Local Matters: Regions, Innovation and Vocational Education and Training in the Australian context

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Abstract

The paper reports on current research in the Riverina region of NSW that is investigating relationships between skill formation, knowledge transfer and the innovation process, with a particular emphasis on the role of VET institutions in supporting and diffusing innovation.

In the recent Australian policy context 'innovation' has been conceived as primarily resulting from capital-intensive research and development. This understanding has been largely derived from international literature, in particular OECD materials that identify 'innovation' as part of a necessary public response to the challenges of 'globalisation'. The paper argues that in practice, innovation in organisations is mostly incremental and process oriented. This understanding is particularly relevant for small to medium enterprises, typical of regional Australia.

The paper discusses case study findings from a number of innovative regional organisations, most of which are competing in international product markets. These organisations, and the communities in which they are situated, depend heavily on regional education and training infrastructure to develop skills, knowledge and supporting social capital. The research findings are presented in the context of a critical analysis of key terms used in the overseas literature, where the concept of 'region' has different geographic, demographic and labour market implications than Australia.

Introduction

This short paper has two general aims. The first is to raise, (with a new audience for the author), issues that have been prominent in recent national level debates in the Vocational Education and Training (VET) sector, primarily in response to recent government policy on 'innovation'. The paper seeks to do this through a report of preliminary findings of research into the involvement of VET with 'innovation' and regional development.

This research involves ongoing identification of innovative sectors of regional to identify the skills and knowledge that underpin innovative practices. Three of the case studies are discussed below; two involving innovation in manufacturing industry and the third broadly concerned with innovative arrangements supporting Tourism development. This research program is intended to complement other work, (primarily investigating technical innovations in regional industry), that has been undertaken by colleagues from the School of Management at Charles Sturt University over several years (eg; Bamberry, 2001; Bamberry & Wickramasekera, 1999; Bamberry, 2005).

'Innovation' has been presented in policy as one of a range of apparently necessary responses (such as 'life-long learning') to irresistible forces of 'globalisation', purportedly manifested in new social relationships required by 'the knowledge economy'. Thus 'innovation' in current policy is presented as a virtual cure-all for economic woes to which a range of deterministic and frequently instrumental educational responses can be presented as 'the answer'.

One of the many issues that arise in contemporary policy discourse is that the terms used are rarely defined, or if they are they tend to be accepted uncritically. The concept of 'region' as used in much of the international literature (using examples such as 'Silicon Valley', 'Route 128' or 'Northern Italy') does not reflect the reality of 'region' as the term is applied in rural and regional Australia. Uncritical acceptance and application of incommensurable terms in public policy can lead to poor policy outcomes.

A key to understanding the role of VET sector in innovation is appreciating that it is, *by definition*, directly related to the labour market and hence through the employment relationship to developmental needs of local and regionally based industry. The development of a research program which investigates these relationships is potentially of great interest as it looks at the integration of education/training with labour market (ie. employment) outcomes, regional infrastructure and 'capacity building' (Macadam et al, 2004; Productivity Commission, 2005; RIDC, 2004).

The second aim follows from the first. It is hoped that raising these issues may lead to interest from other researchers, particularly those working in the area of School Education, in undertaking cooperative research to investigate the actual and possible contributions education and training institutions may make to enhance regional development and capacity building.

Paper proceeds as follows. The first section provides an overview of the innovation debate. It notes that while contemporary innovation policy assumes that innovation is primarily dependant on capital intensive research and development the 'shopfloor' reality is that innovation in Australia is primarily the result of incremental or processes, of 'learning by doing'. The second section briefly notes the difficulties in applying OECD understandings of 'region' to rural and regional Australia with its particular challenges of geography and demography. The third section discusses the skills and knowledge which underpin the examples of innovation in the three case study sites. In the concluding section some comments and suggestions are offered about furthering research in the area.

'Innovation' in policy context

For the past decade, 'innovation' has been hailed in a range of OECD policy prescriptions (eg; OECD 1996; 1997; 1999) as the key to national economic success. This international literature has been reflected at a national level (eg; Marceau, Manley & Sicklen, 1997; Marceau, & Manley 2001; Toner, 2004), framed by the discussions and analyses presented in the federal government's initial discussion paper (1999) *Shaping Australia's Future: Innovation Framework Paper*, and gaining momentum following the release of the formal Report (2001) *Backing Australia's Ability*. Following the OECD (eg; 1992), the various reports and policies that have followed have been explicit in linking science and technology with market exploitation of new products and services. The instrumental focus of this material would be broadly familiar to readers engaged with general education policy debates.

The significance of innovation to development is not, however, a recent discovery of social science although many policy documents, (which seem prepared as much for promotional as analytical purposes), may suggest otherwise. At its simplest, innovation' may be understood as introducing something new. In its economic formulation it has undeniably been a key feature of the growth of Western society under industrialism. Economic historians and developmental theorists as diverse for example, as Adam Smith in the 18th century, Marx in the 19th century, Schumpeter ([1911]1934; 1942), Polyani (1944), Rostow (1960), Wallerstein, (1974), Gerschenkron, (1968) and Williams (1987) in the twentieth century have described and variously explained changes in society, originating somewhere between the Renaissance and the establishment of Newtonian science in the 17th century, that have combined scientific and technological development with market expansion,. In historical perspective, market expansion together with scientific and technological development, *that is to say 'innovation'*, has been typical of Western society at least four hundred years.

However, in the narrower context of identifying innovation in a contemporary commercial environment, the OECD provides the standard definition. This identifies innovation as

' ... technologically new products and processes and significant technological improvements in products and processes. An innovation has been implemented if it has been introduced on the market (product innovation) or used within a production process (process innovation). Innovations therefore involve a series of scientific, technological, organisational, financial and commercial activities. An innovating business is one that has implemented technologically new or significantly technologically improved products or processes during the period under review'. (OECD, 1997: 47)

Innovation in the Australian context

There is a long history of 'inventiveness' in the Australian legend, from the stump-jump plough and Federation wheat through to gene shearing technologies (Cull; 1996), although limitations of geography and demography have inhibited the type of commercial exploitation possible in societies (such as North America) with large domestic markets. However, an important aspect of the OECD definition cited above, and one that has particular significance for the Australian National Innovation System (NIS) is the distinction between product' and 'process' (also known as 'evolutionary') innovation. The thrust of current Australian policy, as a number of critics have noted (see summaries in Pickersgill & Walsh, 2003), has been to enhance the commercialisation of product innovation, generally associated with high levels of capital-intensive research and development and emphasising high levels of direct public investment in basic science, or indirect public investment in private research through tax concessions. While investment in pure and applied science is justified for its intrinsic as well as indirect economic benefits, the present focus runs the risk of ignoring the empirical realities of Australian industry. As the Business Council of Australia (BCA) argued early 1990s, most innovation, particularly in Australian industry, is *incremental* and *process oriented*. The BCA, drawing on a range of management literature, rejected as too 'narrow and misleading' the

> '… conventional wisdom…that innovation equals invention plus commercialisation… Innovation is not science. Nor is it technology or the ownership of invention'. (Carnegie et al 1993: 3)

The significance of *process* rather than *product* innovation in Australian industry has important implications for the Vocational Education and Training system (VET). The VET system is, by definition, necessarily linked to the labour market and hence directly to employment in commerce and industry. In principle at least, this involves VET curriculum developers in a constant dialogue with the contemporary state of technology and work organization practices. *What* to teach, rather than *how* to teach, becomes a primary focus of VET curriculum development. However, as critics have noted, *Backing Australia's Ability* and similar Reports left VET out of the equation (eg: Fitzgerald 2001).

This failure to incorporate the VET sector is significant in two important areas. The first is that if, in practice, process rather than product innovation has particular significance to Australian industry then it is the operational level, comprising those occupations whose skills and knowledge are primarily developed through the VET system, that becomes strategically important.

The second area involves the *diffusion* of innovation. Innovation, to be integrated within a NIS, needs to be 'taken up' by firms and organizations. There is a substantial literature on diffusion analysing processes of technology transfer between multinational corporations and newly industrialising economies (NIEs) (eg; Porter 1990; Mathews & Cho, 1999), frequently expressed in various national 'league tables' of the rate and nature of patent applications (see Dawkins, 2001 for an Australian example). These approaches are unquestionably significant to the charting and measurement of technological development (OECD, 2002a; 2002b). However, given the significance of process innovation in Australia, the function of labour markets in spreading innovation through industry sectors has been less emphasised.

Historically, Australian development has certainly occurred under the constraints of what the historian Geoffrey Blainey famously described as the *Tyranny of Distance*. A relatively small population combined with limited product and capital markets to emphasis import replacement strategies. The production processes of Australian industry have emphasised relatively short production runs in private sector firms that, by international standards, are of small average size. As Adam Smith noted, the division of labour is

constrained by the extent of the market, and this has manifested in Australia through skills and knowledge distributed through occupational labour markets (where skilled individuals move between firms) rather than the internal labour markets (where skilled individuals move upwards within a large firm) more characteristic of firms operating in large domestic markets such as North America, Europe and Japan. This historical development has resulted in the focus by the Australian VET sector on developing 'occupational' rather than 'job specific' skills (Pickersgill, 2004). Broad rather than narrow skill development has lead to great flexibility 'on-the-job' and the capacity of skilled workers (where not constrained by management/industrial practice) to not only move between jobs, but also frequently across related occupations. Movement within these occupational labour markets, combined with the recruitment of VET teachers (both full-time and part-time) directly from industry (with formal teacher qualifications obtained subsequent to employment), provides an important means of diffusion between firms and between VET institutions and local industry.

Thus, what was seen in the sector as a 'neglect' of VET in innovation policy development, and that policy had not taken a balanced view of the reality of Australian industry, lead to range of VET related research projects. The relationships between the historical features of Australian development, the specific nature of the Australian VET system and its engagement with the Australian NIS have been partially addressed in recent National Centre for Vocational Education Research (NCVER) publications (eg: Docherty 2001; Trood et. al, 2003; Dawe [ed] 2004; Curtin, 2004; Callan 2004; Toner et.al. 2004), and reviews and critiques of the role of educational research in assisting policy development (Kearns, 2004).

A critical analysis of this literature is beyond the scope of this paper, however the emphasis on the significance of VET developed skills and knowledge (or 'human capital' in economic jargon) and their role in contributing to regional development and 'capacity building' (Macadam et al, 2004) is important background to the research program whose preliminary findings are reported below.

Regions and innovation

Although the OECD has recently emphasised the contribution of 'human capital' to innovation (OECD, 1996) and commenced programs which attempt to link skill formation, employment and development at regional level, such as the British *Local Economic and Employment Development* program (LEED) and publicised a range of contemporary models of 'regional engagement' (drawn primarily from the eastern United States and the UK), their uncritical application to the Australian context is debateable. The proposals to utilise existing education and training infrastructure, and to integrate educational institutions from schools to higher education in supporting productive employment (OECD, 2005) are not in themselves new or unusual. There is a very old (frequently futile) debate about the social and economic purpose of 'education' and 'training' (eg; Peters, 1965). The role of education and training in adjusting to industry change has underpinned active labour market programs typical of Scandinavian countries since (at least) the end of the Second World War, and are familiar in Australia since (at least) the Kirby proposals of the mid 1980s.

A more problematic feature, for the Australian context, of the regional models proposed in the UK and North America, is the understanding of 'region'. The 'flexible production' thesis (Piore & Sabel; 1986) which strongly influenced the industry and award restructuring policies of the 1980s in Australia (Pickersgill, 2001) was based on generalisations from a handful of textile and design firms in Northern Italy. The LEED models (OECD, 2005) involve regions with significant population and industrial concentrations that are well serviced by extensive transport and communications infrastructure. Other well known exemplars in the United States, such as Silicon Valley and Route 128/Boston Corridor, not only have concentrations of population, industry and financial infrastructure but have as foci major research universities (eg; Princeton, UCLA and MIT) with formal and informal R&D networks connecting a 'critical mass' of research active staff in the universities with local industry.

Apart from a limited application in urban concentrations in the major capital cities, these concepts of region would appear to bear little resemblance to 'regional' Australia. These issues were a topic for VET research at the former ANTA funded *Centre for Research and Learning in Regional Australia* located at the University of Tasmania, and continue to be of interest to former members (eg: Toms et. al, 1998; Falk &;

Balatti, 2004) and other independent research groups (eg: Selby Smith & Ferrier, 2004; Pickersgill & Edwards, 2005), although without the former specialist research funding.

Innovation processes in the Riverina: three case studies

The Riverina stretches from the edge of the Snowy mountains to the open plains of the Hay district in the West, roughly bounded by the Murray River and Murrumbidgee catchment. In area it covers around 60,000 square kilometres and has a population of around 150,000, with the largest regional centre, Wagga Wagga contributing just under 60,000. An agricultural base involves both cropping and grazing, with an important intensive irrigation sector commencing in the Griffith/Leeton/Yanco area. There are also important transport centres in Wagga and Temora, while batch, jobbing and maintenance industries have developed to support the agricultural base. Wagga Wagga is also a major technical training centre for the Australian Defence Forces.

The three organisations reported on were initially identified from a list of known innovative firms presented at a Seminar by the (former) Group for Research in Employment and Training (GREAT) at Charles Sturt University Wagga (Bamberry, 2001). They are, Precision Parts (Wagga Wagga), Flavourtech (Griffith) and the Temora Aircraft Museum (Temora). Although either private or not-for-profit organisation, each has made material available in the public domain through websites noted below. Interested readers can use these to supplement the discussion below.

Precision Parts (Wagga Wagga) http://www.precisionparts.com.au

Precision Parts is a medium sized private company that over the last 25 years has developed into a major automotive supplier of OEM and replacement parts. It specialises in harmonic balancers for local manufacturers, but has developed growing markets in the United States and Europe. It was originally set up by a former RAAF technician. The location of Wagga Wagga on a transport hub assisted the firm's development and also encouraged the original focus of automotive manufacture and repair.

Products, markets and production processes
Production involves the machining of castings into a range of standard products, which have recently focused on General Motors engines. The reason, as stated in interviews, is that the GMH engines are 'global motors'. There is a high performance line developed for automotive racing engines, although this is more a marketing exercise rather than a profit line. The firm has strongly emphasised the adoption of efficient manufacturing and inventory processes, including the introduction of sophisticated computer control systems, developed under licence from the United States. New work organisation practices have been based on team based production unit. The involvement with large retail outlets in the United States, and increasingly Europe, link the firm directly to forces of global competition.

Precision Parts is a clear example in which standard products have been incrementally improved and production processes streamlined, primarily through the application of in-house engineering expertise to product design, work practices and control of production flows.

Skill formation processes
The basic engineering skills are those developed from traditional Australian trade and technician level training in Fitting and Machining, Toolmaking and associated drafting, design and metallurgy areas which have historically formed a core to the VET system. Recent expansion and quality control needs have led to a major upgrade in skills for production workers ('second class machinists'), again provided through the formal VET system, and rewarded through the in-house skill-based classification system. The supply of skilled labour is dependant on the restricted local labour market, hence there is an emphasis on skill retention and the need to maintain links with local VET institutions for external skills enhancement.

Flavourtech (Griffith) http://www.flavourtech.com.au

As described in a previous paper (Pickersgill & Edwards, 2005), Flavourtech is a private company that developed from an engineering supply company, A & G Engineering, which specialised in (mainly) stainless steel products for the local wine industry. Problems with flavour contamination led to a partnership with the CSIRO to eliminate unwanted flavours from wine. A unique 'spinning cone' technology was developed which was able to remove and store unwanted contaminants. This technology has been improved so that it now is able to separate, store and reconstitute a range of flavours across a diverse range of food products. (Interestingly, the original science on which the technology was based was developed in the Manhattan Project to separate radioactive isotopes from ore, although the development and application of the technology now bears little relation to its origins - a not unfamiliar experience with applied technology).

Products, markets and production processes
Flavourtech produces a unique product for the global market, using 'one-off' or jobbing production of individual units based on variations to a core design. However, such modifications to either the size of the machinery, or to control systems, depend for success on considerable background engineering and production expertise. Research and Development depends on initial professional level skills (in chemistry and engineering), supplemented by extensive on-the-job experience with the interaction of the core technology with the both the chemical and mechanical behaviour of different food products.

Flavourtech is an interesting example in which an initial technological breakthrough (a radical innovation) was developed in conjunction with specialised external science research expertise (CSIRO for engineering: CSU for winemaking). Production and marketing success have however depended on evolutionary, incremental improvements and modifications developed by combining professional level (i.e. university) and workshop (i.e. VET) expertise.

Skill formation processes
The design and engineering skills required by the manufacturing process were developed from those originally developed to supply the needs of regional wine industry. These involved university level engineering design skills, but the manufacturing process depends primarily on the tradition trade skills (fitting & machining, metal fabrication, electrical mechanics) developed by apprenticeship training. At the professional level, chemical and mechanical engineering qualifications for the theoretical background, but critical production knowledge is developed through direct experience with the technology. The firm depends on professional level skills imported from the cities, with trade skills supplied through the local labour market and developed in conjunction with the local and regional TAFE colleges.

The Temora Aviation Museum http://www.aviationmuseum.com.au

The Temora Aviation Museum is a not-for-profit organisation, that exhibits, maintains and flies a range of vintage propeller and jet powered aircraft. It is run by a voluntary board, supported by high profile Australian business leaders (such as Westfield) that provides an extremely high level of commercial expertise. The Temora site was originally a Second World War flying school and was chosen to make use of some existing facilities, but also because of the jet quality runway, the ability to control airspace and the mild flying conditions.

Products, markets and production processes
Vintage aircraft are an expensive 'hobby', but notwithstanding the links to corporate Australia, it is the use of volunteers, (from senior pilots employed by international (eg; Qantas) and general aviation sectors through to tour guides recruited from local residents and organizations such as the fire brigade and sporting bodies) that underpin the success of its range flying exhibitions, displays and day to day tourist visits (*Temora Independent*, various dates; Pickersgill & Edwards, 2005). It has developed an international reputation and attracts both domestic and international tourism. Temora has the highest growth rate in the region, and the Museum has, both through generating tourism and employment and though its linkages to Local Government and community groups, been an important part of local capacity building.

Skill formation processes

In addition to the commercial expertise on the voluntary board the museum has a full-time manager with North American aviation experience, supported by a small administrative staff. At a technical level engineering & aircraft tradespersons were originally recruited from general aviation outside the region. Recently a small apprenticeship program in aircraft trades has commenced. Aviation apprenticeship training is not available locally, so off-the-job training is by block release to the specialist metropolitan TAFE colleges. The maintenance of vintage aircraft requires particular expertise in engines and airframes (not to mention great personal interest and commitment) that are no longer formally taught. Many maintenance and parts replacement issues are unique, with the fabrication of new parts to old designs rather than the 'remove and replace' practice in commercial and general aviation. Skill formation is therefore primarily conducted (and transmitted) on-the-job, and by drawing on the shared experiences of other similar organisations around the world. The unique nature of the exhibits, and the extensive use of community based volunteers has also led to a range of (non-compulsory) education and training programs that link the Museum to a range of community based volunteer organisations.

Conclusion

In this overview of innovation in a regional environment some general conclusions may be tentatively drawn. The first is that recognition of the specific incremental and process oriented nature of the Australian innovation system should be acknowledged. This system is, to a significant extent, integrated with local and national infrastructure, and is manifested in a range of local, regional and national networks. In so far as skilled workers are a necessary (if not sufficient) input into maintaining and expanding product and process innovation, the VET system has a significant role. In our investigation the VET system provided skills and training at two levels. The first was in the generic skills developed in the traditional trades, specifically in manufacturing and maintenance areas. These skills are by no means redundant in the purported new 'knowledge economy'. The second was in the AQF 2 levels where a range of formal credentials, and importantly, informal on-the-job training (frequently unassessed) conducted by organizations themselves to the AQF standards, appears to be providing greater consistency and recognition of skill levels within and across important industry sectors. Flexible delivery, *specifically in non-traditional and non-trade areas* appears to assist this process. However, it would be a mistake to conclude that development is primarily responsible for innovation. Innovation is a complex, multiple dimensional process that involves scientific and technical expertise, technical and educational infrastructure, integrated product and supplier networks and effective management and marketing strategies and government support. In terms of policy development, no one single approach is sufficient. The strategy likely to be most effective is one that, as Richard Curtain has recently remarked (Curtain, 2004) incorporates a 'whole of government approach' that involves *all* levels of government.

This would enable the VET sector to diffuse business innovation and enhance its links ... particularly with small and medium-sized enterprises in general and especially those in regional areas. This requires appropriate funding support as part of a more diverse set of performance targets for VET providers.

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