

# The Knowledge Based Economy: Implications for Vocational Education and Training

**A Review of the Literature**

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## The Evolving Concept of the Knowledge Based Economy

There is no universally accepted definition of the knowledge based economy. As a concept, it is very loosely employed and embraces a number of quite different visions of the economy and society.

One view, most evident in OECD publications, sees it as very much bound up with the high skills/high performance/high value added scenario as the only way for firms to compete in a globalised economy.

Another view, found principally in the scientific and technical community, tends to view it more narrowly as applying to knowledge intensive industries where knowledge itself is the core competence. The latter is typically found in software and internet companies, computer hardware and chip manufacturers, computer and electronic equipment sectors, and health care technology<sup>1</sup>.

A third view, the one adopted in this paper, is that all sectors of industry are becoming more knowledge intensive in the very broad sense of that term. Knowledge is seen as a potential generator of productivity improvements in areas as diverse as quality, customer service, variety, speed and technical improvement, as well as innovation in products, processes and organisational structure and behaviour. As companies alter the way their organisations are structured (flatter, non-hierarchical, team based, multi-skilled) in order to compete more effectively, so too workers have needed to obtain a more complex range of cognitive and intellectual resources.

This research project seeks to extend our understanding of the impact of the knowledge based economy on the content of work and training. It does this by acknowledging multiple perspectives on how economies grow and by embracing new definitions of skills, knowledge and training that reflect recent research. In this project, a knowledge based economy is defined as one that is increasingly dependent for its growth on the input of knowledge as a value-added input to the economic system. This is reflected in a change in the basis of 'competitiveness' for economies, organisations and individuals. This is realised in four interrelated ways.

First, such economies experience a changing structure exemplified by new industries, occupations and organisational arrangements.

Second, there is a change in the types of skills required, with a rise in the importance of generic skills, including the ability of individuals to work more autonomously; be self-managing, work as part of flexible teams, adapt to change, solve complex problems, think creatively and engage with innovation as a continuous process.

Third the economy requires new forms of knowledge and places increased importance on the creation and application of knowledge in networks or clusters of companies/enterprises, and within 'communities of practice' where workers are required to work together in new and more complex ways.

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<sup>1</sup> For example refer June 1999 issue of Business Higher Education Round Table newsletter on The Knowledge Economy.

Fourth, innovation becomes more important as a means to increase economic competitiveness, and knowledge management becomes increasingly the key to sustainable competitive advantage, requiring individuals, firms, regions and indeed complete economies to acquire, create and use knowledge as the key productive resource.

Since the 1960s there has been a growing awareness of the decline of the importance of the control of resources for wealth creation, the emerging dominance of specialist knowledge and competencies, as well as the management of organisational competencies and knowledge.

In *Post-capitalist Society*, (1993) Drucker argued that in the eighteenth century the basis for economic development was machines and factories and new industrial technologies. This knowledge was applied to tools, processes and products. The early part of this century was marked by the development of new forms of knowledge characterised by systems of embedded knowledge applied to human work. This was the knowledge of systematic routines. In the late 20<sup>th</sup> century new forms of knowledge are now becoming necessary and specialised knowledge workers are growing in number. These workers are unlike previous generations of workers, not only in their high levels of education, but because for the first time they own the organisation's means of production - knowledge. Drucker has further suggested that, as a result, traditional ways of thinking about organisational structures need to be discarded. In their place new ways are needed to view and construct organisations based around specialised workers, team-based work, flat management structures and flexible practices.

The stability of traditional production systems, product markets, company structures and corporate relationships have been shaken by the fast rate of technological change. Technological innovation and access to knowledge and skills are more than ever key drivers of innovation, and their application has become central to the competitive strategy of firms.

As Kanter (1995) has pointed out, future success will come to companies that can meet global standards and tap into global networks. Similarly, the cities and regions that will be most successful in the 21<sup>st</sup> century will be those that are best at linking businesses to the global economy. Hobday (1995) has pointed out that technological innovation has played a significant role in the economic transformation of many Asian countries. Entire industries and geographical regions can be invigorated by technological change. It has been estimated by Cooper (1993) that new products less than five years old account for 52% of sales and 46% of profits for US firms. At all levels, it appears that competitiveness depends on technological innovation.

In summary, in advanced economies in the last two decades there has been growing recognition of the need for workers who can function with new forms of knowledge, rather than low-skilled workers who can function only with routinised knowledge.

Two different paradigms exist for understanding knowledge and skill. They both have implications for how the relationship of individuals, enterprises and networks of enterprises to the knowledge economy is viewed. One paradigm is based on an understanding of knowledge and skill as dependent on conceptual skills and cognitive abilities, primarily of *individuals*. The second, and emergent paradigm suggests that the appropriate unit of analysis is neither individuals nor organisations, but '*socially distributed activity systems*'. That is to say, knowledge is not something that resides in the heads of individuals. "Knowing" is mediated through systems of language, technology, collaboration and control; it is situated in time and space and particular

contexts; it is provisional, constructed and constantly developing; and it is pragmatic purposive, object-oriented. (Blackler, 1995).

Rather than studying knowledge as something individuals (or organisations) supposedly have, these new theories and approaches study “knowing” as something that they do and analyse the dynamics of the systems through which knowing is accomplished. The learning theories that inform this work are activity theories (Engerstrom, 1994) and social learning theories (Lave and Wenger, 1991; Vygotsky 1978).

The distinction is critically important for VET:

one paradigm implies business as usual, with its focus on individuals and the role of VET in upskilling individuals;

the other directs attention towards networks or clusters of companies/enterprises, or ‘communities of practice’, that is, people who need to work together in some way, but who may be distributed through an organisation or in different organisations, and implies a need to reconceptualise the role of VET.

Cairney (2000) has suggested that regions seeking to compete more effectively within a world economy will need to develop ‘soft structures’ that support knowledge creation and learning and that enable firms to collectively strengthen a region’s capacity for knowledge creation and innovation. Key institutions such as universities, VET providers, regional development organisations and business chambers are amongst the most important institutions within regions. Such organisations act as key knowledge creators and trainers, as well as a means to collect relevant knowledge in the international domain and vehicles for communicating this effectively through a variety of mechanisms and relationships.

The concept of the learning region has emerged to describe those places that offer an institutional environment that encourages both private and social learning at four different scales: the individual workers, the individual firm, groups or clusters of related firms and government bodies. Learning regions are less dependent on the individual excellence of their educational institutions as they are on the extent to which their key institutions, organisations and industry are able to trade, support and jointly create knowledge and knowledge networks. The success of key regions throughout the world has been due in no small measure to social or collective learning processes, in which the role of the region is to animate the formation of ‘interaction relationships’ between individual firms and between firms and other regional institutions. Such regional organisations should also be thought of as learning organisations themselves in that they actively seek to emulate and learn from successful experiences of counterpart agencies in other regions and nations.

Marceau et al (1997) have argued that a learning economy is both knowledge and innovation intensive and is usually technology driven. Regions that will make economic progress are those that have high rates of innovation and learning that are greater than those of their competitors are. Growth in real terms will be produced by activities based on knowledge generation through investment infrastructure, human capital, innovation, research and development and advanced training.

Recent writing and policy pronouncements on the knowledge based economy emphasise its potential application to all businesses in all sectors. It has become accepted wisdom

that firms must incorporate knowledge management into their core business strategy to ensure they remain competitive. Knowledge is seen as a potential generator of productivity improvements through innovation and creativity across the board – whether in relation to product quality, customer service, variety, speed or technical improvements (e.g. see Neef, 1998).

The movement towards enhanced importance for knowledge as a driver of economic growth is widely seen as a response to the processes of globalisation, technological change and the intensification of international competition. Official thinking by OECD as well as governments of industrialised nations posits knowledge as the main driver of growth, wealth creation and employment (OECD, 1996; DISR, 1999; DfEE, 2000), with learning, skills enhancement, innovation and enterprise as the cornerstones of the new economy. The phrase ‘knowledge based economy’ has become shorthand for the emerging set of economic activities, structures and arrangements that are the result of these global processes.

Some view the knowledge economy as synonymous with the shift into a new high skills, high performance, mode of working, reflecting a belief in a workplace change led response to global pressures. This shift in thinking requires both changes in work organisation as well as more workers to whom high levels of discretion have been delegated in order to produce high specification, customised goods and services. Current thinking is that the skill profile needs of a high performance work organisation can no longer be served by skills needs derived from traditional conceptions of work. The skill requirements of emerging technology and innovative work organisation require a new combination of content skills, process skills, cross functional skills, social skills, self-managing skills and complex problem solving skills.

A variant on this view holds that the knowledge economy is not so much concerned with *higher skills* as with the needs of business enterprises for a broad range of general aptitudes, abilities and skills that can be applied to the increasingly *cognitive* demands of jobs and the new ways of thinking and managing. In this modern economy, all workers will need to become lifelong learners. A widely held belief is that they will need the intellectual resources to be self-managing, to engage in continuous learning and to master new skills and behaviours in order to meet the ever changing needs of more dynamic product and labour markets (Drucker, 1999). For Brophy (1998), everyone in the workplace can be creative, it need not be the preserve of the few. Hopkins and Maglen (1999) echo this optimistic vision of the knowledge based economy and the opportunities and benefits it offers to successful lifelong learners of the future.

These diverse understandings of the defining characteristics of the knowledge based economy can be summarised as:

- new industries and organisational structures which are heavily dependent on knowledge;
- changing occupations and skill structures which privilege particular kinds of knowledge production (ie knowledge workers);
- highly intensive workplaces, requiring a range of new forms of knowledge and generic skills and competencies;
- an increased importance for innovation in order to sustain the competitive advantage of individuals, firms, regions and economies.

Having said all of the above we need to stress that much of the writing on the knowledge based economy has a polemical flavour and is contested. The widespread growth of knowledge based economies is a vision for the future rather than an empirical reality.

What is being articulated in much of the literature is an action agenda and strategy aimed at moving economic activity in the developed world out of the old Fordist and Taylorist paradigms into a new high skills, higher performance mode of working.

Running through much of the VET literature in Australia and internationally, is a set of beliefs that have become part of the conventional wisdom about the knowledge based economy and the kinds of policy initiatives needed to support movement towards such an economy. These include such beliefs as:

- The only sustainable source of competitive advantage for a developed economy is one based on a highly educated and skilled workforce.
- Boosting the supply of skilled and educated employees will, of itself, act as a catalyst for economic change and enhanced productivity and competitiveness.
- High levels of skill are an important prerequisite for high value-added production
- The high performance workplace is associated with improved organisational and economic performance.
- High performance workplaces call forth new skill demands.
- The drivers of upskilling and value adding through higher skills include a commitment on the part of employers to lifelong learning.

Recent theorising and empirical research on links between the acquisition and use of skills and knowledge, product market strategies and economic performance suggest that many of these beliefs and assumptions may be ill founded.

At a general level, there are difficulties in establishing a causal link at firm level between skills and competitive performance. This has been recognised by commentators such as Keep and Mayhew (1999), writing in respect of UK VET policy:

The problem with linking training to economic success suggests that a single model of competitive advantage based solely on skill may not accord with present-day reality in Britain. In fact, companies are faced with the choice of product market strategy and with a variety of means of securing competitive advantage in the short, medium and long term. Some of these can be pursued in parallel with attempts to upgrade skills, but others are more or less incompatible with a high-skilled, high-wage, high-value added approach.

It is apparent that many organisations are not following this so-called Reichian model of competitive advantage through skill. Clearly there are alternative strategies in addition to the skill based ones – not least strategies based around standardised mass production of both goods and services. Regini (1995) suggests that the model of a high skills/high value added strategy allied to a supportive VET system that can deliver a highly educated and trained national workforce (as for example in Germany) is simply one of a number of viable models available to firms and nation states. Far from a single, simple, universalistic movement towards higher value added and higher quality goods and services throughout the developed world, different companies, sectors and even countries are following a range of divergent trajectories. These alternatives include seeking protected markets, growth through take-over, seeking monopoly power, cost-cutting, and new forms of Fordism.

Two trends are worth noting here. First, recent events underline the continuing, perhaps growing, importance attached to merger and acquisition as a prime source of competitive advantage. Second, far from being dead, Fordism and neo-Fordism is a growing and powerful model of competitive advantage in some industrialised countries, especially within large swathes of the service sector. While mass production may be declining as

the dominant model for the manufacture of consumer goods, it offers, in combination with economy of scale advantages, the promise of salvation to many major retail chains, retail banks and insurance companies. Management is seeking to achieve the lowest possible cost base, seeing as the key to profitability the delivery of a narrow range of standardised goods and services in markets which are primarily driven by price (Keep and Mayhew, 1999).

Further support for the viability of alternative strategies to the high skill route is found in Culpepper's assessment of the future of the high skill equilibrium in Germany. He observes how West German manufacturing companies in the 1980s maximised their international competitiveness by aiming at less price-sensitive niches where customers most valued the ability to make incremental customisations to existing technology.

Recent research in enterprises places a question mark over the necessary link between high skills and high spec (high value), raising the possibility that soon it may be feasible to produce high spec by Fordist production (ie low skill) methods (Wensley, 1999). Other companies appear to be attempting a mixed model, with limited efforts at upskilling part of their workforce whilst also laying emphasis on cost cutting, increased casualisation of part of the workforce, and organisational restructuring aimed at achieving significant economies of scale advantages.

The linkages between workplace redesign, skill development and economic performance, as measured by increased productivity, are difficult to establish. A wide-ranging study on workplace learning in EU Member countries (Mehaut and Delcourt, 1994) found that many reorganised firms were success stories in terms of increased productivity but not necessarily in terms of workforce skill development. Black and Lynch (1997) analysed data from the 1994 US Educational Quality of the Workforce National Employers Survey. They found that what is associated with higher productivity was not so much whether or not an employer adopts a particular work practice, but rather how that work practice was actually implemented within the firm. The main variable accounting for business success was the introduction of practices that encouraged workers how to think and interact to improve the production process. In Britain, an assessment of companies with the kitemark of Investors in People (signifying a high performance workplace) showed that most employees felt that the IIP process had left their workplace untouched. Those who did notice a positive effect were more likely to be the lower graded and lower paid employees. Employers, for their part, were muted about how far investing in a person was associated with organisational performance in improved financial performance.

A survey of new forms of work organisation of European countries found them to be very much a minority movement. For instance, the proportion of workplaces with semi-autonomous group work approximating the Scandinavian model (extensive delegation, a highly qualified workforce, and high levels of training intensity) was less than two percent of the sample. The OECD acknowledges that 'until now, workplace change that truly supports these objectives in a sustainable fashion, has not been widely diffused' (OECD, 1997).

The paradigm of the knowledge based economy, however, appears to reflect a growing consensus about the nature of wealth-generating enterprises of the future, but nations, and in fact cities and regions, must identify the response to the emerging economy that is most appropriate to themselves.

Consideration of the above issues with reference to the definition of the knowledge based economy that has framed this research leads the project to explore three related factors affecting the role of VET:

- the nature of organisations in knowledge based economies;
- the forms of knowledge required in emerging knowledge based economies; and
- the impact of a need for new knowledge on the 'content' of work.

There is a need to look at knowledge, knowledge production and training of knowledge workers in new ways. An improved understanding of how the knowledge economy is developing will clarify the role of VET and its relationship to the learning needs of individual workers, companies, industry clusters and regions.

### **The high skills/low skills economy**

Researchers and policy makers alike have posed a strategic choice for nations between a high skills economy and a low skills economy, the consensus being that industrialised nations must choose the first route to remain globally competitive. Germany and Japan are often singled out as archetypal examples of the 'high skills' economy, while the UK exemplifies the 'low skills' route (Ashton and Green, 1996). Australia's small domestic market and proximity to countries with large supplies of relatively cheap labour is widely seen as propelling it towards the high skill route. However, comparison of vocational qualifications profiles of workers in different industry sectors suggests that on that particular variable, Australia is closer to the UK than to countries like Germany (Maglen and Hopkins, 1998). Marceau *et al* (1997) in their influential report *The High Road or the Low Road?* challenge Australia to choose the high skills path.

There is a growing body of research and analysis which points to the more complex issues involved in remaking a country's industrial future. Writing more than a decade ago, Finegold and Soskice (1988) introduced the notion of the *low skills equilibrium* to explain why in Britain both employers and the workforce were unwilling to invest in the skills needed for a modern economy. In shifting the focus of debate from supply side to demand side factors, they raised the possibility that employers' characteristic attitudes towards skill might be a rational response to the institutional conditions. For example, short-term financial markets, an adversarial industrial relations system, and a low supply of skills in the labour market- in which they operated.

Finegold and Soskice's seminal idea that a nation might be trapped in a self-reinforcing network of societal and state institutions which interact to stifle the demand for improvement in skill levels has had an important influence on VET policy and research, in the UK as well as globally.

First, it has drawn attention to the importance of a multi-stranded and systemic approaches to tackling issues of skill deficit, and reskilling of the workforce, requiring enabling government action that goes well beyond the VET policy domain. There appears now to be a general consensus that creating a high-skills economy goes far beyond the relatively simple issues of skill supply and means addressing major structural items.

Second, in highlighting the significance of demand side factors, it has prompted a major line of research enquiry centred on micro-behaviour in product strategies at the enterprise level, and the implications such choices have for the distribution of knowledge and skill throughout the workforce. A recurring theme in this research concerns the rationality of employers' decisions to compete on the basis of low cost/low value (and hence low skill, low investment in training) where their strategic marketing analysis supports such a product strategy.

The corollary to a low skills equilibrium, namely a *high skills equilibrium*, has also been a focus of research interest. This has been most evident in studies of skill formation and political economy in newly industrialised economies (Ashton and Sung, 1996; Green et al. 1999), as well as comparative studies in which Germany is often the archetypal case (Culpepper, 1999).

This research has served to highlight the cultural specificity of many skill supply mechanisms and their location within broader systems of production, industrial relations, inter-firm networks, industrial capital, corporate governance and politics (Keep and Mayhew, 1999). Paradoxically, the same institutional factors that have made the German VET system or the Japanese VET system extremely successful in creating large supplies of individuals with intermediate skills, appear to have made them poorly suited for the development of individually driven, collective learning at the most advanced skill levels needed in new high-tech firms (Curtain, 1996). The world economy may be becoming more global, but education and training remains an area where skill supply systems continue to differ quite radically from one country to the next.

Finegold (1999) has now moderated his stark categorisation of a national economy as either predominantly a high- or a low- skill equilibrium, seeing this now as a major oversimplification of reality. There significant high-skill regions or industries existing within otherwise relatively low-skill economies (for example, the Third Italy, or the UK's pharmaceutical and aerospace sectors). International comparisons of economic performance suggest that there are at least three meaningful skill segments in most countries (intermediate or medium, as well as high and low skill) and that the requirements for success in each skill segment may be very different (Crouch *et al*, 1999).

Considering also that the rapid pace of change in technology and global competition reduces the value of static frameworks, Finegold now prefers to speak of *self-sustaining high skill ecosystems* (HSEs) rather than high skill equilibrium economies, and has examined the conditions that give rise to HSEs.

Drawing on cases of the highly successful biomedical and computer hardware and software firms clustered in California, his research shows how HSEs, once started, generate a positive, mutually reinforcing dynamic that fuels ongoing knowledge creation and growth and adaptation to changing competitive conditions.

He observes both the multiplier effects of high tech companies in a wide array of relatively high-paying service sector jobs in the region (high quality restaurants, real estate agents, auto dealerships, travel agencies) and their coexistence with a large, much lower-skilled and lower paid-workforce. These individuals work in some manufacturing, assembly, and lower-skilled support service jobs in the same high-tech sectors, as well as providing personal services to the higher-skilled workers. Income inequality between these high- and low-skilled workers appears to be widening in these regions even more than in the USA as a whole.

Finegold also shows how skill development operates differently in a high skills environment than in the traditional economy. This supports earlier work by Stevens (1999) who predicted low levels of employer investment in formal training in firms in high-technology regions. For the scientists and engineers who are the key drivers of knowledge and wealth creation in these high-skill regions, informal learning was seen to offer greater utility than formal learning.

The following characteristics seem to be evident in turbulent, high-skill environments:

- a dynamic interplay between the high labour mobility of employees within these firms in a free market environment;
- collective social learning processes and a flow of tacit knowledge surrounding innovation made possible by such mobility;
- a willingness of individuals to enter a new employment relationship in which 'employability' (the continuous development of marketable skills) has replaced employment security;
- a critical mass of employers all demanding a similar skill set where individuals can work without having to move location.

In relation to Australia, Curtain (1996) draws together evidence from primary and secondary data sources indicating a nation trapped in a low skills/low quality cycle.

Comparative data on skill formation arrangements in the major industrialised countries, suggest major deficiencies in Australian skill formation practices, as well as low demand for high quality, intermediate skills in the Australian economy.

The focus on the production of low-level, standardised skills through the apprenticeship system has laid the basis for occupational markets. Employers in the past supported this method of industry-wide or cross-industry skill formation because their need for high level, enterprise specific skills was minimal.

Three sets of survey results cited by Curtain produce a consistent finding: Australian enterprises see no link between skill formation practices and high performance, and many small and large enterprises fail to approach their training requirements on a systematic basis. A strategy is often lacking at the enterprise level that would link skills upgrading to other changes in the workplace, with the result that enterprises are unlikely to foster the competitive intermediate skills that are the basis of the German and Japanese export sectors.

As factors contributing to a low skills/low quality outcome, Curtain identifies the small size of firms, the comparatively low level of technology used by manufacturing industry, the short-term planning focus of most enterprises, the attitudes of managers, employees and unions that have been shaped by these structural factors, the limited value-added downstream processing of primary commodities and a narrow import substitution orientation fostered historically by high levels of protection.

## **What is happening to occupations and skills?**

### a) The changing skill map

Until fairly recent times, 'skill' was seen as involving either high level educational qualifications and analytical capacities or 'hard' technical abilities, combining physical dexterity, spatial awareness and technical 'know how'. In the main, people saw 'skill' as referring essentially to the technologist, the scientist, the technician and the craftsman.

By the 1980s the concept of 'skill' had begun to shade into the realm of values, behaviours and dispositions. Today what policy makers and indeed employers have in mind when they talk about 'skill' is considerably broader than in the past. Skill has expanded to include a veritable galaxy of 'soft', 'generic', 'transferable', 'social', and

'interactional skills', that are frequently indistinguishable from personal characteristics, behaviours and attitudes which in the past would never have been conceived of as skills at all (Payne, 1999).

Critics of this broadening of the skills concept observe that 'skill' is now so loosely defined that it stretches across both 'high' and 'low' skill sectors of the economy, allowing policy makers to claim that we are all part of a high skill knowledge economy. The sleight of hand whereby we are all 'skilled' in the new economy devalues the currency of skill when in the past to be skilled implied some level of real market power and personal discretion over one's work.

In the literature, we find two different responses to the ambiguity and diffuseness, which now surrounds the concept of skill:

In the UK, there is some questioning as to whether VET has a role to play in preparing workers with these 'soft' skills, on ethical and social grounds. Many of these desirable personal characteristics are bound up with the cultural capital of different social groups, as well as on pedagogic grounds to do with their transferability (the so-called 'generic' skills require contextually specific knowledge and understanding). Others are uncomfortable with the idea that the VET system should concern itself with developing 'motivation' in the context of jobs which are poorly designed, lacking in discretion, monotonous and closely supervised. New research indicates, for example, that in parts of the 'style conscious' service sector, 'trendy' bars, hotel and retail outlets may be searching for 'aesthetic labour', where having the 'skill' is about having the face, body, image and grooming that fits the corporate image and sells (Nickson *et al.* 1998).

US commentators, on the other hand, have suggested that if skills are really to do with attitudes, behaviours and personality (the so-called Third Dimension Expertise of the new post-Fordist, human resource driven workplace), then the case for involving the education system in their development is made all the stronger (Capelli, 1995). Their analysis, however, pushes them back to the school system as the site where such skills need to be addressed.

There is a second issue to do with the changing skill map and the way in which it maps onto occupations.

Ashton, Felstead and Green (1998) constructed an index of the change in average skills required for a job (the variables are required education, training time and learning time). They used UK survey and case study data to calculate the extent to which overall skill upgrading in that country has been accounted for by:

changes in the occupational composition of the workforce; and  
changes in upskilling within occupations.

They calculated a rise between 1986 and 1997 in the required skills. Half of the rise in skills required was due to occupational changes. But half was due to skill upgrading within occupations. Splitting their sample into 1986-92 and 1992-7, there was no strong evidence that upskilling has gathered pace.

Their survey and case study data suggest that for a great many occupations, occupation-specific vocational skills are fading in importance relative to cross-occupational skills. When this fading becomes especially large, the occupation ceases to

be a distinct category. If that happens in very specific ways and two occupations meld into one it is probably not a profound problem, but when many different occupations all blur into each other, the system becomes almost meaningless. The latter is not happening at present but may occur in the future.

In their assessment of skill changes in the Australian economy, Tegart, Johnston and Sheehan (1998) similarly observed that on the traditional understanding of 'skill', the employed workforce is not becoming more skilled. Employment growth is strong not only in managerial and professional occupations but also in some low skill occupations, while employment is falling in many traditional skilled occupations. Significantly, employment is growing rapidly in many person-based or information-intensive occupations not previously regarded as skilled, but which clearly involve 'skills' of value to modern employers. Tegart and his colleagues suggest that this continuing change in the nature of the skills in demand, is a major challenge both for policy and for educational and training institutions.

It is common in much labour market and VET research to use educational qualification or the number of years of schooling as the proxy for skill levels in the workforce. Using this variable, most advanced industrialised countries appear to have experienced an upward trend in the average occupational status. This measure of skill trend has however been contested by some social scientists, observing that while occupational titles may remain steady for decades the content of each occupation may be radically altered, leading to higher or even lower skills.

In an analysis of changing work skills in Britain, Green et al (1997) employed a new methodology designed to examine skills actually used at work rather than just the qualifications obtained by the population. Their findings showed a remarkable and consistent pattern of increasing skills used in Britain, deploying several different measures of skills. This was true for both ends of the occupational spectrum, giving little support to the claim of polarisation of the workforce (for those in employment, at least). In the aggregate, jobs in 1997 compared to jobs a decade earlier were more likely to require qualifications (including high level qualifications) for recruitment and broadly no less likely to need those qualifications to be used in work (that is, there was no evidence of 'over education' or credentialism). The study findings thus gave little support to the sceptics who question how far these new qualifications are always necessary or appropriate for the jobs that people later do. On the other hand, it may still be argued that people in jobs for which they are over educated nevertheless transform those jobs.

The survey findings also revealed something about the types of skill change that is taking place. Comparing 1997 with 1993, there has been on balance an increased usage of problem-solving skills, of communication and social skills, and of computing skills, and at the same time a reduction in the use of manual skills.

In the US, Wolff (1996) used a combination of quantitative and qualitative data occupational information contained in the *Dictionary of Occupational Titles* to estimate the cognitive, interactive and motor skill required for satisfactory job performance in each detailed occupation in the US economy. By combining these with time series estimates of the occupational structure over the period 1950 to 1990, he was able to conclude that there had been a significant increase in the use of cognitive and interactive skill in the US, and a decrease in the use of motor skill.

Pappas (1998) adopted a similar methodology, both to test the generality of the Wolff results and to map the evolution of the Australian labour market between 1976 and 1995.

He found accelerating growth in the use of cognitive and interactive skills in production since the mid 1980s, and a decline in the use of motor skill. The observed changes in cognitive and interactive skill were strongly correlated with various indicators of technological change, suggesting that these skills complement new technology. Change in motor skill, on the other hand, was positively correlated with a general indicator of technological change, but was negatively correlated with computerisation. The results suggest that technological change is reducing the demand for unskilled labour, and that developments in information technology and structural changes are reducing the demand for motor skill. This trend seems likely to accelerate, as changes associated with the increasing uptake of information technology are yet to have their full impact (OECD, 1996).

## b) Skill Taxonomies

As changes occur in the nature of work and occupations and the requirements made of workers within new jobs and occupations, definitional shifts in skills and skill profiling systems are currently under scrutiny in most industrialised nations. Many labour market researchers have identified the need for new typologies that take account of the nature and growth in the information sector, in particular its blurring of traditional industrial boundaries.

In the US, initiatives aimed at developing new comprehensive taxonomies of occupational clusters include O\*NET, the electronic adaptation of the new Dictionary of Occupational Titles (DOT). The catalyst for the skills standards movement in the United States has been the changing nature of work and work organisation, and the requirements for new skills and attributes essential to do that work. The revised content models of DOT and O\*NET reflect current thinking in the US that the skill profile needs of high performance work organisation can no longer be served by skill needs derived from traditional concepts of work. These new types of skills are referred to as advanced generic skills.

The problematic nature of occupational classification is highlighted in the case of 3D animators. This occupational classification has been added to the O\*NET occupational classifications as part of a Californian pilot study of the digital and multimedia industries, highlights. As the fastest growing sector of the Californian economy, it is a predominantly contract worker sector in which over 70% of the labour force is recruited from outside the US. The sector is increasingly requiring workers with skills beyond those needed for graphical and digital computing. The demand is for workers with fine arts, design and architectural training, knowledge producers in the widest cultural sense. Much of it is state of the art process, and no current occupational designations are attached to jobs which have never existed before and which are now only emerging because of rapid changes in technology. People tend to flit between highly competitive small state-of-the-art companies. These innovative companies often have short life cycles and corporate knowledge bases are not transferable. Jobs are thus often defined in ways that are not transferable to other companies. It is not yet clear whether the O\*NET approach of allowing occupations to be described in terms of more general, cross descriptors, will be effective in this context.

Robert Reich (1991) in *The Work of Nations* proposed a three-way classification of occupations that was intended to capture new and emerging patterns of work in times of rapid economic and technological change:

“symbolic analysts” are workers for whom problem solving and the application of specialised knowledge is critical and includes IT professionals, consultants and cultural workers;

“in-person service” workers belong to the growing service sector and include shop assistants, waiters, receptionists and so on;

“routine production services” cover the traditional ‘blue collar’ occupations and repetitive jobs within high technology firms including data processing.

Reich argued that the future wealth of a nation would be increasingly tied to its ability to increase the proportion of symbolic analysts in its workforce.

Maglen and Shah (1999), building on Reich’s classifications, developed a new occupational framework entailing a major reclassification of existing disaggregated occupational categories contained in the Australian Standard Classification of Occupations (ASCO). The adoption of such a hybrid model allowed them to track the changes that have been going on within and between the jobs people do, based on retrospective analysis of a ten-year series of Australian labour force annual data. Amongst the key findings of their analysis were the following:

In broad terms, the impact of employment of globalisation of the world economy, and of Australia’s increased exposure to it, and of the attendant rapid technological change and organisational restructuring, has been more negative than positive.

Within the sluggish employment growth over the decade to 1995/6, all of the stagnation and decline in employment was in categories most vulnerable to globalisation, technological change and restructuring.

On the other hand, much of the growth that did occur, was in those occupational categories not directly open to global forces and which did not directly add to the competitiveness of the Australian economy. Moreover, within the insulated in-person service occupations, the strongest growth of all has been at the lowest skill end of the employment spectrum, and mostly in casualised form.

Maglen and Shah go on to draw out some preliminary implications of their study for VET, foreshadowing the need for more work in this area. First, they note that VET has a key role to play in preparing people both as in-person service workers and as conceptual symbolic analysts. For the former, high level interpersonal skills, not just technical competencies should be given priority in course design and program development and delivery. And for the latter, institutional priority needs to be given to the already significant source of education and training for a range of conceptual symbolic analysts, especially in the creative arts, media, multimedia and information technology arenas.

Another Australian study (Doyle, 1999), mapping the rise of the ‘office economy’ has taken a different cut across ABS industry categorisations and ASCO occupational classification, using a methodology employed by American researchers Carnevale and Rose (1998). Office work falls into the study’s ‘Administration and coordination’ category. It includes people who work in finance, administration, supervision, law, advertising, sales management, marketing and business services. They are not employed in goods production or over-the-counter retail or hospitality. Their role is to trade knowledge – they are knowledge workers. The office sector, the researchers suggest, is driving the productivity push in Australian businesses by way of adding value through business and service delivery. The researchers analysed survey data from the last five Australian

censuses, spanning the period 1976 to 1996. The study findings show that office work dominates the economy, employing 43 percent of all workers and capturing about 50 percent of all earnings. Office professionals account for more than half of office jobs. Following Carnevale and Rose, the Australian study also classified jobs as elite (high level of training), good (requiring some formal training/education qualifications) and less skilled (little or no formal training or educational qualifications for admission). Over the twenty-year period of census data, elite jobs had increased from 16% to 28%, good jobs had fallen from 48% to 39%, and less skilled jobs had stabilised around 30%. Over 60% of elite jobs and half of all good jobs were found in the office economy.

Regarding what is happening in occupational upskilling, especially at the level of intermediate skills, a report compiled as part of the UK Skills Task Force and drawing together research findings from case studies in the UK, Europe and the US suggests that there is not a single direction of skill change, largely because of variations with which technology and skills can be combined. This depends on such factors as managerial strategy, existing skills, workplace practices and product markets.

In investigating the link between intermediate vocational skills and productivity, the report drew on data gathered from visits to 165 medium sized companies across a spectrum of sectors (manufacturing, engineering woodworking, clothing and food processing, and hotels) in five countries (Britain, Germany, France, the Netherlands and the US). Through case study examples, the researchers highlight the ways in which production of similar products differs between companies with access to abundant skills (such as Germany) on the one hand, and companies operating in a low-skill context on the other (UK, US). In particular, it details the contribution of superior skill endowment in Germany to the higher productivity levels observed in that country. Customisation and flexibility in responding to smaller batch sizes in kitchen manufacture and food processing for example required more frequent resetting of machines and machine tools, and in the clothing industry skilled machinists required shorter changeover times when a new design was introduced. In the hotel sector, the work of unskilled workers was better scheduled, while the supervisor assumed more responsibility for other tasks such as stock control, purchasing and evaluation of new labour-saving equipment than did the British supervisor.

Case studies tend to be rather unstructured and sector dependent – technical workers in the service sector, managers in the engineering sector, and so forth. This tends to make them descriptive and less useful for thinking about the future. Structuring case studies around some more dynamic understanding of employer types (for example, companies that do not export, companies in rapidly expanding markets, contracted out suppliers to local authorities, companies with particularly large or small shares of their market) and in particular around the other drivers of skill needs (technological change and consumer demand), might help to identify future skill needs more accurately.

### c) The value attached to generic skills

Many commentators have argued that 'key skills' are becoming more important in modern workplaces in the context of current technical changes and rising global competitiveness. Most obviously, information technology (IT) skills are argued to be an increasing and pervasive demand in all industries. However, a range of skills have become more valuable. As trade pressures increase, it has been argued that companies need increasingly to have the capacity to innovate and keep ahead of competition. Since rigid old-style forms of work organisation cannot achieve this, there is increasing demand for the skills associated with 'flexible' workplaces. Good communication – whether with

customers or within organisations – has positive value for the firm, and hence the associated skills are scarce. Problem solving skills are now important throughout the workforce, not just for managers. HR professionals are said to regard social skills as being as important as more easily quantifiable academic qualifications. Workers are said to need to be able to work independently, at a range of tasks, planning their own time, as well as to fit in and contribute to teams.

These various attributes, both technical and social, are commonly referred to as 'core skills' or 'generic skills' or 'key skills', though the jargon concepts and precise typologies differ from one country to another. Employers, it is commonly stated, are articulating a demand for many or all core skills. The International Labour Office has recently linked this increased demand in the industrialised economies in part to changes in work organisation, and in part to changes in technology (Nickson, D. et al., 1998). If key skills are proposed to be in increasing demand, one might expect to find that they too enjoy a premium in the labour market.

A major reason why so little is known about the market for skills is that skills are not easily measured. The possession (or lack) of a recognised qualification is in principle easy enough to measure in a survey, but there are no agreed scales to weigh the extent to which particular generic skills are deployed at work.

A recent study in the UK (Skills Task Force: Research Paper 8) subjected the assertions made about key skills to the test of the labour market, using some newly designed generic skills indices derived from a nationally representative survey comprising 2,467 people. The main findings were that:

- Computing skills are highly valued in the current British labour market, attracting an average premium of some 13%.
- Professional Communication and Problem-Solving skills are also highly valued, raising women's pay by around 5% and men's by 6%.
- To a lesser extent, Verbal Skills also carry a pay premium for women, but Planning, and Client and Horizontal Communication Skills have little independent association with pay.
- Jobs involving greater task variety earn more pay, presumably because of the increased range of skills needed. There is however no strong evidence that greater autonomy is positively rewarded.
- There is also some tentative evidence that where work is specifically organised on the basis of teams there is a pay premium.

On the basis of these findings, the authors drew some conclusions about the operation of the skills market for generic skills. Though the findings referred to the past, they conjectured that there will be little or no reduction in the expansion of demand for IT skills in the foreseeable near future. The implication for government is that there are clear incentives for individuals to acquire computing skills providing the costs are less than the gross returns.

Similarly, the findings suggest that there is a functioning market for some of the key skills said to be in increasing demand: notably, Problem Solving Skills, and Professional Communication Skills, and the skills associated with taking on a variety of tasks (an aspect of multi-skilling). Certain other skills have virtually no labour market premium or even a negative reward. Most notably, there is a complete lack of association with Horizontal and Client Communication Skills with pay.

Another UK study, commissioned by the Department for Education and Employment (Dench, Perryman and Giles, 1998) investigated employers' understanding of and need for key skills. These were defined as communication, application of number, IT, working with others, improving own learning and performance, and problem solving. Employers were asked about their need for the different core skills and about the level of skill required for each, on a four-point scale. What was revealed was a general demand for the core/key skills, though in the case of IT, despite the current rhetoric about its centrality to modern business and the supposedly universal need for an IT-literate workforce, British employers reported IT as the key/core skill for which they had least need. One quarter of employers felt that it was either 'not very important' or 'not at all important' for all employees. However, demand for the core/key skills was strong only if the skills were specified at the lowest levels. Higher levels of skills across the core/key skills were not required for the bulk of the workforce in the organisations surveyed and interviewed. The need for higher level skills was restricted to professional, managerial, and higher level technical staff. This structure of demand reflected systems of work organisation and job design that had removed or heavily circumscribed employee discretion:

As Dench, Perryman and Giles (1998) commented, 'there does seem to be some tension ... with the rhetoric around the nature of job change and employers' actual needs' (1998:61). Certainly these findings are in stark contrast with the world of leading edge work practices and job design. Indeed, far from desiring a workforce of self-reliant, self-monitoring, polyvalent, self-developers, these researchers conclude that 'in reality most employers simply want people to get on with their job, and not to challenge things'. A traditional reliance on managers to undertake the thinking, planning, design and decision making elements of work, while the non-managerial workforce gets on with following procedures and taking orders, would appear to still be the norm.

In Australia, Field and Mawer (1996) investigated the generic skill requirements of high performance workplaces that are successfully pursuing programs of continuous improvement. Based on a study of nine workplaces spanning office and customer service, manufacturing and other (vehicle repair and warehousing), the case study data gathered by the authors point to a convergence of views among employees and managers about the five areas of skills and attributes that employees in high performance workplaces need. These are:

- an intellectual and attitudinal core;
- routine technical skills;
- generic skills (the key competences);
- learning;
- empowerment.

The outcome of this essentially descriptive study was a model of skills in high performance enterprises.

There appears to be broad policy agreement in Australia (evident in the publications and deliberations of ANTA, DISR, and industry bodies) that the only sustainable source of competitive advantage for a developed economy is one based on a highly educated and skilled workforce. In an analysis of the new manufacturing in Australia, Pappas (1998) observes that many Australian firms are remaking themselves through the development of new combinations of production and service activities. They are highly skilled in many aspects of modern manufacturing. These include, project management, software development and application, the development of new products and processes, materials sourcing and management, quality control and testing, design and marketing, distribution

and transport, cost control, accounting and financial management. As production costs fall as a share of total costs and as new manufacturing and communication techniques reduce the importance of local economies of scale, these competitive strengths grow in importance. The challenge as they see it, is to integrate Australian expertise into global production/services clusters, both large and small.

In the light of Australia's recent economic performance, however, it is important for us to address some basic questions:

To what extent are Australian firms adopting product development strategies that demand high skills levels?

Is the high performance workplace a reality or a growing prospect?

Is this the direction being chosen by a majority of sectors and firms, or is it very much a minority movement?

## **The importance of Innovation**

### a) Innovation Theory

Understanding innovation is crucial for understanding the dynamics of 'knowledge based' economies. Indeed, our work suggests that increased innovativeness is one of the defining characteristics of a knowledge based economy and that this has implications for organisational structure, the nature of work, and training.

In modern innovation theory, networking, inter-dependency and learning through interaction lie at the heart of the innovation process. The seminal insight of contemporary literature, informed by studies of the world's most successful national and regional economies, is that innovation is not a linear process as previously assumed, but has been more accurately shown to be non-linear, iterative and interactive. That is, innovation is a dynamic social process involving complex interactions between various actors and institutions that actively seek to learn from one another. To successfully innovate, companies are becoming more dependent on complementary knowledge and know-how in firms and institutions other than their own (Roelandt and Hertog, 1999), as well as on knowledge arising from ongoing dialogue and interaction between producers and consumers.

Consistent with this view, innovation is not understood primarily as a process leading to fundamental breakthroughs or 'the big bang', but one that is continuous, day-to-day, and strongly shaped by past insights, decisions, responses to events, and technological choices. Furthermore, it is now recognised as a process that is virtually inseparable from the production process itself, the site of many important product and process improvements (Gertler, 1999). Innovation and knowledge management have become inextricably linked, as the key to sustainable comparative advantage lies in a firm's capability to acquire, create, diffuse and use knowledge as the key productive resource.

### b) Clusters and networks: the Australian experience

Several strands of theory, research and practice co-exist in the broad domain of innovation and economic activity, with broad agreement on the changing character of market-based capitalism and industrial organisation. Of particular interest here are the

emerging knowledge-based theory of the firm, the concept of the learning region and the concept of the cluster.

The ability of firms to innovate successfully depends on their capacity to generate knowledge by participating in strategic production networks. Firms wishing to innovate must interact and exchange knowledge with customers, competitors and specialised suppliers of machinery, services and inputs. The concept of the cluster focuses on the linkages and inter-dependencies among actors in the value chain in producing products and services and innovating. Its scope goes beyond horizontal networks which have been the principal focus of the traditional sectoral approach. It encompasses *also* vertical relationships between dissimilar and complementary firms where there is interdependency among actors in the value chain based on trade linkages, innovation linkages, knowledge flow linkages or on a common knowledge base or common factor conditions (Roelandt and Hertog, 1999).

The EC in its Fifth RTD Framework Programme has a major commitment to 'promote innovation and encourage the participation of SME's'. The outcomes of these support initiatives are already evident in the high proportion of projects funded under the 'Targeted Socio-Economic Research Programme (TSER) to investigate inter-relationships between knowledge creation, innovation, networks and clusters (see EC web site).

Clusters and networks as sites of innovative activity have become a central focus of policy makers and researchers. The burgeoning interest in this field owes much to the convergence of ideas around the inter-related areas of knowledge creation and diffusion, innovation and the learning economy. The importance attached by government to boosting the participation and productivity of small and medium enterprises in the national economy has further added to interest in clusters and networks as a new or rediscovered form of industrial organisation. The horizontal nature of relationships between small and medium sized firms renders them prime candidates for cluster activity. Cluster development policies sit easily with a trend in policy-making away from direct intervention towards creating mechanisms and incentives to facilitate the networking process.

Italy's networks of SMEs in the northern industrial districts are often cited as the leading exemplar of successful innovation within traditional industries. The Italian experience is revealing, and a salutary lesson for those setting great store by national government innovation policy. A finding from a recent innovation survey of 23,000 Italian firms revealed that the large majority of innovating firms declared that existing innovation policy measures had no relevance for the introduction of innovations. Italy would seem to be endowed with a 'natural' or organic innovation system that is deeply embedded within the cultural, economic and social fabric, and that reflects elements that are called for by the more recent interest in the knowledge-based economy and national innovation systems.

Australia has few, if any, naturally occurring or spontaneous clusters of the Third Italy or German kind, or even of the kind analysed by Porter (1990). Marceau (1999) has sought explanations for the lack of spontaneous clustering in the Australian economy, as a precursor to identifying public policy initiatives that could provide the impetus to cluster building which is currently lacking. There appear to be three key factors.

the structure of the economy and the ownership of major firms which reinforce vertical rather than horizontal lines of production and knowledge flows;

the nature of public policies that have often been developed to protect Australian industry rather than to encourage collaboration and the collective development of an industry;

historical and social factors which have not engendered many longstanding communities, and the focus of educational institutions on individual students and their needs rather than on the needs of the enterprises around them.

Marceau's (2000) ongoing work in the policy arena on innovation and industry, suggests some pointers for the way forward. As well, the activity associated with the 2000 Innovation Summit and Action Agendas is indicative of a new concern with the critical linkages between users, producers, research organisations, educational institutions and policy actors.

### c) The nature of innovation

Innovation has many different meanings, and is often employed very loosely. A definition offered by Bryant et al (1996) in a strategic analysis of business innovation in Australia, is that 'innovation involves the application of new ideas in any of the activities of an enterprise, or in its commercial outputs. The most consistently innovative firms possess clear business strategies; are open to the adoption of new technologies and forms of organisation; undertake continuous improvement, creative design and research and development (R&D); and are thus better enabled to commercialise new ideas successfully'.

Innovation is elsewhere defined as any change that adds value, where 'value' is interpreted broadly in terms of improving productivity, sales, customer service, etc. For the Business Council of Australia, 'innovation is something that is new or improved, and done by an enterprise to create significantly added value either directly for the enterprise or indirectly for the customer' (1993).

Two main approaches to innovation are found in the literature, each carrying different implications for management and policy. One view of innovation has been characterised as 'the strategic leap' or the 'step change'. This approach involves developing significantly new products and services unrelated to existing activities that create new business units. It is often based on distinctively new technology, opening up opportunities to sell to different classes of customers in different markets. Businesses adopting this approach typically operate in markets where their competitive advantage depends on new functionality and higher product and service performance and where product life cycles are short.

The second view of innovation emphasises continuous, incremental change. The 'innovating thrust' approach involves building emergent strengths through focused systematic improvements to products, services and supply services. It also involves the occasional 'step-change' represented by new products, services or processes that fit closely with the enterprise.

As might be expected, given the elasticity in the concept of innovation, there are many different ways it can be measured. A common approach is to take R&D expenditure as a proxy for innovation. Many studies however take a broad brush approach and assume that a change represents an innovation. Defining the boundaries of minor (incremental) and major innovations is difficult, and some studies rely on respondents' own assessments of when a major change has occurred.

It is clear that successful innovation does not just depend on R&D but on the presence of a whole set of complementary assets. These include such things as:

- effective supply chain management;
- being able to enhance relationships with customers;
- assessing and improving marketing and distribution capabilities; and
- the ability to marshal the necessary capital.

In both approaches, successful innovation is influenced by the abilities of firms to learn. The factors that are important here relate to ease of communication and the effectiveness of channels of information and skills transmission between and within organisations. As Bryant et al. (1996) note, management and a strategic outlook are of great importance since these set much of the scope for the external linkages and the positive internal attitudes that will promote learning. At the same time, there is overwhelming evidence that in-house R&D is essential for effective innovation. For most firms, the key contribution of R&D effort is the building up of a firm's capabilities, technological competences and their capacity to absorb and make use of new knowledge.

Macro level data on R&D expenditure in the Australian manufacturing sector indicates that the cost of R&D is on average about one third of that of innovation overall (ie, on acquisition of technology, training, tooling-up, industrial engineering, manufacturing start-up and marketing). This is taken as a general indication of the dominance of an incremental approach to innovation (Bryant et al. 1996).

The Innovation Study Commission (Carnegie and Butlin, 1993) gathered information from 120 enterprising businesses operating in Australia. It found examples of enterprises developing new-to-the-world products, services and supply processes although these represented a small minority of the innovation that occurs in enterprises in Australia. More than 90 percent of the innovating enterprises observed were characterised as applying the 'innovating thrust', whereby their emergent strengths grew out of the existing businesses. The Commission considered that this approach was particularly relevant to the circumstances of businesses operating in Australia.

The most successful innovating businesses in Australia in the early 1990s were focused in two directions. First, they focused on achieving high levels of customer satisfaction by identifying the customer's needs for new performance functionality and aligning product and service development on those needs. Second, they focused on ensuring that their supply system gave them a long term profitable base in a highly competitive world.

Oliver (1999) however challenges the appropriateness of an approach to innovation based on incremental change, at a national level. In preparatory work undertaken for the the National Innovation Summit in Australia in 2000, she contrasts the 'business-as-usual' scenario with a scenario of Australia as 'the innovative economy'. Oliver's prognosis is that Australia does not currently have a national innovation strategy, and that continuation of the current piecemeal approach founded on 'a business-as-usual' scenario will sentence the nation to flat-line growth, stagnant productivity and declining prosperity.

In presenting the case for a national innovation system, Oliver sets out what she sees as the key features to be incorporated into an institutional framework. In a fast changing, intensively competitive business world, a key competence is '*excellence in value creation*'. It includes such factors as:

technical and managerial skills;  
competence developed in on-the-job experience;  
access to leading edge knowledge and advice;  
a will to innovate;  
investment in innovative processes in a systematic and competitive manner within firms and nationally;  
orientation to value creation rather than only cost reduction.

Oliver (1999) has suggested that companies which are rated as strongly and strategically innovative have many characteristics in common:

- high annual commitment to R&D, science of technology base to business products;
- skills in managing scientific R&D processes, including patents or rapid continual innovation, management of multidisciplinary innovation teams, systematic approaches to innovation, technology diffusion throughout the company including management and Boards;
- high levels of interaction, usually proactively, with the R&D sector and with universities for knowledge and skills, collaborative approach to business development and growth;
- global integration through multiple joint ventures, agreements to manufacture, distribute and in R&D in a mix and match with overseas market entry requirements;
- commitment to quality, world's best practices and search for continuous improvement;
- commitment to attracting a steady flow of the best and brightest people and retaining them through rewards such as employee share schemes, and keeping the quality of technology 'where it is at';
- high growth through global integration strategies and through R&D, innovation and acquisition;
- long term strategies, pursuit of a vision;
- competitive allocation of resources in-house;
- ability to change rapidly;
- supply of capital; and
- high percentage of exports with global sales and support infrastructure.

Oliver's list of characteristics could be criticised for the extent to which they reflect a 'big end of town' view of innovation, and relate primarily to factors which one might find evident within large companies. Clearly, a great deal of innovation occurs in companies with little capacity to fund a traditional R&D program, nor a lot of patents or high levels of capital to fund new technology. In small to medium sized enterprises, particularly in emerging industries, innovation is harder to identify. What Oliver's analysis does affirm is that:

'real knowledge intensity is being codified and laid down, layer upon invincible layer within well run organisations – organisations which have as their purpose to create extraordinary results from ordinary people'.

An Innovation Study Commission on Australian innovating enterprises, established by the Business Council of Australia in 1991 appears to have relevance in making sense of innovativeness in smaller less technology intensive enterprises. It identified five factors that account for sustained success with innovation. These five 'success factors' (which are largely the product of consistent, concentrated effort by people in the enterprise), comprise focusing on customers, building a competitive supply system, sustaining leadership, building in systematic approaches to innovation, and committing scarce

resources to competition. These five elements strongly connect the three themes of employee relations, applied technical development and high quality management. For the majority of enterprises, innovation is not essentially about science and technology, but rather, systematic general improvement of performance. In the view of the Commission members, “although seeding small, high technology enterprises can be highly successful, by far the greatest returns for the general body of Australian business can be found in undertaking customer-focused enterprise innovation” (Carnegie & Butlin, 1993). The outward manifestations of creative and systematic enterprise innovation include:

- better supply processes;
- new and better products and services;
- combining new processes and new products;
- technological breakthroughs;
- acute marketing judgement;
- across-the-board improvements.

More recent research (Rogers, 1998) has drawn on evidence from the 1990 and 1995 Australian Workplace Industrial Relations Surveys (AWIRS) to investigate the characteristics of workplaces that are associated with innovation intensity. Using change as a proxy for innovation, the study constructed a typology of low, medium and high innovation intensity based on a fourfold categorisation of change. These categories were: introduction of new product or services; changes to how work is done; management reorganisation; and investment in new equipment. The research mapped the workplace characteristics (workplace size, firm size, union presence, employee-management relations, age), environmental factors (commercial, declining demand, unpredictable demand) and management methods (suggestion schemes, share ownership programmes, task forces and quality circles) associated with the different types of workplace change. The results suggest that better employee management communications are associated with more change, and that workplaces with higher levels of training undergo more change. The basic workplace characteristics (part of large firm, ownership, management-employee relations and union presence) also have associations with some of the measures of change. There is some limited evidence that poor external demand conditions reduces the likelihood of new product and process innovation.

Two broad conclusions emerged from an analysis of the data by industry. First, that there are significant differences between industries in the propensity to change. Second, that these differences are not consistent across the measures of change. For example, the mining industry appears less likely to undergo product change but more likely to undergo a restructuring of how work is done and to consider process change.

What innovation theory and research concerning innovation has shown is that the innovativeness of individual workers, companies, clusters or networks of companies and regions is an important factor in the development of knowledge based economies. As we have also outlined above, successful innovation does not just depend on R&D or new technology. It also depends on the utilisation of a whole set of complementary assets including work practices, organisational behaviour, the development of soft structures (e.g. supply chain management and customer relationships), and market assessment and strategic decisionmaking.

## **The knowledge based economy and vocational education and training**

Having looked at the nature of the knowledge based economy and the implications it is having for work, we need to ask what are the implications of a knowledge based economy for the vocational education and training system? The need for VET to respond to changes in industry requirements and to develop the workforce skills required by the new and emerging industries of the information economy is well recognised (see for example, ANTA 1998; Doyle, Kerr and Kurth 1998; State Training Board of Victoria 1998). As discussed in this review, one key implication is that the knowledge based economy demands new skills that differ from those derived from traditional conceptions of work. It follows, then, that such a skill formation process also needs to be supported by a vocational education and training system that has moved beyond one based on previous traditional conceptions of work (Berryman, 1993).

Having said this, it must be recognised that there have been a number of reforms to the VET system in recent years. These include:

- the implementation of a market approach to VET;
- increased emphasis on the workplace as the principal site for VET;
- the opening up of new pathways and options from education to work; and
- delivering VET through curriculum strategies associated with competency based training (CBT).

This research project has a direct interest in whether the changes introduced into the VET system in recent years have appropriately anticipated the demands of the knowledge based economy. To fully assess this issue it is important to consider some key changes in VET over the last 20 years.

a) The implementation of a market approach to VET

In the late 1980s there was a radical shift from the traditional provision of VET programs in Australia. As part of the aim to increase the efficiency, flexibility, quality and responsiveness of VET, the Government promoted the development of a competitive training market within the VET sector, a sector which until the late 1980s operated largely under non-market conditions (Anderson, 1997). The policies and practices associated with this shift have had far reaching implications and have sparked considerable debate. Supporters for developing a market approach (e.g., Robinson, 1997) argue that the outcome will be a more efficient and effective VET system. Those against (e.g. Anderson, 1997) argue that given the Government's publicly-funded VET programs of market reform, giving precedence to the needs of industry can neither be sustained nor justified.

According to research conducted by the National Centre for Vocational Education Research (NCVER):

Research into training markets in Australia has been more about 'personal ideological positions on competition and market reform in the VET sector than objective analysis of relevant trends and developments'. There is currently insufficient empirical evidence to either support or refute claims that increased competition will produce the benefits being claimed by proponents or the severe drawbacks being speculated upon by opponents of the training market. (NCVER, 1998, pi)

Some early analysis of VET markets in Australia was conducted by Allen Consulting Group for the Australian National Training Authority (ANTA) in 1994. Their findings identified six areas of poor performance in Australian training markets:

- On the demand side the initial issue is to encourage demand between enterprises and student individuals who feel that the return on their investment in training is worthwhile;
- On the supply side there is limited knowledge about the supply of training and how well it matches demand;
- The market is not accessible to all, especially small businesses;
- Governments are sending mixed signals in setting the rules under which the market will operate;
- Information to consumers about training products and how to distinguish them in terms of price, quality and service is poor; and
- The implications of this are that clear definitions of VET products and greater consumer awareness and product knowledge amongst enterprises and individuals is fundamental to the effective operation of VET markets (Allen Consulting Group, 1994, pp. 40-41).

It appears that these problems with market reform have not yet been resolved. In a recent study examining the question of how well the training market is meeting the needs of employers grappling with the challenges associated with globalisation, Hall, Buchanan, Bretherton, Barneveld & Pickersgill (2000) presented findings of case studies on two industries in New South Wales. One was a mature industry (metals and engineering) and the other an emerging knowledge based industry (information technology). From the data collected they found that for both industries:

- employers failed to make an adequate commitment to training investment and skills development within the workforce;
- employers lacked knowledge about (i) the amount and type of training they required, (ii) the competency-based training and assessment reforms; (iii) the operations of the new training packages; (iv) the means by which group training companies, networks and cooperative schemes can be used to assist in supporting training; and,
- there was a tendency for employers to attempt to recruit already skilled workers, or buy in skills from labour hire firms, rather than to take on trainees, or train and develop the skills of existing or new employees.

It was concluded that emerging training markets in both these industries were not responding to the challenges companies face in grappling with globalisation. "Many of the reforms surrounding the push to an 'industry training market' assumes that price is capable of providing an adequate and efficient coordinating mechanism. This study reveals that too much is expected of this mechanism" (Hall et al, 2000). The authors suggest that price can play a role, though it needs to be supported by a range of more dynamic and effective mechanisms. Successful mechanisms tend to be regional and industry specific and involve the active participation of firms in a network or cooperative arrangement, enabling the training needs and burdens to be shared among firms.

The implications of these findings in relation to the knowledge based economy are profound. In an environment where knowledge rapidly changes, these difficulties are likely to be further exacerbated. At issue is the degree of information flow between Government and organisations and firms and VET providers. The finding that employers may be failing to commit appropriate investment in the workforce and in some cases simply attempt to recruit already skilled workers, is particularly problematic. Further research needs to be undertaken in other sectors of the knowledge based economy to ascertain if these findings are generalisable.

These conclusions also draw attention to the danger of viewing VET policy in isolation. The VET system is but one component contributing to national innovation and training. The role of VET in enhancing Australia's social and economic wellbeing needs to be evaluated in the context of a range of other reforms.

#### b) The VET client

The advantage of conceptualising VET as a market is that it does provide mechanisms for examining more fully the client base for VET products. In the initial phases of these most recent reforms, industry -- often interpreted as big business-- was regarded as the primary client of the VET system (Anderson, 1997). Indeed "who counts" as the key client has generated considerable disagreement under a user-choice market-driven system (Selby-Smith, Selby-Smith, & Ferrier, 1996). This issue is important in this review because of the implications for access and availability of types of VET services.

Some research suggests that while large employer groups have gained much from VET market reform (Balzary, 1998), small business has not fared as well. Given the rise of small business within the emerging knowledge-based economy, this issue is of concern. There is evidence to suggest that small business operators are not enamoured with the existing VET system (Gibb, 1997). Much of the literature on small businesses and training suggest that small business does not participate in the VET system but relies instead on informal training (Kilpatrick and Crowley 1999; Field 1998; Gibb 1997). Gibb suggests that small business lacks the conviction that training (that is, formal VET) is useful. Reasons why small business may be resistant to training, and the failure of training providers to meet its needs, is that training programs are too general and not targeted to small business needs. Time, quality and cost are also issues of concern for small business (Gibb 1997, p.18). Gibb suggests that one way of better meeting the needs of small business clients is to tailor programs according to their stage of development. This means that businesses would be targeted depending on their years of operation. For example, VET programs for businesses less than three years old would be differentiated from others aimed at "second-stage businesses" which are entering new markets (ibid, p.20).

In contrast to an industry or business focus, Anderson (1997) argues that individuals are the major clients and their reasons for taking VET courses do not always relate to employment outcomes. According to Anderson (1997), participants in the VET system who numbered 1.35 million in 1998 and should therefore be considered the major stakeholder. However, this is also an underestimate of how large the client base could be. Research (e.g., Butler & Lawrence, 1996) into access and equity issues in VET also identify a number of population groups who are currently under-represented in the VET system. These studies show that participation in VET is neither equal for individuals and neither is it accessible. A number of groups (e.g., women, Indigenous Australians, people with a disability, people with a non-English speaking background) remain under-represented in VET provision and work needs to be done to assess if these patterns continue to reproduce themselves in the knowledge-based economy and what can be done to interrupt them.

Several studies (e.g., ANTA, 1999; Pattison, 1998) have examined who participates in VET and have analysed this in terms of market segmentation. A recent study exploring attitudes to learning (ANTA, 1999) surveyed 3,866 members of the community. One of the conclusions of the study was that "Australians are passionate about learning but for most of them learning is not synonymous with education and training and their passion is not linked to their experience -- or even their expectations of - formal education and training" (ANTA, 1999, p. 4). The study identified four core attitudinal groups: those who love to learn (23%); those who learn to earn (31%); those who value learning but, due to

barriers, are not involved in participation (22%) and those who believe learning is not important (15%). An area for further study would be to examine the demographic characteristics of these groups to determine if their participation in the knowledge-based economy is similar or different and to draw on the study's strategies for gaining greater involvement in knowledge-based VET programs.

VET services are also not equally accessible geographically. Kilpatrick *et al* (1998) found that there is a lack of variety and diversity of training programs offered in smaller centres. Policy initiatives which foster competition at the expense of cooperation, such as user choice, can have negative consequences in small or thin rural markets. A lack of industry diversity in individual locations limits the range of work placements for training, especially vocational education and training in schools. The capacity of the predominant small business sector to host trainees is limited by economic factors and business training infrastructure. The move of businesses and government operations away from small communities reduces workplace training and assessment opportunities. Further research is needed to investigate the ways in which cooperation and competition work in small communities (Anderson 1997; Noble, Hill, Smith & Smith, 1998).

There is another side to the emphasis on enterprise demand as the key driver for VET. Burke (1998) concludes that in an economy with the characteristics described earlier in this review, when more people will need training, it may be difficult to sustain a participation in workplace training given current trends in employment and unemployment. Burke concludes that 'increased attention has to be given to sustaining individual demand for training by the growing numbers who are not in large firms or in full-time employment' (1998). In other words VET providers may need to become more responsive to individual demands than to enterprise clients as the demand for VET qualifications is to be sustained in the current economic context (Anderson, 1997).

An economic focus on VET narrows attention to delivery of VET as part of employment, yet there are many people who either are not in the labour market or who work in the voluntary sector. In a study undertaken by the Centre for Research and Learning in Regional Australia (1998) the role of vocational education and training within community was examined in rural and regional Australia. The study found that VET contributes to regional communities in a variety of ways: some of those contributions were tangible in terms of employment related outcomes and community activity and some of the outcomes were less tangible. Less tangible, though it was argued just as important, were outcomes that led to the building of capacity within individuals and communities, enabling those individuals and communities to meet their social and economic needs thus ensuring their future sustainability. The community, as a site for skill formation needs further attention, especially for those who may not participate in employment and therefore, be able to engage in VET in the workplace.

### c) Employability

As has already been discussed earlier in this literature review, the kinds of jobs people are training for are also in a state of flux. Indeed, in his discussion of the formal delivery of VET, Hobart (1999) states that "one of the most significant impacts that globalisation has on the curriculum is the need to develop in the learner the knowledge and skills for 'employability' as well as for 'employment'" (ibid, p.41). Hobart adds that the new competitive framework requires a broader set of skills, both hard (technical) and soft (interpersonal and communication) skills to be viewed as equally important. In a knowledge-based economy, VET systems may no longer be assisting people to get clearly defined jobs as well know them, but may instead be required to assist individuals to develop a portfolio of skills with an emphasis on teamwork, communication and rapid

learning. In recognition of the changing structure of the workforce, Doyle et al (1999) refer to the need to build a portfolio of skills and knowledge 'that will probably fit a succession of jobs rather than just one' (p.6). In this context, the role of transferring knowledge and competencies across settings becomes particularly important.

The concept of employability is attracting increasing attention, and is a focus of interest to both policy makers and researchers. The Melbourne University based CHRDT has initiated a major research programme into the nature of employability in the emerging knowledge based economy. In the UK, employability has gained a strong hold in policy making, as part of the pact of mutual obligation and responsibility between individual workers and employers. In that country, the concept has broadened out from its earlier meaning as a kind of 'meta-characteristic' of workers that combines attitudes, skills, knowledge and attributes, to embrace a wider set of aspects to do with the labour market situation, knowledge of the labour market and company policy. Outin (1990) sees employability as a construct of four elements that influence someone's chances to reach a position in the labour market: individual qualities (relational, motivational), occupation-specific skills, labour market situation and government and employer training policies. Employability thus becomes a shared responsibility of government, the firm and the individual.

In recent work on employability, deGrip, van Loo and Sanders (1999) have constructed an industry employability index that attempts to rank the various sectors of industry according to their employability situation and potential. Drawing on various Dutch data sources, the researchers incorporated into their analysis 1) the willingness and capacity of current personnel in the workplace to engage in activities that keep them attractive in the labour market – based on six indicators converted into a score on mobility, training and flexibility); 2) the need for employability in different industry sectors which is dependent on the intensity of various developments in society – four indicators to do with technological change, organisational, economic and demographic developments; 3) 'the conditions for effectuation' ie. the opportunities that exist to effectuate or expand one's employability ie. the general situation on the labour market, the provision of training courses and the possibilities for career counselling. In the Netherlands, financial services scored highest on the Employability Index. Other sectors with favourable scores were construction and real estate and hotels/restaurants, repair, and business services. The agriculture and fisheries sector performed worst in terms of employability.

#### d) VET in the workplace

In recent years there has been an increased emphasis on the workplace as the key site for VET delivery. There are clearly advantages and disadvantages with such an emphasis. On the one hand, as work within a knowledge based economy becomes more intense and conceptually demanding, it becomes increasingly difficult to learn skills in decontextualised or simulated conditions. The advantage of locating VET within a workplace context is that it enables individuals to directly apply their training in the context of the job at hand. However, such environments can also be a disadvantage. What is being learned is most often skills needed immediately. Immediate needs are important, but are not necessarily helpful in terms of anticipating future or unmet skills needs in rapidly changing environments. Often workplaces are also not set up to incorporate learning and training. The study by Hall et al (2000) reported earlier, also found that workplaces were generally poorly prepared to accommodate a workplace training focus, which is an integral feature of the new training packages. Moreover, workplace training raises the issue of workplace assessment and who is competent to assess the training occurring. In a survey of 23 peak industry bodies, which included employer bodies, unions and Industry Training Advisory Boards, the rigorousness of

workplace assessment (and its moderation) has been identified as a key concern (Owen & Bound, 1998).

The knowledge based economy also signals an increasing diversity in the kinds of working arrangements people will accept. They include a growing number of people who are self-employed and who are not operating as wage earners. The number of people who are self-employed is rising and indicators support a continuation of this trend. Changes in employment arrangements in terms of outsourcing and the increasing contracting out of services mean that the place where work is undertaken may not even be in the workplace but rather from the contractor's home office. Where do these people access VET if the focus is on a traditional workplace? This shift in the labour market, together with its increasing casualisation has implications for VET. Studies show that employers spend less dollars on training contingent workers (i.e., short-term, temporary, part-time, casual, contract) and expect these workers to be responsible for their own training.

What the above suggests is that the role of the workplace in relation to training needs to be carefully considered, and the complexity of industry sectors and variations in industry size and resources understood.

#### e) Competency-based training and the knowledge based economy

The relevance of strategies such as Competency Based Training (CBT) to the skills and knowledge required by today's workforce has been discussed by a number of authors (for example, Billett 1997; Graham 1998; Moy 1999; Mulcahy & James 1999). There is limited evidence that CBT itself is directly associated with the development of a skilful and adaptable workforce. The key antagonism between CBT and the development of adaptability and flexibility is seen by Billet as vested in CBT's focus on outcomes, rather than process, and its failure to understand that the educational intents may deny the very thinking and acting which determined performance. It is also claimed that the national focus and the means of implementation also misrepresents the complexity of vocational knowledge, its situatedness, the teaching and assessment of that knowledge, and the basis by which teachers commit themselves to their practice (Billet 1998, p.3-4).

Recent research into CBT suggests a "shift in the nature of skills requirements at the enterprise level away from narrow technical skills and towards a new training paradigm that emphasises the need for developing broad sets of generic skills in the workforce in order to increase adaptability" (Smith, 1999, p. 115). Within a knowledge based economy greater value is placed on human resources and 'intellectual capital' (Ferrier, 2000). In fast changing workplaces, continuous training and retraining need to be underpinned by attitudes toward continuous learning. According to some researchers and policy makers (e.g. Berryman, 1993; Robinson, 1998), in the 'new economy', specific technical skills are likely to remain relevant for shorter periods of time. A key implication for the VET system is that such fundamental changes will require training to be oriented toward continual skills upgrading as existing skills become obsolete with increasing rapidity. Moreover, the emphasis in some industries, for training aimed at immediate job-specific skills (Billett, 1998) is likely to be an inadequate basis to sustain future skill formation. This leads many researchers to conclude that generic skills will increase in importance. (See Kearns, 2000 for an up-to-date review of research relating to generic skills for the new economy.)

An interest in generic skills is not new. Finn (1991) and Mayer (1992) each recognised the importance of to the VET system of a number of key skills:

- collecting, analysing and organising information;
- communicating ideas and information;
- planning and organising activities;
- working with others and in teams;
- using mathematical ideas and techniques;
- solving problems;
- using technology;
- using cultural understanding.

In a recent industry specific study, examining generic competencies in the Australian construction industry, Crowley, Garrick & Hager (2000) noted that the skill requirements of the construction worker were changing and are underpinned by clusters of the generic competencies. The generic competencies of collecting and analysing information, teamwork, communication and planning and organising activities were evident in construction work of all kinds. However, as in other industries, the construction industry has yet to develop systems and mechanisms for facilitating the optimum transferability and recognition of such skills.

The trend of increasing workplace change has led some (e.g., Capelli, 1995, Manfred, 1995) to suggest that all individuals, not just high-performance, high-skill workers, now require the competencies and qualities previously associated with 'more highly educated individuals' (Manfred, 1995, p.165). The European Centre for the Development of Vocational Training (CEDEFOP) notes that it is expected that more holistic, self-reliant working and greater responsibilities for workers will require broad transferable and flexible skills (Manfred 1995).

In the United States, the Secretary's Commission on Achieving Necessary Skills (SCANS) (1991) reported on the qualities required to succeed in high-performance workplaces, characterised by high-skill, high-wage employment. The SCANS report (in Moy 1999, pp.10-11) found that school leavers and workers required solid three part foundation, or 'fundamental skills' comprising: basic literacy and computational skills; thinking skills (including creative thinking, decision-making, problem solving, learning to learn and reasoning); and personal qualities including responsibility, self-esteem, sociability, self-management and integrity/honesty. The report also recognised five 'workplace competencies', including the ability to manage resources, to work amicably and productively with others, to acquire and use information, to master complex systems, and to work with a variety of technologies.

Hobart (1999) has added that 'global' workers need flexibility, problem-solving and decision-making ability, adaptability, creative thinking, self-motivation, and the capacity for reflection. People with global mindsets have the ability to look at the broader context, accept contradiction and ambiguity, trust processes rather than structure, value diversity and teamwork, view change as opportunity, and strive for continuous self-development (ibid., p.43).

Some research overseas suggests that the best mix for VET within a knowledge based economy is training programs that include a mix of the following categories:

- generic foundation skills development;
- industry or occupation-specific skills in response to current needs; and

specific skills development for the future (Wolff, 1996).

Other research in Europe suggests that workers' involvement in innovation in the workplace may require new forms or combinations of technical skills, including design skills, and skills associated with the management of change. The use of critical-reflective learning is seen by many as essential for successful innovation and change, and these skills may need to be explicitly developed (Brown, 1995).

There is recognition as well of the value of a substantive knowledge base and this is accompanied by a perceptible shift towards investigation of more holistic approaches to learning and assessment in the development of vocational expertise. Soden (1993) has shown that 'good problem solvers have internal representations of fundamental principles relevant to their occupational area and these representations are connected to each other and to broader relevant knowledge. The whole thrust of such ideas is that in order to develop expertise in an occupational area it is necessary for learners to develop mental models, frameworks or networks that link knowledge and ideas from different subjects and domain areas.

In spite of this varied research and writing on the need for generic skills and more holistic approaches, Mulcahy & James (2000) found that a narrow technical view of competence is still alive and well. They found that distinctly different discourses of competency are developing in different industry sectors and between different workforce groups. They identified a discourse of competency for operational technical and trade staff as "specific skills for specific jobs", but a broader view of competency for staff involved in managerial and professional work. They concluded that two broad models of VET are emerging: a training model, which emphasises competence in specific practices, and a developmental model, which emphasises competence in generic practices. Further, they identified a contradiction between what employers say they need and what they demand from CBT.

According to Mulcahy (1998) the skills and knowledge, which are codified in competency standards, are dependent on other skills and knowledge that are not necessarily codifiable (e.g. tacit skill, experiential knowledge). Two types of vocational knowledge are conceptual and procedural knowledge; each being used regularly both in routine and non-routine problem solving. Mulcahy and James (1999, p. 21) argue that "non-routine problem solving ... requires that cognitive structures be transformed, thus furthering and developing, as well as reinforcing, knowledge". Problem solving and transfer require deep conceptual knowledge to enable the learner to abstract the necessary concepts and principles that form the basis of novel problem-solving and transfer across settings, a capacity that is associated with high levels of performance and expertise. However, Mulcahy and James suggest, that the development of deep, robust transferable knowledge depend on the learner negotiating meanings with the environment and constructing knowledge. This raises the issue of the importance of learning in context and of the intersection between formal and informal learning.

A further implication arising from the knowledge based economy is the differentiation between individual and teamwork and learning. The importance of teamwork in the knowledge based economy has already been discussed. A review conducted by Waterhouse et al, into the changing nature of work and its implications for vocational education and training, concluded that in the new economy, individual competencies may not be the most important outcomes to be training for in a VET system. Given the value placed on the ability of groups of people to work effectively together more attention needs to be given to the notion of 'collective competence' (Waterhouse, Wilson & Ewer, 1999). The authors suggest there is a need to identify what group or team competencies

might be. Further research is needed to identify what collective competence in action might look like and how it is manifested in various settings. Consideration also needs to be given to the relationships between individual competencies and group or collective performance. They ask the key question, if social and collective competence is important, what are the implications for teaching strategies based on individualised conceptions of the learner and competence?

Delivery of VET is not simply hindered by structures developed to implement policy. It is also enabled and constrained by the delivery methods available and the capabilities of VET providers. A key area emerging in the VET literature is the issue of professional development of the VET industry and the capacity to develop creative and flexible materials that are of relevance to the target group. Pedagogically, research indicates a lack of creativity on the part of VET providers (see for example, Bennett, Priest and McPherson 1999; Greville 1998). Vet providers have also been slow to take up the development of flexible delivery strategies (Spark & Associates, 1996; Kearns, 1998). In examining statistics on delivery methods used in Victoria and Queensland, Kearns (1998) concluded that less has been achieved than hoped, and that "flexibly delivery on the whole, with some significant exceptions remains in a marginal position with regard to mainstream vet provision" p. 78). VET delivery is still delivered largely through traditional classroom teaching with some indications of a trend towards self-paced learning (Kearns, 1998).

There are obviously a number of critical issues facing VET if it is to respond to some of these important training needs that industry faces in the 21<sup>st</sup> century. There is a tension between the provision of skills and competencies through the VET system that are centred on traditional occupation categories with the emerging need to consider how VET can play its part in the development of generic skills and the preparation of workers for lifelong learning.

While it is obviously necessary for individuals to have an increasingly sophisticated range of skills and knowledge in order to manage the future, it is the underpinning skills of learning to learn that "will become the bedrock capability of both individuals, and organisations" (EdNA 1999). This approach has been endorsed by Kearns et al:

We have concluded that there is a need for active promotion of learning organisation principles and for experiment and innovation in a range of contexts. These include enterprises of all sizes and VET institutions. Learning in the workplace is intimately linked to the other contexts for learning discussed in this report, so that the need exists for integrated policies and strategies that foster learning in this range of contexts. Forging strategic partnerships associating all stakeholders will be essential for this purpose. (1999, p. 59)

## **Conclusion**

The central concern of the knowledge based economy is the need for modern industrialised nations to adopt a high skills and knowledge driven approach to economic development competitive strategy. As our review has shown, this will involve occupational restructuring as well as skill and knowledge changes within existing occupations. As well, it will be associated with changes in the structure of firms and the way they relate to other customers and competitors. This will also be associated with an

increased demand for innovation on the part of individual workers, the firm, clusters of companies, regions and indeed complete economies. Our review has suggested that understanding innovation is crucial for understanding the dynamics of 'knowledge based' economies. In modern innovation theory, networking, inter-dependency and learning through interaction lie at the heart of the innovation process. Research has also shown that innovation is not a linear process, but is actually non-linear, iterative and interactive. Hence, innovation is a dynamic social process involving complex interactions between various actors and institutions that actively seek to learn from one another. To successfully innovate, companies are becoming more dependent on complementary knowledge and know-how in firms and institutions other than their own, as well as on knowledge arising from ongoing dialogue and interaction between producers and consumers. Training and education must do more than simply develop skills and specific knowledge; it needs to prepare workers for lifelong learning and to be part of the process of innovation in whatever industry employs them.

Research, both theoretical and empirical, suggests there has been an over-simplification of issues surrounding training. VET faces a far more complex set of inter-dependent issues in the future. Not only are there significant industry and firm level differences in the perceived strategic value of moving down a high skills/high value path, but international comparative studies also highlight systemic features which may constrain a nation's intent to reposition itself in the global economy.

The general thrust of research findings is that movement towards a knowledge based economy (in terms of adoption of high performance workplace, upskilling of the workforce, occupational shift towards knowledge workers) is slower than many commentators predicted. Investment in human capital as the key to economic competitiveness appears not to be the only competitive strategy in a globalised economy, and indeed is not the favoured one by many firms. The tendency for researchers to focus on 'best practice firms' (echoed in the writing of OECD and national governments) gives a misleading picture of changes in firms' management practices across the board.

Occupations and skills are undergoing change. Boundaries are blurring between occupations, and the concept of 'skill' is expanding to reflect employers' needs for a range of 'soft' skills. However, research findings reveal a varied picture. It would appear that there is not a single direction of change in skill levels, nor is the common depiction of skill polarisation an accurate one. Rather, the findings are again far more nuanced. Macro data on skills in the workforce is often at odds with findings from case studies and more micro level survey work.

International research findings indicate accelerating growth in the use of cognitive and interactional skills, and decline in the use of motor skills. Many studies of employer attitudes also reveal increased demand for 'soft' skills or generic competences. When tested in the market place, there is some evidence that employers are willing to pay a premium for IT, problem-solving and communication skills, although research also shows that demand for such skills is strong only if specified at the lowest levels of the workforce. The intangible nature of many of the skills supposedly valued by employers renders their market value particularly problematic.

The need for VET to respond to changes in industry requirements and to develop the workforce skills required by the new and emerging industries of the information economy is well recognised. One key argument raised in this brief review of literature is that the knowledge based economy demands new skills that differ from those derived from traditional conceptions of work. It follows, then, that such a skill formation process also needs to be supported by a vocational education and training system that has moved

beyond one based on previous traditional conceptions of work. The VET system needs to re-examine its role and delivery strategies as we enter an age of increased demand for new knowledge, generic skills and workers who are equipped for lifelong learning.

As we have outlined in the introduction to this paper, our work is shaped by a definition of the knowledge based economy as one that is increasingly dependent for its growth on the input of knowledge as a value-added input to the economic system. An important concern for us therefore as we attempt to examine the changing nature of work and policy implications for VET is the extent to which there is evidence of:

- changing industry structure exemplified by new industries, occupations and organisational arrangements;
- changes in the types of skills required within firms and across industry sectors, and the importance of generic skills;
- new forms of knowledge and increased importance within regional economies for the creation and application of knowledge in networks or clusters of companies/enterprises;
- changing organisational structures within firms and whether workers are being required increasingly to engage in 'communities of practice';
- innovation becoming more important as a means to increase economic competitiveness;
- knowledge management becoming increasingly the key to sustainable competitive advantage, requiring individuals, firms, and regions to acquire, create and use knowledge as the key productive resource; and finally
- how needs for training are changing in relation to purpose, content, process and outcomes.

Ultimately, our findings will need to be examined in the light of current government policy and practices in the VET sector. The potential policy considerations for the Board that will arise from our research include the appropriateness of the current National Training Framework for the emerging skill needs of industry, enterprises, individuals and the community, the role that VET might play in stimulating the development of regions, the suitability of existing provisions to meet the needs of emerging industry structures such as networks and clusters, and the extent to which VET can meet the need for generic skills that tend increasingly to transcend employment classifications and industry sectors. More recent concern within the VET sector with market based approaches, increased emphasis on the workplace as a site for training, online delivery and alternative pathways for training, suggests a preparedness to consider change and adaptation to meet industry needs.

The role that vocational education and training is playing, or might play in the future, is obviously the central policy dilemma that drives this research. The research literature suggests that the formation of a new generation of knowledge workers cannot be achieved simply by established educational and training structures, institutions and programs. Adaptation and change are an integral part of meeting emerging challenges.

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