite of the difficulties associated with employer-based surveys, they are used widely in practice to assess skills shortages. Roy, Henson & Lavoie (1996) suggests the information from these surveys is likely to be more effective if it is used in conjunction with a suite of other indicators, including qualitative data and in-depth studies covering a group of interrelated occupations.

Structural models

Structural models of firms adjusting to internal labour market imbalance and market-wide models reacting to supply and demand shocks have been used to assess current and future labour market imbalances (Wilson 1992; Hughes 1994;

Heijke 1994; Boothby, Roth & Roy 1995; Adams et al. 1994). Some of these are occupational labour demand models. There are pros and cons in using these models.

One advantage of using them is the usually sound theoretical underpinning of the results obtained from them. The models offer the potential for a more rigorous study of imbalances. They are also better suited for assessing future skills shortages than the market indicators or employer-based surveys.

There are, however, drawbacks limiting the use of structural models in practice. First, in general, the models have very large requirements of quality data to calibrate and maintain them. Consequently, many of these models are highly aggregated and simplified. Usually, the more disaggregated the models are the simpler is their specification. Second, most models project occupational demand requirements rather than current or future market imbalances which somewhat limits their use unless ancillary information from other sources is available on turnover and supply.

In-depth studies

The above discussion suggests finding evidence of apparent skills shortages is relatively easy but assessing genuine market imbalances, particularly based on a single measure or methodology, is more difficult. For example, most employer-based surveys are likely to indicate shortages. A holistic approach that considers a raft of measures for a group of inter-related occupations is more likely to provide robust information on imbalances. Roy, Henson and Lavoie (1996) call this approach an in-depth study.

An in-depth study would ideally begin by providing a framework within which to situate the labour market under investigation together with the demographic and educational characteristics of those who work in it. It would also include the nature of jobs available in this market. In such an approach, not only all available economic indicators, including those on supply, are gathered in a coherent framework in both time series and cross section modes, but also new data generated through additional surveys and through meetings of the relevant partners who have a stake in the issues. The study would ascertain whether the imbalances had a geographic dimension or not. The analyses would provide indications of how and how fast the occupational market resolves imbalances. Where possible an in-depth study would also include forecasts of growth and various types of turnover and job openings in the occupations being investigated.

In-depth studies are costly if they were to be done at an economy-wide level. Since these types of studies take time to do, it may only be feasible to use the technique to investigate markets in which imbalances are persistent and adjustment periods are long. The study of the ICT sector in Australia by the Centre for International Economics is an example of a good in-depth study, discussed in the next section.

5. Studies of labour shortages in Australia

This section reviews some major studies on occupational skills imbalances in Australia are reviewed. The review is not exhaustive.

5.1 DEWR's national skills shortage list

The DEWR program is probably the only one that collects data on and monitors national and regional skills shortages on a regular basis. The program covers assessment of skills shortages in three occupational areas—trades, professionals and information and communication technology (ICT)[2]. The DEWR produced list of skills in shortage, together with other information, is used to compile the *Migration Occupations in Demand List* (MODL) every six months, which the Department of Immigration and Multicultural and Indigenous Affairs uses in its assessment of skilled migration visa applications. The assessment is carried out on an annual basis for trades and professionals and on a six-monthly basis for ICT skills. The focus of the DEWR program is in assessing skills shortages and recruitment difficulties and excludes assessment of skills gaps (as defined earlier). Recruitment difficulty is assessed in an occupation when an adequate number of suitably qualified persons may be available to fill the positions in the occupation but employers are still unable to recruit them for a variety of reasons.

Although the prime focus of DEWR's approach is surveying employers who have recently advertised for selected skilled occupations, other statistics on the demand and supply are also considered before final assessment of skills shortages is made.

The *Survey of Employers who Recently Advertised* (SERA) is implemented at state-based Labour Economic Offices (LEO) of DEWR. The telephone-based survey targets employers who have recently advertised for positions in selected occupations, in general, in the major metropolitan newspapers. DEWR and its state-based offices pre-determine the occupations that will be targeted. Each LEO selects and contacts a certain number of employers who recently advertised. Employer contact is continued over the following weeks to determine if the vacancy was filled or not. 'Difficult-to-fill' vacancies are those that are still unfilled four weeks (six weeks for professional occupations) after initial advertising. Quantitative information from the LEOs on employer recruitment difficulties in filling vacancies, especially the proportion that remain unfilled, are collated at the national office to derive the imbalance situation at the national level.

Under the DEWR definition, shortages are typically for 'specialised and experienced workers' and can co-exist with relatively high unemployment overall in

[2] The trades group includes chefs which strictly is not a trade occupation according to ASCO (second edition) classification. Similarly the professionals list includes child care worker, enrolled nurse and dental assistant which are not professional occupations.

the occupation. Thus, an occupation can be assessed as being in shortage even though not all specialisations are in shortage. Furthermore, occupations may be in shortage in a particular geographical area and not in others. In each state, occupations are assessed as being in shortage in the capital city and in the regions. If the shortage is in both the capital city and the regions then it is considered as being state-wide. Instances where skills shortages are not evident but some employers have had recruitment problems are also identified. If shortage for a particular specialisation in an occupation is evident in the three largest states of New South Wales, Victoria and Queensland or in a majority of states then the shortage is declared nation-wide.

The most recently released skills shortage list contains 14 professional and 20 trade occupations with a national skills shortage (DEWR 2003b). ICT skills shortages were only in certain specialisations (SAP, Java security and electronic commerce, Peoplesoft and CISSP). Registered nurse shortages were across a large number of specialisations but secondary teacher specialisations were for manual arts/technology studies, maths, physics/chemistry and general science. Some occupations had shortages in certain states only. For example, dental assistant shortages were assessed in Queensland and the Northern Territory only, even though there were recruitment difficulties for them in South Australia. While an assessment of shortages was made for social workers in the Northern Territory, in South Australia, there were only recruitment difficulties and in Victoria and Tasmania, these were confined to regional areas.

The DEWR methodology to assess imbalances is different and has advantages over the usual ad-hoc employer-based surveys. Firstly, only employers who have actually advertised positions are included in the DEWR survey. This means that 'opinions' of employers who are not in the process of recruiting are not used for assessing shortages. Secondly, a follow-up survey of employers who advertised ascertains whether vacancies remain unfilled or not and the reasons thereof. It is, however, not clear from the available documentation how information on trends in demand and supply are integrated with the data from employer-based surveys to make assessments of skills shortages. Improvements in the currently used methodology could include a sounder statistical foundation and better documentation.

5.2 In-depth studies

A number of in-depth studies related to shortages in particular groups of occupations have been published in the last few years. All these studies reflect on the situation at one point in time, and therefore may not be a reflection of the current situation. The studies vary in the breadth and depth of analysis presented. A number of them are for ICT.

National Office of the Information Economy (1998)

NOIE (1998) was a joint study involving four Commonwealth departments[3]. The study is comprehensive and includes data on a range of indicators of skills shortages in the sector. Among others, these include employment, unemployment, vacancies, earnings, migration supply and qualifications. The data source on shortages in this report is the same as the DEWR skills shortage list discussed above.

The rapid changes in the fortunes of the ICT sector since the report was completed means that some of the information, particularly on shortages, is outdated now.

IT&T Task Force (1999)

This is another report put out by the NOIE, but unlike the report just discussed, it provided projections of growth in the ICT industry for the period 1999-2004 (IT&T Task Force 1999). Only the executive summary of the report is publicly available. The report projected a 50 per cent growth in employment in ICT occupations. Even with the most optimistic output of IT skilled graduates from training institutions, it is difficult to believe, if these projections were to realise, that sever future skills shortages could be avoided. However, the validity of these projections is difficult to ascertain. Apparently, the projections are based on a survey of employers carried out by the consulting firm Deloitte Touche Tohmatsu, but the methodology is not detailed in the summary for it to be reviewed here.

Boston Consulting for BCA (2000)

In 2000, the projections of growth in employment in ICT to 2004 from the IT&T Skills Task Force report were reiterated in a report to the Business Council of Australia (BCA) (Boston Consulting Group (with assistance from Arthur Andersen Freehills) 2000)

NSW (2001)

The 2001 New South Wales Government report, *Skilling People for an Information Society*, quoting figures from the above-mentioned IT&T Skills Task Force report, include the following:

> *Over the past two years, the information industry has identified a gap between the supply and demand for people with specialist [IT] skills. …estimated demand [as above]… The skills shortage came about during an era of rapidly changing technological and business conditions* (ICT Industry Skills Consultative Group 2001).

[3] The Department of Communications, Information Technology and the Arts; the Department of Education, Training and Youth Affairs; the Department of Employment, Workplace Relations and Small Business; and the Department of Immigration and Multicultural Affairs.

Centre for International Economics (2001)

The Centre for International Economics was commissioned by the Australian Information Industry Association to examine the benefits of investment in ICT higher education in Australia (Centre for International Economics 2001). In general, the report is well written and argued. Although the main objective of the report was to identify the level of direct investment in the ICT higher education and its spill over beneficial effects to the rest of the economy, a substantial part of the report is devoted to examining the labour market for ICT workers and skills shortages. An economic framework is developed to explain the operation of the labour market for ICT workers in a clear and concise manner.

The report identifies the demand and supply drivers of skills shortages in the ICT sector, and the extent to which they are associated with 'frictions' or 'failures' in the labour market. Some of the drivers identified are:

1. The capacity constraints in the Australian higher education institutions prevents them from meeting the industry demand for the quantity, and in some instances, quality of graduates, constraints which are principally related to:
   - the public funding system to which universities are bound;
   - trends in the level of public funding; and
   - shortages in the availability of IT teaching staff.
2. A poor industry training record, because of the failures and frictions in the ICT labour market, results in firms being unable to capture and retain the benefit of their investment in training[4].
3. The skills demanded by industry are dynamic with unpredictable trends because they depend, in large part, on technological change and the workplace changes they precipitate.

The report projects a shortfall of 27 500 ICT workers over the five-year period to 2004. This figure is arrived at by starting with the baseline figure of 45 000, which is the number of additional ICT places in higher education that the BCA called for over the five-year period to 2004, and factoring in the impact of the softening in the demand for ICT workers and recent government policy changes. The policy changes were announced in *Backing Australia's Ability* by the Commonwealth government. The changes include an increase in the funding of additional ICT places in higher education and relaxing permanent settlement visa requirements for overseas students who completed their course in Australia (Commonwealth of Australia 2001).

The BCA calculation of the shortfall assumes jobs growth in the ICT sector to be the same as that was projected in 1999 in IT&T Task Force (1999). The market for ICT had softened considerably by 2001, and therefore, even if net turnover needs are factored in, job opening for new entrants is likely to be less than what has been assumed above. Furthermore, the IT&T Taskforce's projection of growth in employment was apparently based solely on an employer-based survey whose methodology and analysis are unavailable for scrutiny. Employer-based surveys may provide some indication of employers' expectation of hiring intentions in the short

[4] The 'mission critical' nature of work in the industry also creates a lack of training resources, particularly for small and medium sized businesses, which dominate the Australian ICT sector. The result is a desire to buy 'off the shelf' IT skills, evidenced by claims of an IT 'experience' shortage.

term, but a one-off survey such as the IT&T Taskforce's is unlikely to yield quality information to enable projections that are of a reasonable degree of accuracy.

Allen Consulting for NOIE (2002)

In 2002, in a study for NOIE, Allen Consulting reported a third of businesses in the survey they conducted cited a shortage of labour with the necessary IT skills as a barrier to more involvement in the information economy (Allen Consulting Group 2002)

Victorian Skills tracking and monitoring system (2003)

In recognition of the very important, in the context of the rest of the economy, and dynamic nature of the ICT sector the Victorian government publishes a bi-annual report on the state of the sector in the state (Department of Infrastructure 2003). The report contains a number of indicators of the supply and demand for skills in the sector from a variety of sources. These include trends in employment, vacancies, migration, enrolment and completion of courses, shortages, types of skills in demand, demographics and salary movements. The analyses include the most recent data collected by various public and private agencies. The commentary in the report is largely based on the statistical data collected but it is also augmented by focus group research of major employers and recruitment agencies. The data on shortages is supplied by DEWR, and hence, the information on it is no different to that published in the *National Skills Shortage List*. The report concluded that:

1. employers seem to be expecting more for less, more skills advertised per position;
2. the average salary for an ICT professional in Victoria fell by 7.8 per cent in the second half of 2002 compared to the first half;
3. the number of advertisements for jobs in Victoria was down by 41 per cent in the second half of 2002 compared to the first half;
4. there are recruitment difficulties in areas of security, communications data warehousing and CRM/ERP; and
5. based on data from Information Technology Contract and Recruitment Association (ICTRA), the majority of successful candidates for a job had a higher qualification than that requested by the employer.

The publication has several commendable points. It contains timely information from a variety of sources. A number of relevant indicators of both supply and demand are presented to indicate skills imbalances. The information is likely to be useful for all actors in the labour market for ICT skills, and perhaps help reduce the friction or the adjustment time to equilibrium. The report seems to mainly deal with the past or the current situation and could be enhanced if information on the future demand for skills is included. For example, it could include indicative forecasts on occupational growth, net turnover and job openings for new entrants (see Shah et al. 2002). Other information that would be useful includes the total number of vacancies, including intra-occupational vacancies, filled in ICT occupations over a fixed period (DEWR 2003a; Shah & Burke 2003b).

Media and industry commentary (ICT)

Beside the above studies, it is worth noting a few recent articles in the media and a media release from a recruitment agency on the ICT labour market.

- In March 2003, Graeme Philipson wrote an article titled: 'Skills shortage is a wretched myth' in *The Age*. He wrote:

  > *Unemployment in the IT industry is at an all-time high, according to …Australian Computer Society (ACS)…Tony Abbot, the Minister for Employment and Workplace Relations, says 'ICT skills shortages have eased considerably…there was a rise of 14 400 in the employment of ICT professionals in the year to 2002'…Department of Immigration is still granting temporary visas to ICT workers stating 'ICT vacancy figure is far greater than any other occupation'…Alston (the Minister for Communication and Information Technology) dismissed the ACS report as 'blatant grandstanding'.*(Philipson 2003).

- In April 2003, the ICTRA reported 14 360 'real' job ads on their website, an increase of 32 per cent over the previous three months (ICTRA 2003).
- In September 2003, Chelsey Martin in an article titled: 'Fear of skills shortage as students shun IT' in the *Australian Financial Review*, reported a drop of 25 per cent in the enrolments for IT programs in the last three years (Martin 2003)

Summary comments on ICT labour market

Based on the National Skills Shortage List and the above the reports and media commentary, the following observations can be made on the ICT labour market in Australia:

- the market for ICT skills is very dynamic;
- it seems to adjust relatively quickly to changes in supply and demand and wages play a significant role in this;
- data from ad-hoc employer-based surveys should be used with caution, in particular if the data not recent;
- shortages in some specialisations can co-exist with a balance or a even a glut in other areas; and
- imbalances can have a geographical dimension.

NCVER studies on shortages—trades occupations

NCVER were involved in four studies on skills shortages following discussions on emerging trade skills shortages between the Commonwealth government and a number of business and employer groups. Separate reports were produced for the following groups of trade occupations:

- electro-technology trades (Robinson 2000);
- automotive trades (Borthwick, John & Werner 2000);
- building and construction trades (NCVER (in association with DEWRSB) 2001); and
- engineering trades (Smith 2002).

Some comments can be made about the level of analysis in these reports. First, the reports do not distinguish between skills shortages, skills gaps and recruitment difficulties. For example, the reports state that an insufficient level of up-skilling among currently employed workers is a cause of skills shortages, when this is probably a problem of a skills gap. Second, the reports suggest that one of the causes of skills shortages in these trades area is high separation of qualified personnel because of low demand for their skills or declining industry. If the demand for particular skills is low then such a condition is more an indication of skills surplus than a skills shortage. Third, adjustment of wages, an important factor in a competitive market, is not included in the discussion of skills shortages. Finally, three of the reports (electro-technology, engineering and automotive) utilise occupational growth forecasts from two models—Murphy and MONASH. It appears that the short-term (one-year) forecasts are from the Murphy model and the longer-term forecasts (five-year) forecasts are based on the MONASH model. This gives rise to an inconsistency in the analysis. For example, it is reported that in the automotive trades, based on the Murphy model, employment growth is expected to be negative in the coming years, but the same report notes that according to the MONASH model employment in these occupations is expected to grow albeit at a slower rate than overall employment (Borthwick, John & Werner 2000).

Apart from the report on building and construction trades, all of the above reports have a standard format. They contain a large amount of statistics on employment changes, migration and numbers in training. Shortages data in the reports are in the main based on the DEWR skills shortage list.

National Industry Skills Initiative

The National Industry Skills Initiative (NISI) is a partnership amongst the Commonwealth government and a number of business organisations[5] to address issues of skill shortages. The initiative is instituted as an industry led process designed to establish steps that industry, government and the partnership of the two could take to redress skill shortages.

A report in 2002 by NISI draws four main conclusions based on a study of six industry areas of engineering, electro-technology, retail motor, commercial cookery, building and construction and rural industries (wool production, horticulture, viticulture and cotton) (National Industry Skills Initiative Working Groups 2002). The four lessons drawn are:

- Skill shortages can and do exist at most stages of the business cycle, however, the intensity varies. Skills shortages can co-exist with low or declining employment growth in an occupation or industry.
- Although apprentices are a major source of supply in the traditional trade areas, there is increasing evidence of alternative pathways into these jobs. Some alternative pathways are through traineeships and others are completely outside the New Apprenticeships system. The alternative pathways are becoming important in areas where licensing or regulation requirements are not an issue.
- Rapid changes in technology means that training programs need have continual improvement mechanisms built into their development. Furthermore, up-skilling of the existing workforce is just as important an issue as that of training new entrants.
- Solutions for tackling the problems of skills shortages and skills gaps, in general, should be tailored to needs of the particular occupation or industry. This does not preclude some solutions may have a generic application.

[5] Australian Chamber of Commerce and Industry (ACCI), Business Council of Australia (BCA), Australian Industry Group (AIG) and National Farmers Federation (NFF).

6. Public policy responses to shortages

In a competitive market, there are always going to be unfilled vacancies, and a proportion of these could be considered hard-to-fill vacancies. The number of hard-to-fill vacancies will fluctuate depending on the phase of the business cycle and other changes occurring in the market. When the number of unfilled vacancies reaches some 'intolerable' level, there are calls for intervention in the market. However, in some cases, the observed imbalance may be *socially optimal* for the particular labour market, and public intervention would simply be adding to costs of adjustment that are being borne by the market (Roy, Henson & Lavoie 1996). Therefore, when is it appropriate for government intervention? Equally important are the questions of why and what of government interventions.

Labour markets may be sub-optimal because of the presence of inefficiencies. The sources of some these inefficiencies may be due to a range of factors—externalities, legislative or institutional. Externalities occur when an activity (e.g. training) undertaken by individuals or firms lead to benefits (or costs) to other individuals or firms. If the externalities are significant then the result could be a sub-optimal level of training activity, which could result in skills shortages or gaps. Such things as wages policy, subsidies, quotas on registration and managed supply or demand in some government employment can reduce the market-clearing role of prices and wages. Other factors that could contribute to sub-optimal markets are low labour mobility and a lack of good quality information on the labour market, available to both employers and suppliers of skills.

Once market imbalances, including their severity and causes, have been identified, the next question as to what government action, in terms of its effectiveness and cost, is to be taken arises. The course of action will depend on the specific labour market that is in imbalance, as each market may need a tailored solution. This will involve consideration of the magnitude and severity of the shortage; evidence of cyclical factors; evidence of long-term persistence; the likely extent of substitution with other types of labour; the geographical distribution of the shortage; and the specific types of skills that are in short supply.

Information on shortages, recruitment difficulties and skill gaps provides part of the data that is needed to inform public policy-making on education and training. As considered in this paper, shortages are caused by a number of factors affecting demand and supply and there may be a range of ways they may be brought closer to balance. The rest of this section discusses some of the options available for public policy to deal with current skill shortages and to avoid future ones.

6.1 Publicly provided training

Provision of publicly funded training places is one of the ways of overcoming skills shortages and gaps. Public provision is usually rationalised in terms of efficiency

and equity arguments. Since economic performance is negatively affected by skill gaps, it is argued that more but appropriate training will result in an adaptable workforce with skills that are better able to satisfy production (employer) requirements.

Publicly funded training to satisfy employer needs, however, requires a thorough and extensive knowledge of the workings of the particular labour market because not all such needs are most effectively satisfied through such means. The recent inquiry into future skills in South Australia concluded that 'government needs to resist the urgings and the urge to do something about' skill shortages (Government of South Australia 2003). The inquiry found virtually no evidence to suggest that skills shortages, where they exist, are the result of an inadequate training system. The Construction Industry Training Board (South Australia) who made a submission to the inquiry noted:

> *…skill is not a commodity that can be readily stockpiled for use when demand for it emerges…Much is made of current or impending skill shortages. Often it is contended that this reflects a failure on the part of the 'training system'. In fact, rarely is the training system to blame.*

The nature of the intervention will depend on whether the problem is a skills shortage, recruitment difficulties or a skills gap. Recruitment difficulties may not need public provided training as a remedy, though raising employers' awareness to the causes of recruitment difficulties and possible solutions for them are important issues.

If it is concluded that there is a need for a training response there are still important questions are what will it cost, who should pay for it, how will it be provided and how will students or workers be attracted to it. The policy choices need to be seen in the context of a commitment to lift the overall skill level of the workforce. There is also a need to remember that the public system has a major role in promotion of equity and education for citizenship or personal development. This includes providing growing opportunities for young people and for older workers who have been affected by the rapid change in the structure of employment.

The matters that can be addressed in relation to shortage include:

- expansion of the available places in the areas of shortage, subject to cost considerations;
- incentives to enrolment (or provision of contracts of training) in the places made available;
- development of short courses in the skill areas in most demand;
- ensure that underpinning knowledge and generic skills are developed to allow quicker retraining; and
- development of new courses of training in emerging areas.

These issues are in large part the responsibility of ANTA, state and territory training authorities in conjunction with Industry Skills Councils and industry training boards.

6.2 Other policy options

Other policy options are also available to government to alleviate skills shortages, skills gaps and recruitment difficulties.

Encouraging training in industry

Employers' capacity to respond to shortages will be increased the greater their awareness of the importance of training and the greater their involvement in planning and provision. Engendering a training culture among employers takes time, as it requires attitudinal changes. Considerable attention has been given to this by training authorities in Australia in the last 15 years. Improving the training culture requires employers to take a longer-term perspective on training and its benefits for innovation and profits. Employers want to recoup returns on investment in training and are naturally concerned about undertaking the costs of training where there is the danger that much of the benefit may be gained by other firms, particularly in dynamic markets where margins are small (Government of South Australia 2003).

A way of increasing employer involvement and responsibility for training tried by various governments has been various types training levies. Levies have a longer history in European countries than in Australia. It was tried in Australia the late 1980s, as the *Training Guarantee Levy*, but abandoned in 1994 because of objections employers. It is a matter of conjecture whether the levy would have succeeded given fine-tuning and more time.

It has been suggested that a training-levy system that is owned and controlled by industry groups, including unions, may have a better chance of success than a system that is national (Government of South Australia 2003; Gasskov 2002). An advantage of such a system is that firms within the industry decide whom to train and what form the training should occur[6]. Any training-levy system has to ensure equity of access to training for all workers, particularly those who are least qualified and who have the least bargaining power.

Employer training can also be encouraged by tax relief or subsidies to firms commensurate with the amount of training they provide their employees. The main example in Australia is the subsidies for the employment of apprentices and trainees. Apprenticeships and traineeships have been a major means of encouraging employers to provide general training of value to a wide range of employers by allowing payment of less than market wages (at least in the later years of training) (Dougherty & Tan 1997; Dockery et al. 2001).

Employers, together with individuals and training providers, are assisted by a range of government support such as information on 'best practice', the New Apprenticeship Centres and various state and territory support organisations for training, such as the Local Learning and Employment Networks in Victoria. Schemes to promote innovation in industry and heightened awareness of the importance of highly skilled workers as part of the intellectual capital of the firm are

[6] Various state-based building and construction training funds are examples of industry-based levies that can work successfully in practice (Government of South Australia 2003).

worth further consideration as a means of improving the training culture (Toner 2003); Ferrier & McKenzie 2002).

Social partnerships between employers, training providers, governments and unions have the potential to increase employer investment in training. However, to succeed these structures need bi-partisan support at the political level and long-term commitment as in the short-term they are likely to encounter considerable teething problems.

To the extent that labour market imbalances are the result of relatively low retention of workers, much of the response would seem to be in the hands of employers. These responses can include improvements in working conditions and career options and better wages or wage flexibility.

Labour market information

Transparency is essential for the efficient functioning of a market. Pertinent, reliable information about various aspects of the market that is up-to-date and available to all actors provides this transparency, and help clear imbalances in the market. The provision of this information, if left to the free market, is likely to be less than what would be regarded as socially adequate because of the *public good* nature of the information. Thus, governments have an important role to play in providing such information. In Australia DEWR is the best and most comprehensive source of this information (DEWR 2003a; 2003b).

The ABS and DEWR collect considerable statistical data about the labour market. Some of the products include occupational classification systems, career guidance tools, occupational certification, occupational projections in terms of job openings and qualifications frameworks. It is important to emphasise the importance of replacement needs or turnover information because often job openings due to turnover are more numerous than job openings due to growth, if indeed there is growth in the occupation. Even when there is contraction in an occupation job openings may exist because of turnover. The information is likely to help firms, households and governments to make better human capital investment decisions. The classification systems provide a point of mediation between those demanding skills and those supplying them.

Anticipating skill needs is a difficult exercise. Forecasting models that are able to integrate business investment decisions with the rest of the workings of the economy and arrive at labour growth forecasts are useful in providing baseline information. This information can be enhanced, particularly at a regional level, by governments insisting that a detailed training impact statement is produced by proposers of any major project in the region. An example of such a statement, though on a much bigger scale because it involves more than one enterprise, is that for the Burrup Peninsula in Western Australia, *Emerging Industries on the Burrup: Skills needs and Strategies* (Burrup Skills Taskforce 2003). Such reports are useful in providing some basis to plan provision of future skill needs. They also help plan curriculum changes and anticipate staff development needs.

It is difficult to determine the adequate amount of information that governments should provide. Generation of information is expensive, in particular when it is demanded at increasing level of disaggregation and over ever smaller geographical areas. Finally, it must be borne in mind that after a certain point there is diminishing return to increasing investment in producing information.

Immigration

Immigration can be used as a policy instrument to solve shortage problems. It has been used to solve both skilled and unskilled labour shortage problems in industrialised countries of Western Europe and the United States.

Countries like Australia, Canada and the United States have skilled migration programs to meet expected shortfall in particular types of skills in their respective economies. One of the reasons for some skills being included under these programs could be due to lack of capacity, perhaps because of under investment, in the local training system to meet peak demand. As discussed earlier, details of Australia's skill migration program are available from DIMIA (2003). The migration programs attempt to identify skills in shortage and those wishing to migrate with these particular skills are given higher priority over others. In general, the programs are not open-ended, annual quotas put a ceiling to the number who are allowed in and occupations in the priority list change too. One of the problems with the system is that arrival of migrants, with appropriate skills, often lags by a considerable time the actual occurrence of the shortage. This means that sometimes the market has already corrected itself by the time the migrants arrive. The migrants then find themselves having to work in alternative occupations. Another problem is that migrants generally prefer settling in urban, usually large metropolitan, areas while the shortages are often in regional or remote areas.

Finally, there is an ethical dimension to using immigration to solve shortage problems. Often the flow of skilled labour is from developing or under-developed countries to the rich and developed countries. Notwithstanding the fact that every individual should have the freedom of movement to maximise their own potential economically and in terms of personal security, there are ethical issues involved when there is an exodus of scarce skilled personnel from a country which can least afford to lose them. When this happens with aggressive recruitment drives, enticing large numbers of individuals with enticement of higher remuneration, the impact on the labour market of the donor country could highly negative. In general, unless there is a bilateral government-to-government agreement, the donor country has no recourse to recoup the investment it had made in training the individuals who leave. Some remittances may flow back from the migrant workers but they are hardly enough compensation for what is being lost.

Encouraging mobility

Assistance to encourage internal mobility may help alleviate geographical skills imbalances.

An important issue is that qualifications are recognised throughout Australia. ANTA in conjunction with the states and territories has developed the Australian Quality Training Framework to provide a set of nationally agreed standards to ensure that all qualifications issued by Registered Training Organisations are recognised throughout the country.

Internal migration programs are more likely to succeed if they are backed with comprehensive information systems, not only about the labour market but also about other services, such as schooling, health and housing. Large disparities in housing costs between different regions cold inhibit worker flows, at least in one direction. Whether governments should provide financial assistance for internal

migration or not is a difficult policy issue and would depend on how strategic the problem is to the government. It has to be careful that the assistance does not just substitute what the firm would be paying in a competitive market.

7. Concluding remarks

This paper has provided a review of the concepts, measurement issues and implications of skills imbalances. It has also reviewed some of the more recent studies on skills shortages in Australia.

Economic theory suggests that skills imbalances are a permanent feature of a competitive market. Without major hindrances to the market adjustment process and without externalities, these imbalances resolve over time and do not require intervention. There will always be unfilled vacancies, some of them hard-to-fill positions, alongside people looking for work because of continual adjustment of the market towards equilibrium. Adjustment usually takes time because of the speed at which the information about the changes in the market gets dissipated and the time it takes an individual to acquire new skills. Managed or semi-managed labour markets have their own modus operandi.

However, real-world labour markets are seldom perfect and may not lead to optimal allocation of resources. Government action to correct the market may be justified if there is strong evidence showing sub-optimality. Before any effective policy is designed and implemented, it is important to understand the operation of the current market and to investigate reasons for its failure. Lack of good empirical knowledge of how markets adjust, and the time lag from when an imbalance is observed to the impact of a policy makes effective intervention difficult in practice.

The international literature on skills shortages suggests that ad-hoc employer-based surveys on their own are problematic in providing accurate and reliable information. These problems stem from a misunderstanding of the concepts of skills shortages, recruitment difficulties and skills gaps. The best way to assess skills shortages it seems is through in-depth studies. Such studies provide an opportunity to understand the distinctive features of the market for particular skills. These understandings are essential for identifying and finding solutions to skills shortages problems. Imbalances in particular specialisations or geographical locations must be distinguished from imbalances that are occupation-wide or national. Solutions appropriate for overcoming shortages in particular specialisations or locations are generally more focussed and may have less general application. For example, mobility allowance and other incentives may be necessary to entice individuals to move to remote areas where there are skills shortages.

The modern production process in manufacturing puts emphasis on just-in-time management of physical inventory. It appears that sometimes this philosophy extends to the management of labour as well. This is evidenced by the continuing growth in part-time and casual work. This may be reducing firms' ability to absorb shocks that result in skills shortages. As skilled labour gets scarcer, workers, on short and/or casual contracts with little attachment to the firm, change employers in pursuit of higher wages. This then creates a perception of a shortage situation among employers.

With rapid technological changes, there will always be a skills gap in the workforce. The rate at which the gaps are bridged depends on the training system in place. If employers rely on the public training system to finance and bridge the gap, then the adjustment process will be longer because of the bureaucratic necessities and the time it takes a third party to gear up with new curriculum and delivery strategies. If

the firms were to take greater responsibility to bridge the employee skills gap then the adjustment will be much faster and the training could be tailored specific to the firm, thus reducing problems of externalities.

In Australia, the only agency that monitors skills shortages and recruitment difficulties across a wide range of skilled occupations is DEWR. It has developed it owns methodology to collect data on these issues. The technique has been in use over a number of years. DEWR also augments information on skills shortages with information on other areas of the labour market, including future job prospects in all occupations. Assessment of future job prospects is based on forecasts of occupational growth and job turnover. The Victorian government publication, *ICT Skills Snapshot*, also provides labour market information but only in the ICT sector. Labour market information is important if labour markets are to adjust quickly to shocks.

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