NSW BVET submission to the Productivity Commission research study into public support for science and innovation

Introduction

The NSW Board of Vocational Education and Training (NSW BVET)'s submission will focus primarily on the research study's second Term of Reference which seeks comment on impediments to the effective functioning of Australia's innovation system. In particular, we will be highlighting the pivotal role played by innovation in enhancing the competitiveness of Australian industry, and the role and significance of vocational education and training (VET) within Australia's innovation system.

In addressing 'current impediments to Australia's innovation system' from a VET perspective, we will also address impediments that are workforce-related and barriers to the diffusion and transfer of knowledge (refer questions on page 17 of the Issues Paper). We will highlight options for more effective and appropriate actions by governments to address impediments, focusing in particular on the relationship between Cooperative Research Centres and non-university training and education organisations.

We rely on the commonly used definitions of innovation and innovation systems in the literature (see Toner 2006; Productivity Commission 2006) and will focus on gradual or incremental forms of innovation as these forms account for the major part of innovation in Australia. Gradual/incremental innovations:

> involve minor modifications and improvements to existing products and processes, each of which are of small significance but, cumulatively, are of major significance in terms of gains in productivity and product/service performance (Rosenberg, cited in Toner 2006:16).

Incremental innovation, often involving the application of external knowledge, has been shown in many studies to predominate in Australia. For example, ABS data indicate that between 2001 and 2003, 73 per cent of product or service innovations and 92 per cent of process innovations in Australian firms are new to the business and in some cases to the industry, but *not* new to Australia or the world (Toner 2006:29).

As Scott-Kemis (2004:69) has argued, 'Australian firms are largely users and adaptors of core technologies and as such could be termed "systems integrators". This is a particular capability to add value by integrating or assembling systems, resources and technologies rather than involvement in their development'.

Research and development, on the other hand, accounted for only some 31 per cent of the spending on innovation by Australian innovating firms in 2002-3 (analysed in Toner 2006:24).

Key sources

We will be drawing on:

- published research (key documents are Curtain, 1987; Ferrier, Trood and Whittingham 2003; Misko and Saunders 2004; Ferrier (2005) and a Background Paper prepared by Dr Phil Toner for BVET, currently available in draft form and appended at Appendix A)
- papers and proceedings from a June 2006 NSW BVET conference on skills and innovation (see summary at Appendix B)
- consultation and research with VET providers and applied researchers carried out by NSW DET
- the experiences and reports from national skill ecosystem projects (DEST-funded innovation projects that focus on the support systems for skill formation in workplaces and industries).

Discussion – why is the VET system important to innovation?

> Building innovation is like creating a bird that flies. Neither the bird's feathers or its light bones are particularly functional features by themselves – in fact they both could be sources of weakness and vulnerability. But, together with other features of the bird's physiology, they contribute to the well-adapted flying system that is the bird. This is also true of creating the capacity for innovation. It is a complex process which needs a balanced and comprehensive approach.
> (Professor Jonathan West, from the Australian Innovation Research Institute, speaking at the *BVET Skills and Innovation Conference*, June 27-8, 2006).

West's point is that innovation, like most complex systems, depends on the degree of co-adaptation of its parts as well as the individual parts themselves. In other words, how well do the building blocks of a system work together to maximise the end result of that system?

VET is a significant, though often neglected, part of the processes of *knowledge transfer* and the development of *innovation capability*, and we see the neglect of the roles it plays as a major impediment to innovation. VET skills and VET institutions should be viewed as necessary building blocks, along with research and industry investment, in the complex of interdependent elements that make up the innovation system in Australia.

The rest of this submission will focus on aspects of VET's role and will close with recommendations for how this role can be better supported and developed.

The diffusion and transfer of knowledge

The Issues Paper seeks comment on whether there are significant barriers in Australia to the diffusion and transfer of knowledge.

NSW BVET argues that there is much room for improvement in the diffusion of new technology, and proposes strengthening the links between applied researchers and the VET system as one means to address this. We believe that there is considerable scope to achieve this within the current Cooperative Research Centre (CRC) program, and have consulted several CRCs and registered training organisations (RTOs) about the matter[1]. In the process of this consultation, we have uncovered certain examples of very good practice which, we argue, need to become the norm rather than the exception.

The CRC for Viticulture, for example, starts from the position that for the Australian wine industry to remain internationally competitive there needs to be rapid uptake of innovations and process improvements *within three years* of their invention (Peter Mansfield, CRC for Viticulture, speaking at the *BVET Skills and Innovation Conference*, June 27-8, 2006). Three years represents the window of opportunity which the Australian industry has to stay ahead of its international competitors.

The CRC for Viticulture found that incorporating wine-making and viticulture innovations into VET curricula through the Training Package[2] review process provided the best way to achieve quick uptake. The CRC also developed a range of extension relationships with training providers to deliver licensed programs to the industry's existing employees. Its partnership with VET, developed during its second term, allowed the CRC to have its research discoveries translated into 'VETspeak' and delivered effectively to its industry, most of whose workers are not attuned to higher education.

As a result, and despite the current downturn, the Australian industry's competitiveness has been maintained, built on its quick adoption of improvements in the areas of wine-grape quality management, water usage, plant nutrition, pruning and canopy management, and chemical usage.

The VET system also benefits because it has direct access to, and the latest advice on, new research findings and technology in its industry. This translates to a much better VET product for industry, and enhanced VET relevance.

Other CRCs also provide good examples of successful VET-focused strategies. The Weeds CRC is perhaps at the forefront of successfully adapting research and academic products to VET audiences Australia-wide. It works with 70 vocational training organisations across Australia, including TAFE colleges, private providers and adult and community sector organisations. Its resources (training manuals, kits and fact sheets) are used

[1] An RTO is an organisation registered by a state or territory recognition authority to deliver training and/or conduct assessments and issue nationally recognised qualifications in accordance with the Australian Quality Training Framework. TAFE Institutes and colleges make up the majority of RTOs in Australia, but also included are adult and community education and private training organisations, and enterprise RTOs.

2 Training Packages are sets of nationally endorsed standards and qualifications for recognising and assessing people's skills. They describe, but do not prescribe, the skills and knowledge needed to perform effectively in the workplace. They are developed by educators working with people and organisations in industry, or industry sectors and are reviewed every three years or less.

in 50 per cent of conservation and land management courses taught in Australia, ensuring that environmental officers, horticulturalists, council weeds officers, landscape designers, landcare and water catchment authority workers among others, have access to the latest knowledge and techniques from CRC researchers and scientists. Not only does this aid the diffusion of innovations, it significantly multiplies the value generated per dollar of Australian Government investment in the CRC program.

The Sustainable Tourism and the CAST Metals CRCs are two other CRCs that espouse a continuous improvement approach, seeing themselves as providing 'competitive advantage' for their industries by drawing in national and international expertise. The first sees TAFE as a means of reaching small and medium enterprises, and has worked with them to develop a flexible learning resource to support the CRCs recently developed Decipher tourism industry data base. The CAST CRC recognises that VET-trained workers are more significant than university graduates in the vulnerable Australian die-casting industry, and partners with Swinburne TAFE's Centre for New Manufacturing to provide workplace-based advanced skills training/process improvement workshops across Australia.

In short, technological and process improvements only benefit industry and the community if these improvements are successfully diffused. The VET system can provide a crucial medium in this process, where, and if, effective partnerships are put in place. Currently, examples such as those given above are the exception rather than the rule. A study conducted in the late 1990s found that:

> Currently there is no systematic process supporting the flow of information between CRCs and the VET sector and in many cases linkages are weak or informal. As a result, the centres can be unaware of VET sector interest in what they are doing and knowledge of the work of the centres may be uneven or missing altogether in different parts of the VET sector (Ferrier, Trood and Whittingham, 2001:27).

It does not appear that the situation is substantially different today. An informal survey undertaken in 2006 by NSW DET found that of the existing 70 or so CRCs, less than ten reported having a relationship with the VET sector. Commonwealth funding guidelines still do not encourage VET-related activities, and VET organisations cannot access funding to support their involvement.

The CRC program should be revised to include formal requirements for collaboration with the VET sector. The requirements should allow enough flexibility to allow the partners to tailor their relationships to their particular environment. This is discussed further below (see recommendations).

The role of skilled workers in adapting and utilising technology

As well as maximising diffusion efforts to industry to increase uptake of technological advances and innovations, it is also important to provide an environment that allows industry to incorporate and modify advances for their particular circumstances.

The evidence suggests that innovating firms in Australia rely heavily on the skills and capabilities of their existing workforce, in turn highlighting the role of solid educational institutions as the basis for putting innovations into practice. Innovation-intensive firms also tend to be above-average trainers. But the funds devoted by such firms to training remain relatively modest ($1.50 out of every $100 in 2002-3, cited in Toner, 2006:24). Toner (2006:49) notes:

> The practical skills and underpinning knowledge imparted by VET training to tradespeople and technician occupations is the key foundation for the role of these occupations in incremental innovation in Australia.

ABS surveys of innovation in Australian business find that the most commonly identified source of ideas for product and process improvement, by a large margin, was *within the firm itself*. When managers were asked to identify which groups within their firms were responsible for these ideas, production employees were rated substantially above R&D and marketing staff as sources for these ideas.

Indeed, Toner's analysis (2006:38) showed that 43 in every 100 people directly engaged in business research and development in Australia are classified as VET-trained technicians, trades or clerical support. They are involved, for example, in computer-aided drafting and design, installing and maintaining research equipment, building prototypes, monitoring the performance of prototypes and experiments, conducting standardised laboratory and biological tests and so on.

Our argument is that the role of production workers in innovation needs to be better recognised, and more effectively fostered.

Research shows, the core competencies required for innovation are of a generic as well as technical nature. Scott-Kemis argues that 'systems integrators' (see above) require workers who have project management, logistics and problem solving abilities, and skills in adapting techniques to particular circumstances (2004:69). This is consistent with the Ai Group's 2006 study of employer perspectives on skilling in Australia where employers' most sought after qualities in their employees were 'being flexible and adaptive' and 'willing to learn on the job'.

Equally important is the development of a workplace culture that supports innovation. While new technology is an enabler, the organisation's culture and leadership, and the links it has with suppliers, other firms, and educational and research organisations are as important in building innovation capacity.

In a workshop on innovation competencies at the BVET Conference, Tess Julian argued that organisations must:

- provide stimulating environments
- value creativity, ideas and people
- and reward practices and behaviours compatible with innovation

(at http://www.skillecosystem.net/events/1144301815_3981_20060406.html). Field Code Changed

Equally, firms need *systems* to support innovation capacity, whether in recruitment, knowledge management, performance/talent management, earnings and development and quality assurance.

The VET system is an important provider of the competencies needed to establish and maintain such systems, for example through the recently developed Competitive Manufacturing Training Package (designed to support lean and agile manufacturing processes) and the Certificate IV (Frontline Management) within the Business Services Training Package which emphasises the development of effective workplace relationships and continuous improvement (see Attachments C and D).

Furthermore, the VET system is ideally placed to partner with Australia's existing medium and low technology industries, which are the site of the vast majority of innovation activity. Smith and West (2005:6), submitting to a previous Australian Government Inquiry, note that while developing and commercialising break through technologies is important, most innovation occurs in response to problem-solving activities in firms and is part of:

> the pervasive technological upgrade needed to retain competitiveness in the industries Australia already possesses.

As Toner (2006:10) points out, the VET sector has a more explicit economic development role than universities, a greater focus on meeting the needs of firms in their region, and greater flexibility with the potential to offer short-term customised training. It is, as a result, particularly suited to the role of technology intermediary and to the task of widening the number of innovating firms from the current 30 per cent which innovate over any three-year time period.

For any successful approach to invigorating innovation in Australia and broadening public support, VET needs to be embraced as a necessary partner along with research organisations and industry. Currently, this is not the case.

The Federal Government spends over $5 billion per year on science and innovation in Australia, but the VET sector is largely excluded from being a beneficiary of this large investment. The enormous innovation potential of the

VET sector is a potential systematically overlooked in the federal innovation agenda.

For example, the VET sector has received scant attention in the principal government statements on innovation policy, *Backing Australia's Ability.* Similarly, *Backing Australia's Ability* annual reports rarely mention vocational education and training, despite, in the 2005-6 report, 20 pages which discussed 'accelerating the commercial application of ideas' and a further 13 pages that focused on 'developing and retaining Australia's skills'.

In another example, AusIndustry's Registered Research Agency program (http://www.ausindustry.gov.au/library/RRAlist04052005041310472 7.pdf) lists only five VET-related organisations out of nearly 200 organisations listed. (RRA status enables organisations to access various AusIndustry programs linked to the national innovation system, as well as conferring favourable tax status.)

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Finally, although the Australian Research Council (ARC) funds research in universities, greater VET involvement as partners in the ARC's Linkage – Infrastructure, Equipment and Facilities (LIEF) program (http://www.arc.gov.au/apply_grants/linkage_infrastructure.htm) in particular could be highly beneficial. This would also further the objectives of the LIEF program, which strongly emphasise cross-sectoral collaborative arrangements.

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At the state level, BVET has been working to combat this neglect, with a focus on VET and innovation in our research and funded projects. This focus has supported TAFE NSW and other training organisations that are pursuing innovation in the workplace and in their skills development partnerships with industry.

However, we believe Australia faces serious national difficulties in maintaining the currency of knowledge and equipment within public technical institutions. These arise from the ageing teaching workforce, the rapid pace of technological progress, the high cost of leading edge equipment, the shift from generic classroom to workplace-specific training delivery, and discrepancies in pay and conditions between public VET institutions and private industry.

The recommendations below draw from a number of reports identified at the beginning of this paper.

VET's role in the innovation system

i. VET representatives should be included on innovation advisory bodies to government. This would allow VET early access to knowledge about the directions of innovation; it would also provide governments and industries with information about the kinds of VET responses that would be possible (see Ferrier 2005:47).

ii. Specific funding is required to ensure the skills and knowledge of vocational education teachers are up to date through additional professional development and programs to ensure the currency of equipment. TAFE, the major provider of trade and technician training, has received a significant real reduction in funding over several years, and supplementary funds are required to support its capacity for leading edge training.

iii. Funding should be made available for collaboration on incremental innovations, the application of new production processes and extension work between VET teachers, industry and government research agencies.

iv. Funding is also needed to support the customization of courses and the development of new courses in areas of emerging technology, where the number of people to be trained is small but where training is needed to help small companies adopt and adapt new technologies and production techniques.

The relationship between Cooperative Research Centres and the VET system

CRC guidelines should be revised to achieve the following objectives:

i. VET involvement with applied research organisations occurs in a timely manner, so as to maximise its capability to support industries (ie early enough to allow course development and accreditation)

ii. closer relationships are systematically developed to bring about a rapid flow of new knowledge and practice into the VET sector, and to increase the application of CRC innovations within industry.

CRCs should be required to develop structured agreements with relevant VET organisations that involve the following strategies, where appropriate:

- VET organisations are represented on the CRC Board or management committee, and/or are CRC members

- in consultation with VET teachers, CRCs customise their products for VET delivery and map them to national training packages. Consideration should be given to the provision of CRC products to VET providers free of charge, or at a very low cost, in all cases where there is industry relevance, because fees and license agreements can obstruct vocational education usage

- CRC and VET organisations collaborate on the design, application and trialling of research products

- CRCs contribute to training package development and review to ensure they reflect the most innovative industry practice

- VET organisations and CRCs collaborate on the delivery of training products developed by the CRC to workers in VET-related occupations and their managers

- CRCs provide professional development for VET staff, and teacher return-to-industry programs are developed within CRCs and/or start-up firms

- the participation of VET students in CRCs is encouraged, either as trainees, research assistants or working on student projects

- CRC and VET organisations take up opportunities to jointly train VET and/or higher education students (for example, in technical and generic areas such as occupational health and safety).

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