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28/5/2008

RESEARCH TRAINING IN AUSTRALIA

House of Representatives

Industry, Science and Innovation Committee

Australia is part of an increasingly open world where trade in labour, ideas capital, goods and services are all part of an emerging single global market. Despite the current focus on key national challenges to address the risks of climate change, water security, environmental degradation and energy futures, some public policy settings are constraining the institutions responsible for the training of Australia's next generation of people and their capability to solve such problems. These situations need to be addressed in order for Australian research institutions to fulfil their potential in fostering high calibre researchers that are comparable to any leading nation. Government involvement in university-based research strategies twenty years ago, while well intentioned, has produced a rigid framework within which universities must operate. Governments can not take the true costs of research, infrastructure, teaching and learning into account – thereby reducing the ability of universities to 'play to their strengths' in determining their strategic direction. There is already extensive analysis and commentary of many of these issues. Rather than reiterate, this submission will present four policy settings that seek to address the terms of reference, namely:

- Education and community engagement;
- The importance of world-leading collaborative infrastructure;
- Knowledge transfer through improved academic-industry linkages;
- International linkages to facilitate adoption and adaptation of worlds best practice.

1. **The contribution of research training programs to Australia's competitiveness in the areas of science, research and innovation.**

   There is increasing recognition around the world that research training programs are a key driver of the competitiveness of organisations in the global economy, and the quality of both public and privately provided services. It is evident that the most successful societies grasp the opportunities and challenges of innovation, make it their own vision of the future and translate this into reality through strategic action. Within the diversity of modern economies lies a common thread to success – investment in human capital as part of a broader research, technology and innovation framework that provides a confident business environment and enables knowledge transfer.[1]

   Competing in any high-technology field is dependent on the skills and abilities of employees. These skills range from conceptual and academic skills among researchers to technical skills in research facilities and to entrepreneurial/managerial skills in start-ups and commercialised entities.

   Australia has a unique distribution of R&D in comparison to other modern economies with nearly two-thirds conducted by universities compared to half in the United Kingdom and one-third in the United States. This poses both opportunities and challenges to differentiating ourselves by developing niche capabilities. Universities need to develop their own strategies towards long-term sustainability of research programs. These institutions should be considered to have appropriate foresight in terms of strategic direction, not the unresponsive nature of governments. The role of government should be to provide tertiary institutions with high quality information reflecting domestic and international trends to enable sound policies to be developed. Australia's innovation system needs universities to play to their strengths and not be consumed by the idealism of being all things to all students. This approach will benefit both established metropolitan universities and contemporary regional universities.

2. **The effectiveness of current Commonwealth research training schemes.**

   At the institutional level there is considerable change proposed for university research funding. Currently, the $540 million *Research Training Scheme* or *RTS* allocates funding on the basis of research student completions, success in obtaining research grants and numbers of publications. Universities have been encouraged to build relationships with the private sector by way of designing funding sourced from firms to be ranked equally with that obtained from competitive grants.

[1] Business Council of Australia, 2006. *New Pathways to Prosperity: A National Innovation Framework for Australia* (http://www.bca.com.au/Content/100942.aspx, accessed 22/5/08).

Nevertheless, research training within Australia is currently heavily influenced by success in obtaining funding from the Australian Research Council (ARC) and the National Health and Medical Research Council (NHMRC). In recent years the amount of funds provided to each of these instrumentalities has doubled with the *Backing Australia's Ability* initiatives of the Commonwealth Government. Notably, the success rate of applications (typically 21-30%) has not increased substantially since the increase in funding, suggesting that grants provided to university researchers, largely through *Discovery* projects have increased in quantum.[2]

The ARC has encouraged collaboration between the public and private sectors via the *Linkage* program. On the whole, this has been an effective driver for public-private R&D partnerships, and at the very least has informed both sectors of the discrete interests of the other. There are cases of deviation from the stated aims of the *Linkage* program in terms of the legal agreements entered into by each party following approval of a grant, but these are considered to be few in number and insignificant in terms of stimulating knowledge transfer. The greatest threat to effective public-private R&D would be further regulation by government. While accountability needs to be maintained from the use of public funds, unnecessary restrictions or onerous reporting requirements will reduce the attractiveness of the *Linkage* program to busy academics and industrialists.

It is difficult to assess the effectiveness of current research training schemes without a measurement instrument designed for quality. The proposed *Excellence in Research for Australia* or *ERA* will go some way to provide this, although caution should be given to the reliance on a metric-driven assessment alone. While the concept of 'verifiable metrics' may appeal to politicians as a means to substantiate claims of research quality, an understanding of the metrics (like any statistic) is paramount to the effectiveness of assessment schemes. A major shortcoming of the ERA is the absence of any *impact* assessment. If we are to truly value public-private R&D collaboration and translation of research outcomes, then why wouldn't we measure its impact in society? While there may have been some conjecture concerning the appropriateness, or otherwise, of the *impact* assessment for the now defunct *Research Quality Framework (RQF)*, it was a bold step to emphasise the importance of academic-industry linkages in our innovation system. Furthermore a measure of research *impact* can specifically include the success of higher degree research in terms of end-user engagement.

Conversely, the core role of universities remains the provision of teaching and the generation of high quality, openly disseminated, basic research. Even where universities undertake research that has practical applications, it is the transfer, diffusion and utilisation of such knowledge and technology that matters in terms of community wellbeing. Commercialisation is just one way of achieving this and should not be over-emphasised.

[2] Science Industry Association, 2007. *Working with Universities: A guide to establishing efficient working relationships with Australian Universities*. Science Industry Action Agenda (http://www.scienceindustry.com.au/pages/action_agenda.asp, accessed 6/10/2007).

3. The adequacy of current research training schemes to support Australia's anticipated future requirements for tertiary-qualified professionals in a wide range of disciplines.

Typically, Commonwealth funds to support postgraduate research students fall far short of supporting the desirable number to advance research in scientific disciplines. In part this impediment may be alleviated by recent measures to double the number of Australian Postgraduate Awards from 2009. Nevertheless, external funds are necessary, leading to many early career researchers initiating alliances with existing research centres, including involvement with Cooperative Research Centres, Linkage grants with industry and grants direct from industry to commence their research. It is fair to say that funds are available in Australia to support good research, but the problem is one of commencing research programs.

4. Adequacy of training and support available to research graduate students in Australia.

Research training systems must provide Australians with the capabilities to be innovative, including industry-relevant technical skills, communication, teamwork, problem solving, entrepreneurship and leadership. Australian researchers must be able to understand the financing of R&D through pre-seed, incubation and venture capital stages. A lack of relevant skills training for Australian researchers is often cited as a barrier to research translation. The creation of the *Commercialisation Training Scheme*, or *CTS*, will go some way to addressing this deficiency in the future by providing 250 places at a cost of $5 million per year. The CTS should be doubled to provide an increasing number of higher degree research students and postdoctoral appointees with an understanding of, and exposure to, the concepts and processes involved in the management of technology products and services.

Postdoctoral appointments in Australia tend to have a bench or desktop focus and there is considerable merit to this in terms of research quality. One of the deficiencies often encountered, however, is their exposure to good management practices. Indeed, instances of poor management from the research group leader often perpetuate such practices for future generations of researchers.

Post-university development courses should be run in conjunction with industry associations as a way of broadening the professional skills of researchers and widening their career options as well as facilitating their uptake by industry. With the diminishing importance of large R&D firms the scope for in-house on-the-job training has also been reduced. Programs to develop work related skills such as technology transfer or specific areas of technology management are a means of addressing this gap.

5. Factors for graduates that determine pursuit of a career in research.

Pursuing a research career requires good advice. There is currently insufficient knowledge of the careers available, particularly for the enabling sciences such as chemistry, physics and mathematics. There has been a concerted effort to develop strong links to industry in order to promote careers for researchers, as well as create an atmosphere in which industry and universities can conduct collaborative research.

Similarly for most professions, morale is a key ingredient in retaining quality researchers. Access to modern research infrastructure is a major factor governing the morale of researchers. The Department of Innovation, Industry, Science and Research should begin evaluation of the $542 million *National Collaborative Research Infrastructure Strategy* or *NCRIS* following implementation of the initial rounds and provide a business case for federal cabinet to consider an expanded $1 billion scheme to begin in the 2010-2011 financial year. A potential benefit of the new ERA research assessment initiative will be to provide financial support for research infrastructure on the basis of quality outcomes. In addition, an increase in *Research Infrastructure Block Funding* or *RIBG* to universities would more appropriately account for the full costs of performing high quality research.

6. Opportunities for career advancement for research graduates and staff.

Australia's R&D base is strong, with world-leading innovation across a range of disciplines. Career advancement for researchers can be improved via knowledge transfer to end-users and the general public. There are two important components that strengthen knowledge transfer from research graduates and staff:[3]

- Knowledge production – academic publication, patenting, licensing and spin-off formation;

- Knowledge relationships – contract research and academic-industry linkages. Beyond postdoctoral research there are two ways in which career development can be enhanced between academia and industry:

    i. Industry Sabbatical Scheme – Academics have traditionally undertaken sabbatical terms at internationally recognised institutions that are involved in complementary areas of research. Encouragement should be provided for university researchers to serve domestic sabbatical terms within government and/or industry sectors.

[3] Department of Education, Science and Training. *Knowledge transfer and Australian Universities and Publicly Funded Research Agencies*. Commonwealth of Australia, 2006.

ii. Industry Fellow Scheme – Industry experts can provide teaching and research assistance to academic staff, together with advice to senior university management concerning strategic trends within disciplines.

7. Factors determining pursuit of research opportunities overseas.

With a tight labour market and fierce competition for skilled workers, research training needs to foster the next generation of Australian science leaders. The skills of our researchers need to be developed to a high level and retained within the Australian research sector. This is particularly important for emerging platform technologies such as genomics, proteomics and metabolomics in the life sciences. Some areas of concern about the supply of scientists – such as the 'brain drain' – are not well founded.[4] In fact, the number of researchers has more than tripled since the late 1970's, representing a higher average growth rate than for most other OECD countries. Moreover, there are now as many researchers in universities alone as there were in the country as a whole across universities, government laboratories and business in 1990.[5] In almost all professions the Australian workforce is participating in global exchange and on balance Australian research capacity is fairing well. Migration patterns for researchers show that the inflow of staff is more than offsetting those departing. This is not to say that there are no areas of weakness. A decade ago saw a relatively large exodus of high-profile, experienced mathematicians, which has not been corrected in recent years. This was due to the shrinking of mathematics faculties, a consequence of two factors that have conspired to make Australian universities less attractive to high-profile mathematicians:

- Declining student interest resulting from inadequately trained teachers and ill-informed careers advice at the school level, and;
- Propensity of university management to devolve mathematics teaching within universities to other faculties.

Opportunities for international experience are a vital component of research training for Australians. The necessity for international post-doctoral employment is two-fold: First, it is a measure of quality for Australian research training that leading institutions are keen to recruit our early-career postgraduates. Second, the exposure to 'best practice' methodology overseas results in a net advantage to Australia as these researchers return to take supervisory roles in universities or development roles in industry.

[4] Productivity Commission, *Public Support for Science and Innovation*. Commonwealth of Australia, 2007.

[5] Barlow, T. *The Australian Miracle: An Innovative Nation Revisited*. Picador, 2006.

8. Australia's ability to compete internationally for high quality researchers.

Australia must be capable of attracting the necessary number and calibre of new researchers to make discoveries and develop them into new products and services. In the global economy, this will involve growing the pool of international experience in Australia, whether by attracting staff from overseas or by bringing back Australians working elsewhere. The fellowship scheme announced in the recent budget for mid-career researchers is a welcome initiative to reduce the barriers encountered by established staff to continue their research following early-career success. The costing of this program should not, however, be to the detriment of the widely acclaimed Federation Fellowship scheme that has been instrumental in building research capacity by luring high quality staff back to Australia.

Australia gains considerably in net terms with immigration of scientific personnel. The rationale to attract high calibre researchers from overseas is similar to that presented in point 5 for retaining Australian talent. Most importantly, additional infrastructure investment in the form of NCRIS and RIBG needs to be fulfilled. In terms of building human capital, the number of *Endeavour International Postgraduate Research Scholarships* for foreign students should be increased in conjunction with the skilled migration program. Experience suggests that a high proportion of international postgraduate students remain in Australia after their degree is conferred to take up residency and citizenship.

9. Whether Australia's academic workforce is ageing, and its impact on research capacity.

The ageing academic workforce will have a detrimental effect on Australia's research capacity. While most science occupations may not be currently in short supply, there is a recognised shortage of engineers and of secondary school teachers in science and mathematics. The shortage of engineers is partly self-correcting as it has elicited a rapid growth in salaries for both graduate and experienced engineers, encouraging entry into the profession. In the case of science and mathematics teachers however, shortages have instead been accommodated by using teachers without adequate skills in these areas. This will adversely affect student performance and decrease future university enrolments in the sciences, the combination of which would significantly decrease Australia's research capacity. In teaching, pricing signals have not been able to respond to shortages due to the inflexible pay levels and structures inherent in union-dominated workplaces.[4] More than any other issue this must be subject to immediate reform through consultation with the Australian Education Union and state-based teacher federations. The question needs to be asked of these organisations why they would oppose greater remuneration and recognition for their members engaged in the teaching of science-related curricula for the sake of outdated pattern-bargaining practices propagated within the teaching profession.