

## **Industry Training Organisations in Changing Times: New Research Possibilities**

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### **Abstract**

The tertiary education reforms have placed considerable pressure on Industry Training Organisations (ITOs), which are now required to assume “new roles as strategic leaders in skills and training needs for the industries under their coverage” (Ministry of Education 2003a:21). This paper argues that the Statement of Tertiary Education Priorities (STEP) requirement can lead to productive relationships between ITOs and established research organisations. It considers the new context within which ITOs now operate and offers an illustrative case study of the sort of research that can result from collaborative relationships. Specifically, it reports on research commissioned by the New Zealand Industry Training Organisation (NZITO), which covers dairy manufacturing, meat processing, and leather processing, as part of its strategic planning. The research reported includes: an analysis of the industries covered by the NZITO and their economic significance; the impact of an ageing workforce and other demographic on the labour market and its implications for NZITO industries; the impact of technological change on the labour market; and some of the consequences of the continuing integration of the global economy.

### **Introduction and Background**

This paper considers the emergence of Industry Training Organisations (ITOs) as lead bodies in education and training. Its specific purpose is to examine the possibilities that role provides for productive relationships between ITOs and established research institutions, such as universities. The paper first discusses aspects of the broader policy framework; it then draws on a case study that illustrates research possibilities.

For the last two decades, tertiary education in New Zealand has been subjected to an almost continuous process of “reform,” the explicit intent of which has been to reconcile better formal education and the perceived skill needs of the labour market. The latest chapter in the current phase was the second Tertiary Education Strategy (TES) and the associate Statement of Tertiary Education Priorities (STEP) (Ministry of Education, 2006).

As we discuss more extensively elsewhere, the reform process has moved through three distinct phases, each of which has been driven by a particular ideological perspective; these can be loosely categorised as: “residual labourist” (1987-1990); “neo-liberal” (late 1990 to late 1999); and “third way” (late 1999 to present) (Law, 1994, 1996a, 1996b, 1998, 2003a,

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2003b; Law and Piercy, 1999, 2000a, 2000b, 2000c, 2004; Piercy, 1999, 2003, 2005). Each phase has been pursued by a particular government (Labour, National, and Labour-led) and, of course, has been tied inextricably to each government's broader industrial relations policy. With respect to workers' education and training, the present, third way phase is characterised by steering mechanisms, a qualified tripartite (employers, unions, and government) framework, and a measure of understanding of the wider social context and associated broader learning needs.

A common theme throughout the reform process since 1987 has been a determination on the part of successive governments to involve key stakeholders more directly in both the formulation and implementation of their particular tertiary education strategy. However, Labour and National parties have differed as to who constitutes "a key stakeholder".

In the late 1980s, the Labour Government promoted an inclusive notion of stakeholders that included workers and their unions. Thus its notion of an "industry-led" approach retained a significant residue of the tripartite framework that had long characterised the vocational training sector. The 1990s National Government broke with that tradition. Its neo-liberal approach placed a much stronger emphasis on employer leadership, voluntary participation, a market model of delivery premised on competition between education providers, and the "new" human capital perspective that regarded skills and knowledge as a "private good" (Marginson, 1993, 1997).

As elaborated below, we hold that the 1990s was a wasted decade for industry education and training. Framed by a market model of educational demand and deliver, National's 1992 Industry Training Act (ITA) was hampered by a lack of any strategic policy direction, the inherent weakness of ITOs, and the limitation of their role. Furthermore, as a direct consequence of both the neo-liberal voluntarist approach and the impact of the 1991 Employment Contracts Act (ECA) unions were, to varying degrees, steadily sidelined, even in industries, such as dairy manufacturing, that had remained substantially unionised (Law, 1998, 2003a; Law and Piercy, 2000c; 2004; Piercy, 2003).

We further hold that by the end of the decade, there was widespread agreement that the market model was failing. This was captured in Labour's 1999 election manifesto which foreshadowed a more "hands-on" approach to industry training.

## **The Policy Background and the Changing Role of ITOs**

What distinguishes the present, third phase from the 1990s is the new role envisaged for ITOs.

Very early in the reform process (the late 1980s), ITOs were seen as the appropriate vehicle to provide strategic leadership to worker education and training. However, the change of government at the end of 1990 not only delayed the enabling legislation it also resulted in a retreat from a strategic approach and the favouring of a market model of demand and provision. Not surprisingly therefore, the Industry Training Act 1992 (ITA), which provided

for the establishment of ITOs, differed quite significantly from Labour's draft legislation. Under the ITA, an ITO could be formed by two or more enterprises that had similar inputs and outputs. Further, unions had no statutory right to ITO membership; their participation was effectively determined by employers (Law and Piercy, 2000a; Murray, 2001; Piercy, 1999). A number of ITOs did include union representation.

National's voluntaristic approach led to a very ad hoc development of ITOs. In practice, their responsibility was to design education and training for an industry and to purchase its delivery from separate providers. These could include polytechnics but there was considerable government encouragement to use and build private training establishments (PTEs). ITOs have also been responsible for monitoring trainee's progress through their training programmes (Green, Hipkins, Williams and Murdoch, 2003; Murray, 2001; Piercy, 1999). Under National, funding was inadequate. Again, the market model assumed that employers and, increasingly, learners would pay for much of the training. The extension of the student loan scheme was linked to this "new" human capital perspective that viewed the acquisition of skills as a private good (Piercy, 1999, 2005).

As noted earlier, by 1999 there was a widespread recognition that the market model had failed (Doyle, 1999). Labour's (1999) manifesto document *21<sup>st</sup> Century Skills: Building Skills for Jobs and Growth* outlined its views on the limitations of National's industry training system and foreshadowed its subsequent more directive approach, its quite strong inclination towards legislation and semi-regulatory underpinnings and a more pronounced, "third way" notion of partnership (Cochrane, Law and Piercy, 2004b; Law, 2003a, 2003b; Law and Piercy, 2004; Piercy, 2003; 2005).

The Education (Tertiary Reform) Amendment Act 2002 provides the legislative framework for the establishment of the Tertiary Education Commission (TEC), the adoption of five-year, tertiary education strategies, and the creation and implementation of the STEPs. Each STEP, published at least every three years, outlines the priorities that are needed to work towards the Government's six strategies (Ministry of Education, 2002a). The current Minister for Tertiary Education, Michael Cullen, called for submissions on the shape of the new TES and next STEP (Ministry of Education, 2006). Submissions closed in October 2006. These resulting changes build on those established by the first three STEPs outlined below.

The three STEP documents published to date demonstrate the impact of the TES on ITOs. The first STEP (2002-2003) outlines the extent to which elements of the market model have been retained in order to ensure responsiveness on the part of Tertiary Education Organisations (TEOs). However, future-oriented statements in the first STEP and in the two subsequent STEPs signalled the Government's intention to provide a more certain and supportive policy climate in order to promote collaboration between key stakeholders (Ministry of Education, 2002b). Briefly, the current charters and profiles process requires TEOs to focus on the achievement of both the TES and the six national goals while the discussion around the "distinctive contribution" of TEOs effectively defines their nature and scope (Tertiary Education Commission, 2004a, 2004b).

For the most part, the priorities in STEP 2003-2004 remained largely unchanged from the first, given that the reform process had not yet finished (Ministry of Education, 2003a). But for the purposes of this paper, a significant shift in emphasis allowed for a greater leadership role for industry training and its stakeholders: ITOs, employers and unions (Ministry of Education, 2003b).

The key priority for the period covered by the third STEP, 2005-2007, is to improve “the quality and relevance of tertiary teaching, learning and research” (Ministry of Education, 2005:1). This longer term STEP “focuses on securing the shifts that the education reforms were designed to bring about” by reiterating more firmly how funding via the profile process will be linked to an organisation’s ability to provide relevant courses (Tertiary Education Commission, 2005:1). This statement makes it clear that the development phase is over and that organisations involved in the provision of tertiary education (which now includes industry training and adult and community education) will have to demonstrate the ability to meet targets or risk losing public funding. It also created impetus for the re-development of the funding system and a new emphasis on student completions (Cullen, 2006).

Those involved in the provision of education and training related to industry training have the opportunity to benefit significantly in this new environment; the Government has made quite clear that through increased funding it will give priority to TEOs that support research and innovation that contribute to social and economic development (Piercy, 2005).

## **The Role of Research in the New Environment**

One of the most obvious limitations of the reforms is the assumption that all TEOs, including, for the purposes of this paper, ITOs, have the immediate capacity to provide the strategic leadership expected of them. There are at least two aspects of this issue that concern us here. First, the assumption that each ITO represents an “industry” is unsound on at least three counts: (a) while there has been some rationalisation of ITOs, there is still a patchwork of coverage with some serious overlaps; (b) employer participation remains voluntary; and (c) many employers appear to lack a commitment to industry training. Second, even where ITOs have good industry coverage and employer participation, it is optimistic to assume that they have the immediate capacity to exercise the strategic leadership that is now expected of them.

Fortunately, we do have a very good, recent example of what a sector/industry strategy might look like. In August 2006, the Government’s Food and Beverage Sector Taskforce released its forward-looking report: *Smart food, cool beverage: New Zealand’s future in the food and beverage sector*. In June, that taskforce’s Skills Working Group released a companion document: *Skills action plan for the food and beverage sector*. Together, those reports offer both a strategic direction and an associated skills development policy. In that sense, the two reports illustrate what can be achieved when resources are dedicated to fund reasonably adequately, sensible, focused research that informs a committed team of sector stakeholders. But in another sense, the two reports highlight just how much work is required if other sectors

and industries are to accept the Government's challenge to adopt integrated strategies with a high level of industry ownership.

The *Skills action plan for the food and beverage sector* report highlights some of the practical challenges facing the sector. For example, it emphasises as a high priority the need for better labour market information. The report also identifies an encouraging range of research that either has been undertaken or which is underway. Under the broad heading, "More strategic investment in training," it explores a number of areas that require more investigation. Examples include: the exploration of industry best practices with respect to skill development; exploration of ways to improve the ability of the skills and training system to adapt rapidly to change; and the review of the quality and relevance of sector qualifications. Of considerable interest to us are the suggestions in the report that the sector takes advantage of the possibilities inherent in the very exciting New Zealand Council of Trade Union's (CTU) "Workplace Learning Representatives" project. The report also notes the challenges posed by multiple ITOs: "of the approximately 40 ITOs that have been in operation since 2002, eight are important in facilitating industry-specific training relevant to the food and beverage sector" (Food and Beverage Task Force (Skills Working Group), 2006:40).

## **Case Study**

### ***Background***

It is against the broad background sketched above that we now focus on some of our work which we present here as an abbreviated case study. That research dovetails quite neatly with the Food and Beverage Taskforce's reports in that we have had two commissions from a major food and beverage ITO, the New Zealand Industry Training Organisation (NZITO) to undertake labour market research with respect to dairy manufacturing. The first study was a demographic report on the NZITO's trainee profile (Cochrane, Law and Piercy, 2004a). The second study, which is discussed here, examined the possible impact of contemporary labour market trends on industries covered by the NZITO (Cochrane, Law and Piercy, 2006).

### ***Demographic Change***

The first task was to provide the ITO with easily understood information about demographic change. This information should be useful, of course, for almost all ITOs.

It is well known that western societies are under going significant demographic change with declining fertility and mortality contributing to the median age in these societies increasing markedly from around 28 in 1950 to a projected value of about 39 in 2020 (U.S. Census Bureau, 2000). New Zealand is no exception, though the comparatively high fertility rates of the Maori and Pacific Peoples has moderated this effect when compared to some northern European and Asian societies, with the proportion of the New Zealand population aged over 65 projected to increase from around 12% in 2001 to nearly 20% in 2026 (Statistics New Zealand, 2005). The changes occasioned by these demographic trends are likely to be both

broad and profound with two effects in particular being of significance to industry training organisations.

First, the decline in the proportion of persons aged under 15 years implies a reduction in the in-flow of new workers to the labour market and raises the possibility of pervasive labour shortages. This supply side problem can be mitigated in two ways, increasing labour market participation by peripheral and non-traditional groups<sup>1</sup> and increasing productivity. In respect to the former point should non-traditional and peripheral groups be drawn into labour market participation the challenge for ITOs will be to develop training programmes that address the specificities of these groups and recognise the factors that have hitherto, and no doubt continue to mitigate against their participation in the labour market.

It should be noted that the demographic changes alluded to above will not proceed in an even fashion. Spatially the age structure, migration, fertility and mortality of different regions can vary greatly resulting in marked heterogeneity in the sub-national experience of ageing. This will magnify the labour supply problems of those industries, the meat processing industry and to a lesser extent dairy manufacturing being examples, which are generally located in peripheral regions subject to large out migration flows in the prime working age groups and appreciably higher rates of ageing. Equally it is important to note that the process of age structural change does not proceed in a linear fashion in which an ordered array of cohorts moves through the age structure with the larger “baby boom” cohort leading. Rather the population size in an age group can change quite radically over a five-year period as differently sized population cohorts move through the population structure creating wave effects. These wave effects can result in marked fluctuations in the size of cohorts at ages with high propensities to engage in training hence ITOs can be confronted with substantial fluctuations in the demand for training driven by purely demographic factors (see Lepina and Pool, 2000; Pool and Cheung, 2003; Rindfuss, 1991 for a discussion of this effect).

In terms of the productivity effects of population ageing it has been estimated that the effects of these demographic changes will be equivalent to, approximately, an annual reduction of 0.24 percentage points in labour productivity growth; that is, from around 1.5% to 1.26% per annum (Guest et al., 2003). Given the magnitude of this decline it would seem plausible that the rate of productivity growth could increase sufficiently to compensate for this decline. However achieving an increase in long run productivity growth will require a considerable up grading of the skill levels of the labour force. Moreover, given the reduced inflows of new workers this upgrading of human capital must be made in large part with the (ageing) stock of existing workers (Albrecht et. al., 2006).

This brings us to the second effect of population ageing of relevance to ITOs. ITOs will be training, and frequently retraining, older workers which, while sharing many of the characteristics of their younger counter-parts, also have a number of specific characteristics that will have to be accommodated. For instance, the physiological consequences of ageing impact on the productivity of individual workers.

There is evidence that while older workers remain highly productive within a field that they know well and where long experience is beneficial, when they perform work where they are required to reorient themselves to new task requirements and to solve novel problems their performance is below that of younger workers. This effect appears to be compounded by the work/task complexity; that is, as task complexity increases mental agility becomes more important compounding the age-induced productivity effect (Myerson et al., 1990). This can become particularly problematic, as the pace of technological change increases the importance of being able to assimilate new techniques and adapt to new ways of working (Skirbekk, 2003:7-8). However at least for some skills, such as literacy skills, there appears to be a “use it” or “lose it” dynamic with workers who are employed in environments that require continual learning being less susceptible to a decline in their ability to acquire new skills (OECD, 1998:138). This implies that any tendency for the ability to acquire new skills to decline with age can, at least in part, be ameliorated by continued training.

### *Technological Change*

We have also attempted to examine technological change.

Technological change has been a pervasive feature of modern life with every indication that the pace of this change is unlikely to decelerate in the near future. In terms of specific technologies that are likely to become widely adopted in the immediate future, Karoly and Panis (2004) have identified three key areas; continued development of current integrated circuit technology (ICT), nanotechnology and biotechnology.

The current technologies used in the manufacture of integrated circuits have not yet reached their limits and are unlikely to do so for 10 to 20 years. Continued development of ICT will facilitate the development of more sophisticated manufacturing robotics which in turn will support the adoption of agile manufacturing strategies; that is, strategies built round rapidly reconfigurable or retoolable machines that can switch between producing a wide variety of products in response to consumer demand. This implies major changes in the fields of manufacturing logistics and inventories (Anderson et al., 2000) which themselves will be promoted by the introduction of faster and more flexible technology. In addition, the increasing sophistication of robotic systems will allow the automation of routine tasks of relatively high levels of complexity. For instance, in the food processing sector there is increasing use of robotics with the development of robotic, primal cutting systems in the pork processing industry (Purnell and Brown, 2003), similar systems for scribing (Li and Hinsch, 2003) and for brisket sawing beef carcasses (Templer et al., 1998), Y-cutting mutton carcasses (Hurd et al., 2005) and the boning of fish fillets (Malone et al., 1994).

Nanotechnology refers to technologies that are able to manipulate matter at an atomic level. This has obvious applications in the development of esoteric materials; however the full impact of the technology spans the fields of biology, chemistry, physics, engineering, and computer science. Initially, that is over the next 10-15 years, it is likely that nanotechnology will be used to enhance existing technologies through, say, the production of lighter, tough, harder and more flexible alloys.<sup>2</sup> In the longer term, the ability to manipulate basic molecular

structures, such as proteins and nucleic acids, will allow the creation of novel chemicals and pharmaceutical products and the combination of organic and synthetic materials to merge biological functions with other desirable material properties (Karoly and Panis, 2004: 96-97). The science and technology consultancy, Helmut Kaiser (2004), estimated that the market for “nano-products” in the food and beverage packaging sector alone would increase from 2004 US \$860 million in 2004 to over 2004 US \$30 billion, around 25 per cent of the market, over the next decade.

Biotechnology broadly refers to “techniques that use organisms or their cellular, sub cellular or molecular components to make products or modify plants, animals, and micro-organisms to carry desired traits” (Paugh and Lafrance, 1997:9). This technology is frequently controversial as it encompasses areas such as genetic engineering, the mapping of the human genome, the extension of human life and even the creation of artificial life forms. All of these applications raise tremendous ethical issues (see Sherlock and Morrey, 2002, or Burley and Harris, 2002 for introductions to the ethical implications of biotechnology). However should these objections be overcome the increasing understanding of the nature of complex organic processes will allow substantial gains in productivity and the creation of new applications and products. For instance in dairy, this could range from the production of hardier more prolific pasture plants, to the use of enzymes to improve the efficiency of cows in converting pasture to milk or the suitability of milk for further processing.

These innovations all have the potential to profoundly reshape the labour market. Karoly and Panis (2004:102) have identified a number of likely, changes:

- Automation and investment in new technology may lead to higher productivity but reductions in the size of the work force.
- Demand for workers with higher levels of education is increasing as some jobs, particularly those cannot easily be automated, become more specialised and require greater analytic and problem-solving skills.
- Increasingly remuneration is increasingly being tied to skill with the result that the pay differential between those with higher levels of skills and those with lower levels of skill is increasing.
- With greater specialisation and work products that can be digitised and distributed over electronic networks, it becomes possible to redistribute workers across geographically dispersed work sites rather than requiring workers to be collocated.
- The incorporation of new technologies requires the reorganisation of work to account for the new responsibilities and level of decision making required of workers in various occupations.
- Adapting to technological change often requires retraining workers so that they are able to work with the new technology and within new organisational structures.



## **Discussion: Relating Impacts to High Performance Work**

That list of likely impacts has some direct crossover to the work our expanded research team is currently undertaking with respect to high performance workplaces systems (hpws) (see Cochrane et al., 2006; Cochrane, Dharmalingam, Harris, Law, and Piercy, 2005; Cochrane, Law and Piercy, 2004c; Cochrane et al., 2005a, 2005b; Law and Cochrane, 2004), Fonterra, along with other forward-thinking manufacturing companies worldwide, recognises the advantages of hpws. However there is considerable evidence in the literature that we have reviewed to suggest that successful worker participation in such systems is more likely when a genuinely co-operative approach is employed to both introduce and sustain those systems. The notion of “worker voice” appears to be quite significant as there is also evidence to suggest that such systems work better in unionised environments and with active union involvement.

Ashton and Sung (2002) identify four dimensions of haws: “employee autonomy and involvement in decision-making support for employee performance, rewards for performance, and the sharing of information and knowledge” (p.12). From our preliminary work we have developed a better appreciation of the collective nature of workers’ learning, knowledge and attributes. Many writers hold that considerations of professional identity, work identity, and group identity – including that of union member – are all of critical importance when attempting to understand the nature and acquisition of workplace skills. Our review of the research literature led us to conclude that the majority verdict with respect to haws, although a conditional one, is that haws provide net gains to both employers and employees. This majority verdict also seems to hold that for haws to succeed, they require an environment in which all parties to the employment relationship are committed to the success of the project and work in good faith for its achievement.

Further, the relevant learning literature challenges an instrumentalist approach to the introduction and implementation of haws and the education and training associated with such systems. It also underscores the collective dimension of workplace culture and the learning that takes place at work. In the context of the industries covered by the NZITO and within the existing employment relations setting, the majority verdict on haws noted above, especially when read in conjunction with the selected insights provided from the workplace learning literature, implies that for haws to produce “win-win” outcomes, the employer, the union and the workforce as a whole must act together to promote the necessary trust and cooperation.

## **Conclusion**

The point of this paper has been to highlight the research possibilities that have opened up as a result of the tertiary education reforms. In particular, we have focused on the challenges faced by ITOs as they assume responsibility for providing strategic leadership with respect to skills development and training. In this paper we take the view that possibilities can only be appreciated and taken advantage of when the context is clearly understood. To that end, we have not only sketched the context but also made a number of observations about the political

economy of education and training. We have argued that recent work in the Food and Beverage Sector highlights not only what can be achieved when resources are dedicated to systematic inquiry but also the further research that needs to be funded if the full value of that work is to be realised. Our brief discussion of recently completed research commissioned by the NZITO illustrates the contribution that can be made, at a more micro level, by quite small research units, such as the University of Waikato's Centre for Labour and Trade Union Studies. Finally, we also indicate how such work can be linked to other relevant, current research.

Finally, although we have not discussed this possibility above, we hold that there is much to be gained from closer trans-Tasman co-operation around research topics of common interest. For example, we have developed links with colleagues in Australia who are investigating the adoption by Australian workplaces of the same hpws that we are studying in Fonterra. Another productive line of inquiry is the possible application to New Zealand of the notion of "skills ecosystems" and the recommendations made by John Buchanan (2006) in a report for the New South Wales Government. An emerging researcher associated with our Centre, Victoria West (2006), has been exploring those recommendations in relation to the Food and Beverage Sector Taskforce's skills report.

## References

- Albrecht, J., van den Berg, G.J., and Vroman, S. (2006), The Aggregate Labor Market Effects of the Swedish Knowledge Lift Program, *Discussion Paper No. 2385*, Bonn, Institute for the Study of Labor.
- Anderson, R.H., Antón, P.S., Bankes, S.C., Bikson, T.K., Caulkins, J., and Denning, P. (2000), *The Global Course of the Information Revolution: Technological Trends; Proceedings of an International Conference*, Santa Monica, RAND Corporation.
- Ashton, D., and Sung, J. (2002), *Supporting Workplace Learning for High Performance Working*, Geneva, International Labour Office.
- Bryant, J., Jacobsen, V., Bell, M., and Garrett, D. (2004), Labour Force Participation and GDP in New Zealand, *Working Paper No. 04/07*, Wellington, The Treasury.
- Buchanan, J. (2006), *From "Skill Shortages" to Decent Work: The Role of Better Skill Ecosystem*, Sydney, University of Sydney.
- Burley, J. and Harris, J. (2002), *A Companion to Genetics*, Malden, MA., Blackwell Publishers.
- Cochrane, W., Dharmalingam, A., Harris, P., Law, M., and Piercy, G. (2005), *Skill Needs and Worker Voice in High Performance Workplaces: A Case Study of the Dairy Industry, Literature Review*, Hamilton, New Zealand, Centre for Labour and Trade Union Studies, University of Waikato.

Cochrane, W., Law, M., and Piercy, G. (2004a), *Demographic Report on the Trainee Profile of the New Zealand Industry Training Organisation*. (Commissioned report for the NZITO), Hamilton, Centre for Labour and Trade Union Studies, University of Waikato.

Cochrane, W., Law, M., and Piercy, G. (2004b), Skills Forecasting and Industry Training Pathways. Paper presented to the *Industry Training Federation Vocational Education Research Conference Forum*, June, Hotel Intercontinental, Wellington.

Cochrane, W., Law, M., and Piercy, G. (2004c), The Knowledge Society and High Performance Workplace Systems: Enhancing Worker Voice, in Blumenfield, S.B., and Lafferty, G. (eds) *Labour Employment and Work in New Zealand: Proceedings of the Eleventh Conference*, November 22-23. Wellington, Industrial Relations Centre, Victoria University of Wellington, 79-90.

Cochrane, W., Law, M., and Piercy, G. (2005a), *The Food and Beverage Sector: A Trade Union Perspective*, Hamilton, Centre for Labour and Trade Union Studies, University of Waikato.

Cochrane, W., Law, M., and Piercy, G. (2005b), Lean, but is it Mean? Union Members' Views on a High Performance Workplace System, in Baird, M., Cooper, R., and Westcott, M. (eds.), *Reworking Work AIRAANZ 05 Refereed papers, Proceedings of the 19th conference of the Association of Industrial Relations Academics of Australia and New Zealand*. Sydney, University of Sydney, 129-138.

Cochrane, W., Law, M., and Piercy, G. (2006), *Possible Impact of Contemporary Labour Market Trends on Industries Covered by the New Zealand Industry Training Organisation*, (Commissioned report for the NZITO), Hamilton, Centre for Labour and Trade Union Studies, University of Waikato.

Cullen, M. (2006), Ensuring Quality and Relevance – Future Directions of Tertiary Funding. Speech, retrieved 4<sup>th</sup> April 2006, <http://www.beehive.govt.nz/ViewDocument.aspx?DocumentID25358>.

Doyle, S. (1999), Workers' Organisations and Private Sector Training: The New Zealand Council of Trade Union's Strategy for a Skilled Workforce, Paper to *ILO APSDEP Regional Seminar*, Chiba, Japan.

Food and Beverage Taskforce (2006), *Food and Beverage Taskforce*, Retrieved June 2006, <http://www.nzte.govt.nz/section/13685.aspx>.

Food and Beverage Taskforce (2006), *Smart Food, Cool Beverage: New Zealand's Future in the Food and Beverage Sector*, Wellington, Food and Beverage Taskforce.

Food and Beverage Taskforce (Skills Working Group), (2006), *Skills Action Plan for the Food and Beverage Sector*, Wellington, Food and Beverage Taskforce.

Green, N., Hipkins, C., Williams, P., and Murdoch, C. (2003), *A Brief History of Government Funding for Industry Training 1989-2002*, Wellington, Industry Training Federation.

Guest, R., Scobie, G., and Bryant, J. (2003), *Population Ageing in New Zealand: The Impact on Living Standards and the Optimal Rate of Saving with a Flexible Real Exchange Rate*, Working Paper No. 03/34, Wellington, The Treasury.

Helmut Kaiser Consultancy (2004), *Nanotechnology in Food and Food Processing Industry Worldwide 2003-2006-2010-2015*, Tuebingen, Helmut Kaiser Consultancy.

Hurd, S.A., Carnegie, D.A., Brown, N.R., and Gaynor, P.T. (2005), *Development of an Intelligent Robotic System for the Automation of a Meat-Processing Task*, International Journal of Intelligent Systems Technologies and Applications, 1(1/2): 32-48.

Karoly, L.A., and Panis, C.W.A. (2004), *The 21st Century at Work Forces Shaping the Future Workforce and Workplace in the United States*, Santa Monica, RAND Corporation.

Law, M. (1994), *Adult Education and Working People: A Critical Reappraisal*, in Klenovesk, T. and Olesen, H. (eds), *Adult Education and the Labour Market*, Ljubljana, Slovenia Adult Education Centre, 146-183.

Law, M. (1996a), *Worker Education and Training in a Voluntarist Environment: What Role for Unions?* in Olesen, H. (ed.), *Adult Education and the Labour Market II*, Roskilde (Denmark), University of Roskilde, 117-133.

Law, M. (1996b), *Workers' Education and Training in a New Environment*, in Benseman, J., Findsen, B., and Scott, M. (eds), *The Fourth Sector: Adult and Community Education in Aotearoa/New Zealand*, Palmerston North, Dunmore Press, 159-176.

Law, M. (1998), *Market Oriented Policies and the Learning Society: The Case of New Zealand*, in Holford, J., Jarvis, P., and Griffen, C. (eds), *International Perspectives on Lifelong Learning*, London, Kogan Page, 168-179.

Law, M. (2003a), *Unions and Social Policy: Enhancing Educational Opportunities for Workers*, in Jorgensen, C.H., and Warring, N. (eds), *Adult Education and the Labour Market VII*, vol. A, Roskilde University, Roskilde, Denmark, 9-33.

Law, M. (2003b), *Bringing the State back In: New Directions in Trade Union Education in a Small Democracy*, in Flowers, D. et al. (eds), *Proceedings of the 44<sup>th</sup> Adult Education Research Conference*, San Francisco, San Francisco State University, 235-240.

Law, M., and Cochrane, W. (2004), *Interim Report NZ Dairy Workers' Union Manufacturing Excellence Survey 2003*, Hamilton, Centre for Labour and Trade Union Studies, University of Waikato.

Law, M., and Piercy, G. (1999) Workplace Democracy and Training Reform: Some Emerging Insights from Australia and New Zealand, in Salling Olesen, H. and Jackson, K. (eds), *Adult Education and the Labour Market V*, Roskilde, Denmark, Roskilde University Press, 63-86.

Law, M., and Piercy, G. (2000a), Training and the New Industrial Relations: New Zealand Research that Explores Streeck's Thesis, Paper presented at *Adult Education Research Conference*, Vancouver, June.

Law, M., and Piercy, G. (2000b), The Carmichael Vision and Training Reform: Some Insights from across the Tasman, in Burgess, J., and Strachan, G. (eds), *Research on Work, Employment, and Industrial Relations 2000: Conference Proceedings, Vol. 2*, Newcastle (Australia), AIRAANZ/University of Newcastle, 141-150.

Law, M., and Piercy, G. (2000c), Unions and Education and Training Reform: A Neglected Story, Paper presented to the *New Zealand Association for Research in Education Conference*, Hamilton, December.

Law, M., and Piercy, G. (2004), The "Knowledge Society" or the "Knowledge Economy": Does it Really Matter? Paper presented to *ESREA Network Conference: Learning Participation and Democracy*, October, Barnham, Britain.

Lepina, M., and Pool, I. (2000), Social and Spatial Differentials in Age-Structural Transitions. Implications for Policies on Ageing. *Espace, Populations, Societies*, 3: 399-410.

Li, Z., and Hirsch, A. (2003), A New Approach to Detect the Cutting Positions for a Robotic Beef Carcass Scribing System, Paper presented at the *2003 Australasian Conference on Robotics and Automation*, Brisbane.

Malone, D.E., Friedrich, W.E., Spooner, N.R., and Lim, P.P.K. (1994), Knowledge Based Control in the Processing of Highly Varying Product, Paper presented at the *IEEE International Conference on Robotics and Automation*, San Diego.

Marginson, S. (1993), *Education and Public Policy in Australia*, Melbourne, Cambridge University Press.

Marginson, S. (1997), *Markets in Education*, Sydney, Allen & Unwin.

Ministry of Education (2002a), *Tertiary Education Strategy 2002/07*, Wellington, Ministry of Education.

Ministry of Education (2002b), *Statement of Tertiary Education Priorities 2002/03*, Wellington, Ministry of Education.

Ministry of Education (2003a), *Statement of Tertiary Education Priorities 2003/04*, Wellington, Ministry of Education.

Ministry of Education (2003b), Press Statement, *Statement of Tertiary Education Priorities 2003/04*, Retrieved 10 September 2003, [http://minedu.govt.nz/print\\_doc.cfm?layout=documentid=7366&data=1&fromprint=y](http://minedu.govt.nz/print_doc.cfm?layout=documentid=7366&data=1&fromprint=y)

Ministry of Education (2005), Press statement, *Statement of Tertiary Education Priorities 2005/07*, Retrieved 6 July 2005, <http://www.minedu.govt.nz/index.cfm?layout=document&documentid=10296&data=1>.

Ministry of Education (2006), *The Developing the Second Tertiary Education Strategy*, Ministry of Education, Wellington.

Murray, N. (2001), *A History of Apprenticeship in New Zealand*, Unpublished Masters Thesis, Lincoln University, Christchurch, New Zealand.

Myerson, J.S., Hale, D., Wagstaff, L., Ponn, W., and Smith, G.A. (1990), The Information Loss Model: A Mathematical Theory of Age-Related Slowing, *Psychological Review*, 97(4): 475-486.

New Zealand Labour Party (1999), *21<sup>st</sup> Century Skills: Building Skills for Jobs and Growth*. Retrieved 24 April 2002, <http://www.liveupdater.com/labourparty/print.asp?ArtID=2069458396>.

Organisation for Economic Cooperation and Development (1998), Work Force Ageing: Consequences and Policy Responses, *Working Paper No. 4.1*, OECD.

Paugh, J., and Lafrance, J.C. (1997), *The U.S. Biotechnology Industry*, Washington, D.C, U.S. Department of Commerce, Office of Technology Policy.

Pool, I., and Cheung, J. (2003), A Cohort History of Mortality in New Zealand, *New Zealand Population Review*, 29(2): 107-138.

Piercy, G. (1999), *Strategy and Vision: The Influence of the AMWU on the NZEU 1987-1992 with Respect to Education and Training Reforms*, Unpublished MSocSc Thesis, University of Waikato, Hamilton, New Zealand.

Piercy, G. (2003), A "Third Way" in Industry Training: New Zealand's Adaptation of Selected British Policies, in Jorgensen, C.H., and Warring, N. (eds), *Adult Education and the Labour Market VII*, Vol. A, Roskilde, Denmark, Roskilde University Press, 35-62.

Piercy, G. (2005), Riding the Knowledge Wave: An Examination of Recent Work-Based Learning in New Zealand, in Hager, P., and Hawke, G. (eds) proceedings of the *4th International Conference on Researching Work and Learning*, 12-14 December, 2005, Retrieved from OVAL research Group, University of Technology, Sydney (UTS CD-ROM, 2006 Release),

Purnell, G., and Brown, T. (2003), Automation for the Meat Industry, *New Food Magazine*, 3, 80-85.

Rindfuss, R. (1991), The Young Adult Years. Diversity, Structural Change and Fertility, *Demography*, 28(4): 493-512.

Sherlock, R., and Morrey, J.D. (eds.), (2002), *Ethical Issues in Biotechnology*, Lanham, Md, Rowman and Littlefield.

Skirbekk, V. (2003), Age and Individual Productivity: A Literature Survey, *Working Paper No. 2003-028*, Rostock, Max Planck Institute for Demographic Research.

Statistics New Zealand (2005, 28 February), Statistics New Zealand, Medium Sub National Population Projections: 2001 (base) - 2026, Series 5. Retrieved 16 December, 2005, <http://www.stats.govt.nz/products-and-services/info-releases/nat-pop-proj-info-releases.htm>

Tertiary Education Commission (2004a), *The Distinctive Contributions of Tertiary Education Organisations: A Tertiary Education Commission Consultation Paper*, Wellington, Tertiary Education Commission.

Tertiary Education Commission (2004b), *Summary of Responses to the Tertiary Education Commission Consultation Paper: The Distinctive Contributions of Tertiary Education Organisations*, Wellington, Tertiary Education Commission.

Tertiary Education Commission (2005), Press Statement, *Statement of Tertiary Education Priorities 2005/0*, Retrieved 6 July 2005, [http://tec.govt.nz/about\\_tec/strategy/step/step.html](http://tec.govt.nz/about_tec/strategy/step/step.html)

Templer, R.G., Nicholls, H.R., and Nicolle, T. (1998), Robotics for Meat Processing - From Research to Commercialisation, Paper presented at the *1st International Workshop on Future Automation for Meat Processing*, Frankfurt.

The Treasury (2004, 28-29 July), Productivity Workshop, Retrieved 27 October 2005, <http://www.treasury.govt.nz/productivity/default.asp>.

The Treasury (2005, 14-15 April), Workshop on Labour Force Participation and Economic Growth, Retrieved 27 October 2005, <http://www.treasury.govt.nz/lfpw/default.asp>.

U.S. Census Bureau (2000), *An Ageing World: 2001*, U.S. Census Bureau.

World Tribune (2006), New Nanotech Armor Called 5 times Stronger than Steel [Electronic Version]. *World Tribune*. Retrieved January 9, [http://www.worldtribune.com/worldtribune/WTARC/2006/me\\_military\\_01\\_09.html](http://www.worldtribune.com/worldtribune/WTARC/2006/me_military_01_09.html).

West, V. (2006), Developing Skills Eco-Systems: The Application of Australian ideas to New Zealand. Paper presented to *Sociological Association of Aotearoa-New Zealand Conference*, University of Waikato, 23 November.

## Notes

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<sup>1</sup> See Bryant et. al. (2004) for a discussion of this in respect of prime age women and the more general discussion in the papers arising from the treasury participation and productivity workshops (The treasury, 2004, 2005)

<sup>2</sup> An early example of such a usage was the announcement by an Israeli firm, ApNano, that nano-engineered armour five times stronger than steel and twice as strong as any impact-resistant material used in protective gear would enter volume production as early as 2009 (World Tribune, 2006)