

The role of polytechnics in the innovation system

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Over the last 40 years New Zealand has gone from being the 8th to the 23rd in the OECD rankings of GDP per capita. Its rate of productivity growth has been low for at least 30 years. As a consequence, average annual wage rates are roughly 25% lower than Australia's, and 20% lower than Denmark's. Between 1983 and 2009 our share prices remained nearly static, while those of Australia and Denmark both rose by 500%. The situation has been recognised by government, and there are a number of proposals under way to significantly boost public and private investment in research and development. Many of these will affect the roles of current and emerging players in the science and innovation field including tertiary education.

It is well known that the average OECD government invests 0.65% of its GDP in research and development. New Zealand invests one-fifth less than that, and our private sector invests two-thirds less than the average OECD private sector.

The 2010/11 Budget created several interventions, many of them formulated on the back of the new Economic Growth Agenda, which is focused on: a better regulatory environment for business; a growth-enhancing tax system; better infrastructure; better public services; improved skills and education; and improved science, innovation and trade.

So the environment seems set for New Zealand to rectify its poor innovation performance, and polytechnics and institutes of technology have an important emerging role in the innovation system.

New Zealand's Institutes of Technology and Polytechnics

The system of Institutes of Technology and Polytechnics (ITPs) in New Zealand is unique and the envy of many other jurisdictions:

- They specialise in applied, practical learning outcomes at the high end of the qualifications spectrum.
- ITPs offer their own degrees and postgraduate qualifications, and have access to the Performance-Based Research Fund (PBRF).

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- ITPs have strong and intimate links with industry at national and regional levels, but especially with Small/Medium Enterprises (SMEs).

As a feature of our tertiary education system, ITPs are closely associated geographically not only with centres of population, but also with centres of economic interest, including agriculture, aquaculture, and manufacturing and other industries (Figure 1).

The largest ITPs have combined to work together as the Metropolitan Group. These six Metropolitan ITPs (Metros),

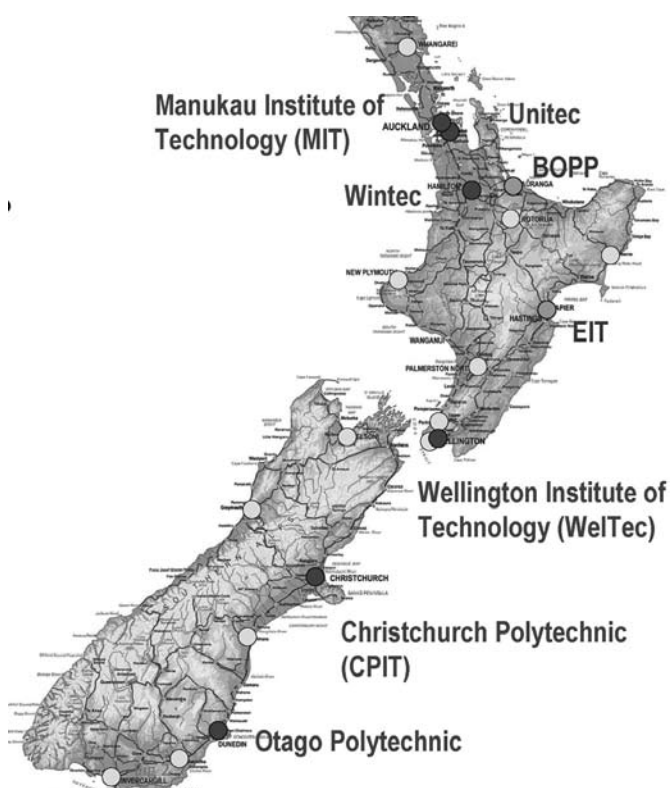


Figure 1. Distribution of the 20 Institutes of Technology and Polytechnics in New Zealand. Dark circles, Metro Group; light and grey circles, provincial ITPs.



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based in Auckland, Manukau, Hamilton, Wellington, Christchurch, and Dunedin, work very closely together, and have led the development of a web-based tool for identifying where business-based innovation resources are available in any one of the contributing Institutes through the website *Innovating New Zealand* at www.innovatingnz.org.nz.

Some regional ITPs also have a strong track record in research and technology transfer, such as the Eastern Institute of Technology (EIT) in Napier, and the Bay of Plenty Polytechnic (BOPP) in Tauranga. These are fully fledged tertiary education institutions that devote some time and effort to research. The research and development that they do relate closely to the characteristics of their local economies: for the EIT the focus is oenology and agriculture while the BOPP focuses on marine biology, aquaculture, and local environmental issues like the cause of lettuce bloom in the Tauranga harbour, and the impact of boat disturbance on sea grass.

The Metropolitan ITPs have similar patterns. While generally more broadly-based than regional polytechnics, they have particular strengths that relate directly to their local economies and interests of employers. So, for example, Wintec in Hamilton has a strong focus on agribusiness; WelTec, in Wellington, has a strong focus on enhanced manufacturing; Christchurch Polytechnic Institute of Technology has a strong focus on IT and electronics.

So it should be noted that the ITP sector within New Zealand's tertiary education system is geographically dispersed and also reflects the geographical dispersment of communities and industry around the country. It also has growing strength in research and development (R&D) and technology transfer (TT), both strongly linked to the needs and interests of the regional businesses, many of which are small and medium enterprises.

Size and saliency of the Metropolitan ITPs

Together the Metros within the tertiary education system offer joint qualifications and services, and make a sizeable contribution to New Zealand's education and intellectual landscape.

In 2009, they were responsible for delivering 50% of the entire (20-strong) ITP sector equivalent full-time students (38 000). They won \$500 m revenue, 50% of the entire sector's total revenue. They awarded 15 000 undergraduate degrees, by far the majority of degrees within the sector, and another 1200 post-graduate degrees. External research revenue earned in 2009 was \$2 m. By contrast, the internal investment in research was around \$9 m (Metro Group 2010).

As 'research polytechnics', the Metros are marked by very close connectedness with industry, both large and small companies around New Zealand. This is manifested by a number of key characteristics. About 850 or more companies form part of the decision-making and advisory apparatus of the ITPs. Their representatives form advisory committees, give guidance on the content of qualifications, and are often involved in decisions about appointing staff. They second their own staff to act as teaching staff within their local institute of technology. They are frequent visitors. Some of them are actual industry 'partners in residence', others give time and space for students of those institutes, and frequently, employ the graduates. These companies often co-fund equipment, or at the very least, they are regular users of equipment that has been bought with public funds for education and research.

Figure 2 shows the evolution of the role ITPs play in an industry's ability to innovate and commercialise a product or service over the past decade. In addition to an industry's evolution over that time the contribution of ITP's to the sector itself has evolved.

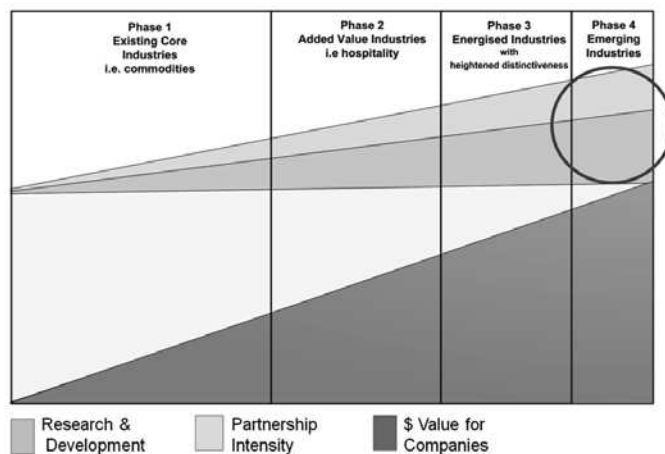


Figure 2. Key characteristics of New Zealand companies on the spectrum, commodity-based to high-tech high value, in the evolution of industrial innovation, and the potential contribution of ITPs (based on Webb & Grant 2003).

Traditionally (Phase 1) ITPs delivered graduates with pre-employment training in the skills needed to service the core, commodity-based industries, and to keep the basics of the domestic economy ticking over – we trained builders, farmers, foresters, meat workers, office staff, cooks, nurses. That phase pretty well reflected the stage of development of much of the New Zealand economy at that time.

The second phase is where many of those same industries/companies started to build 'value-added' into their products, and differentiated on the basis of value for money.

The third phase is where industries and companies take decisive steps into international markets with highly developed and differentiated products, where imitation becomes difficult because of the cluster of skills and ways of working that are bundled up in it. There are a number of key characteristics:

- These companies earn big money.
- R&D is integral to their success.
- Because of the bespoke nature of their skill and knowledge requirements, they are learning companies, and for those who find an education provider they can partner with, the relationship is a genuine partnership.

Phase 4 belongs to industries and companies that have not evolved in this way but are created to meet an entirely new need. They need the highest level of partnership intensity, and have the highest requirement for fully infused R&D. That combination of focused skills development and participation in the company's own R&D goals is what is likely to deliver the greatest economic value. The most advanced ITPs are now able to meet the needs of Phase 4 companies.

The ability to innovate consistently and with sufficient 'newness' and to deliver economic value through innovation is not easy. It requires high levels of achievement in research, and a business strategy that encompasses both capital development and organisation-wide skills. New Zealand's ITPs can play

a unique role in reconciling that tension, and in the journey between these poles.

The New Zealand Institute in its NZ Ahead Report (New Zealand Institute 2010) draws on both OECD surveys and the World Competitiveness reports to dig into New Zealand's business innovation and business sophistication track record to see how we are doing against others on a raft of measures. Table 1 summarises the Institute's findings.

Table 1. New Zealand's innovation and business sophistication rating.

What New Zealand does well
Quality of scientific research institutions (14th of 139 countries)
Sophisticated production process (26/139)
Local supplier and quality (16/139)
Willingness to delegate authority (10/139)
What New Zealand doesn't do so well
Ranked 20/31 OECD countries in innovation
Low innovation score a key determinant of low GDP per capita
95% of OECD average value since 2006
Competitive advantage through unique products/processes (74/139)
Availability of scientists and engineers (67/139)
State of cluster development (56/139)
Company spend on R&D (38/139)
Private sector invests two-thirds less in R&D than 'average' OECD country

Source: The New Zealand Institute NZ Ahead Report (Sept 2010)

Basically:

- There are important things going right, but they are somewhat fragmented and isolated from one another.
- There are many important things not going so well. What they have in common is that they spring from an unwillingness by companies to invest their own money; and they are often the product of too few of the players joining the dots and working together.

Ways to enhance New Zealand's innovation scores

Ways in which ITPs can help to enhance New Zealand's innovation scores can be summed up in the acronym RDT³ (R&D plus Technology Transfer plus Training). The key features potentially available include:

Strong applied research capability

- Degree programmes are applied and students spend significant time in industry and workplaces.
- The Innovating New Zealand website takes clients to whichever of the participating ITPs staff or student research groups can assist.
- ITPs are typically home to sophisticated technologies that are there for use by industry, with staff and student resources to assist. Much of this resource enables the creation of prototypes and ad hoc devices which companies can requisition or make for themselves.

Technology Transfer

- Although ITPs conduct 'blue sky' and development research as well, technology transfer is peculiarly appropriate territory for them.
- This means that applications developed elsewhere are adapted to New Zealand or company-specific conditions, and the problems of implementing them in specific companies are more able to be solved.
- Some of the skills needed for successful technology transfer within firms and industry are systems thinking and problem-solving in a multi-disciplinary setting. ITPs prepare adept graduates through workplace projects, problem-based learning and mechanisms such as internships, cadetships, and outplacement which are often integral and compulsory parts of courses of learning.
- Technology transfer is often as much about skilling the new users as it is about the technology itself. Because of their vocational and technical training mandate, ITPs can be the right research partner for this work.

Training

- Training, up-skilling, and company-wide skill development are the core business of ITPs and the 'research polytechnics' in particular.
- This function is much broader than training for use of new technologies. It is also cultural, strategic management training so that, for example, a new technology can be embedded into a newly 'lean' environment and work processes. Typically, it can also involve raising technical literacy and computational skills to high levels.
- Training should not be discounted as a contributor to innovation. *'The ... current focus on fostering productivity growth via exciting high-tech breakthroughs misses a big part of what really drives innovation, the diffusion of better business processes and management methods'* (The Economist 2010)

To summarise, ITPs, and especially the 'research polytechnics', have a particular and important role to play in science and innovation. They are supporting the next TIN100 (Technology Investment Network top 100 New Zealand companies) and the next after that.

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