

SOUTH AUSTRALIAN GOVERNMENT

SUBMISSION TO THE

INQUIRY INTO RESEARCH IN AUSTRALIAN UNIVERSITIES

BY THE

HOUSE OF REPRESENTATIVES STANDING COMMITTEE ON

INDUSTRY, SCIENCE AND INNOVATION

JUNE 2008



**Government  
of South Australia**

## **Overview**

This submission will address the two principle terms of reference of the inquiry, with data and commentary that is specific to the state of South Australia, and will also make more generic comments applicable to the wider Australian setting.

Information yielded by the recent work of the South Australian Premier's Science and Research Council is provided, including the results of a SWOT analysis of R&D capabilities in the state. An overview of the workforce profile for science, engineering and technology-based researchers in the state is included, along with focus sections on the social sciences and health sectors, and our University City project.

The submission concludes with a number of suggested priority examples for program reform and investment that will develop Australia's university-based 'human capital' more broadly.

## **Introduction**

Delivering benefits from our research training system and improving our competitiveness in science, research and innovation, and attracting and retaining high quality research staff requires:

- An education system ensuring high quality teaching and learning in maths and science and the social sciences at all levels of the education system;
- Research organisations, teams and individuals capable of undertaking world class research, and with sufficient critical mass to be competitive and recognised;
- Effective links and collaborations between researchers and their research conducted both across Australia and in overseas research organisations (where the vast majority of research is undertaken) for purposes of skills building and dissemination of research results;
- A research workforce profile which covers the spectrum of ages with an appropriate mix and balance of disciplines that contribute to basic research as well as feeding into clinical settings, industry and other users of research;
- Clear career progression structures and opportunities with attached resources to support promising and ambitious young researchers;
- Structures and processes within government that facilitate policy development and delivery to enhance the links between research and innovation, education and industry/service/clinical settings; and
- An incentive framework that appropriately recognises both researcher innovation (and the need to support young researchers), and systems and capital infrastructure requirements for both universities and their partner institutions.

## **Contribution of Australian universities to research training in Australia**

The inquiry is examining the contribution of Australian universities to research training with flow-on effects to our competitiveness in science, research and innovation. South Australia is particularly interested in the interface between different levels of education eg secondary to tertiary, and the effectiveness of current systems in engaging students at a variety of levels to make education choices that will lead to science and research based careers.

As such, the Chief Scientist for South Australia and the Premier's Science and Research Council (PSRC) have focussed their agenda recently on the issue of quality and effectiveness of teaching and learning, and in student participation rates in maths and science education. In doing so they have urged the Government to recognise the strategic importance of improving maths and science education at primary, secondary and tertiary levels, and the need for a whole-of-government approach (at both State and Federal levels). The development and implementation (with appropriate resourcing) of an integrated strategy aimed at increasing student numbers and improving the quality of teaching and learning at all levels was suggested.

To that end the PSRC has committed to establishing a Working Party to undertake further analysis and make recommendations to the State Government in relation to improving:

- the quality of teaching and learning in maths and science at all levels of the education system; and
- the number of students participating in maths and science-based courses in schools, further education and higher education.

The Council is expecting to conclude this work later this year and the findings of the Commonwealth inquiry will be of interest to the Council's working party in its deliberations.

In addition, the Council has, in the last 18 months undertaken a SWOT analysis of the State's R&D capabilities, showing tangible links between the existing research training programs and our state's output across research disciplines. As part of the SWOT study, a bibliometric analysis of research publications for the period 2000-2004 shows that:

- South Australia produced 9.9% of Australian publications, well above its population share of 7.7% (at mid 2002)
- Research output was particularly high in the three life sciences fields of Medical and Health Sciences, Biological Sciences, and Agriculture, Veterinary and Environmental Sciences
- The quality and impact of research in Agriculture, Veterinary and Environmental Sciences (as indicated in the analysis of citations of research publications) was outstanding with an impact measure well above the world and Australian averages for that field
- Physical Sciences research also had a high impact – well above the world average, although somewhat less than that for Australia as a whole

The SWOT analysis shows that government investment in research in South Australia is characterised by heavy Commonwealth investment in Engineering and Technology, Physical and Chemical Sciences, and Information, Computing and Communication Sciences (presumably, mainly in DSTO) and heavy total investment by the South

Australian and Commonwealth Governments in Medical and Health Sciences, and Agriculture, Veterinary and Environmental Sciences. This investment by both governments is clearly of great benefit, delivering economic, social and environmental benefits to all parts of the State.

Our Constellation SA strategy (<http://www.constellationsa.sa.gov.au/>) and Premier's Science and Research Fund (PSRF) (via <http://www.innovation.sa.gov.au/>) both aim to build the State's research capacity and capability through the increased skilling of our local research community and the attraction and retention of high quality researchers. This occurs largely through our state universities, both also in large public research institutions such as our hospitals, and the South Australian Research and Development Institute (SARDI). In 2007, the objectives of the PSRF were expanded to include a capacity building component, which allowed for the State government's support to be used to recruit and retain suitable qualified personnel for the first time. Further information about these programs can be made available on request.

#### Adelaide's University City Project

Established in 2006, University City sets out the Government of South Australia's vision for Adelaide to become a leading international centre for higher education. University City aims to deliver partnerships with foreign universities that will bring expertise in teaching and research to South Australia and to foster collaboration between South Australia's universities and targeted world-class foreign universities in key current and emerging areas. It has already attracted three foreign universities to set up campuses in Adelaide.

A key strategic strength of the University City Project is the targeted choice of universities, and the courses that they will offer in order to specifically meet sectoral and geographic demand (ie servicing key industries and sectors within South Australia, Australia and the Asia Pacific region). In doing so, over time it is anticipated that the graduate pool from these locally based foreign universities will increase our competitiveness in those areas of science, research and innovation where we already have, or are seeking to further our competitive advantage.

Carnegie Mellon University opened its campus in Adelaide in May 2006 with two schools; the H John Heinz III School of Public Policy & Management and the Entertainment Technology Centre. The Heinz School will deliver Carnegie Mellon's top ranked Master of Science and Information Technology as well as the Master of Science in Public Policy and Management with more courses to come.

In October 2007, the world-renowned Cranfield University announced a centre in Adelaide to offer postgraduate defence and security studies and research to defence organisations and industry professionals.

On 30 May 2008 it was announced that the top ranked University College London (UCL), a world-leading British institution, will deliver a post graduate Masters of Science in Energy and Resource Management, as well as offer places to a small number of doctoral students. It is also expected the UCL will establish a dedicated research program to support an internationally-recognised energy policy and research institute.

## **Challenges for universities in training, recruiting and retaining high quality research staff: focus on South Australia's science workforce**

### South Australia's Science Research workforce profile

In 2006/07, the Science and Innovation Directorate within the Department of Further Education, Employment, Science and Technology worked with South Australia's three main universities to complete an analysis of the demographic profile of the science, engineering and technology (SET) based academic workforce in the universities. The data used related to a survey undertaken in 2005. This report identified the ageing workforce in our universities in key disciplines and highlighted the need for our universities to develop appropriate succession planning strategies. This work was made available to the universities through the Higher Education Council for South Australia. This document can be shared with the committee on request, and it is anticipated that the findings of this parliamentary inquiry may help the State in working with our universities to develop succession-planning strategies. The key findings were as follows:

- There are 1793 SET based academic staff across the three universities in SA.
- The gender balance varies greatly with University of Adelaide having the lowest percentage of female staff at 31.1%, followed by University of South Australia with 41.6% and then Flinders University with 48.8%.
- The modal age<sup>1</sup> of all staff across the three universities is:
  - 30-34 years for Chemistry/Physics;
  - 35-39 years for Computing;
  - 35-39 years for Engineering;
  - 40-44 years for Other Health Related;
  - 40-44 and 45-49 years for Pharmacy;
  - 40-44 and 45-49 years for Molecular Biology/Bio Medical/Biological Sciences;
  - 45-49 years for Medicine;
  - 45-49 years for Agriculture (Food and Wine);
  - 45-49 years for Earth/Environmental Sciences;
  - 50-54 years for Nursing;
  - 55-59 years for Mathematics;
  - 55-59 years for Dentistry.
- If it is assumed that disciplines with less than 30% of staff aged under 40 years and/or more than 30% of staff aged over 55 years may have potential workforce staffing problems, in SA these include:
  - Nursing, Mathematics Medicine, Dentistry, Earth/ Environmental Sciences and Other Health Related
- For the three main South Australian universities, the highest proportion of staff (27.7%) has qualifications from an Australian institution other than the three main South Australian universities. 26.2% of staff have qualifications from an overseas institution, 26.3% have qualifications from University of Adelaide, 9.6% from Flinders University and 8.7% from University of South Australia.

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<sup>1</sup> The modal age is the age group with the highest number of staff.

### Lack of critical mass in scientific research teams

In its recent SWOT analysis of R&D capabilities in South Australia, the Premier's Science and Research Council highlighted the preponderance of small research teams in South Australia. Many of these teams have high-level research skills, but are highly dependent on a few individuals for their success.

This feature makes the State's research base vulnerable to 'poaching' by other States and overseas organisations that can offer better funding and access to leading edge research infrastructure. The loss of a key researcher from a small research team can mean that an associated research program is lost to the State. Small size has the additional disadvantages of inability to tackle large and complex problems and a lack of 'visibility' in the international research community.

In particular, the potential threat to the State's research base from the burgeoning economies of India and China must be recognised. Not only can it be anticipated that overseas students from these countries may reduce in numbers, but that our teachers and researchers may become targets for recruitment, thus exacerbating a range of problems.

In the recommendations coming out of the SWOT analysis, the importance of adopting strategies for research funding that will encourage the development and maintenance of 'critical mass' in research teams and areas of research expertise was noted. This approach is likely to generate a number of benefits, including:

- enhanced justification for the purchase of leading edge infrastructure/ equipment
- development of a more professional approach to research management and planning
- reducing the impact of a key researcher leaving the team
- improved success in competitive grant processes
- increased team profile and attractiveness to other researchers
- increased likelihood that major research groups and high profile researchers will relocate to SA; and
- offering a career development structure for young researchers.

### **Challenges for universities in training, recruiting and retaining high quality research staff: focus on social sciences**

Research, of course, is not limited to the 'hard' sciences, and it is also critical to ensure an ongoing research capability in the social sciences, including the disciplines of psychology, social work, criminology, social planning/geography, housing, urban planning and disability studies. This is an essential support to innovation and evidence-based policy, planning and service delivery in areas that are critical to the development of Australian society and the quality of life of our community, including child and family welfare, disability, housing, homelessness, justice, urban design, community development and ageing.

The social sciences have particular challenges in developing and maintaining a research profile, including a limited capacity to attract research funding from sources other than government. It is rare for social sciences research to generate commercialisable Intellectual Property; it is therefore not so attractive from an investment point of view. In addition, the 'industry' (or potential research partners) in question are generally not-for-

profits (such as community welfare organisations) which will have limited, if any, funds available for research. In competitive funding processes, the ‘hard’ sciences may often be preferred to these more ‘soft’ areas. However, social sciences research is often relatively ‘cheap’ (ie projects do not require large-scale investment in research consumables etc).

The South Australian government is keen to foster a strong research capability in these areas. Current mechanisms – for example, through the Department for Families and Communities – include strong collaborative relationships with the university sector; the development and nurturing of shared research priorities and interests; support for post-graduate research; and use of a range of competitive grant processes, including the ARC. The Australian Centre for Child Protection (funded by the Australian Government) has also made a significant contribution to South Australian research capacities, bringing with it a high profile across Australia and internationally, as well as research capability and networks

There are also issues for the social sciences in relation to the adequacy of training and support for young researchers and opportunities for research careers.

Over recent years there has been a marked increase in students undertaking higher degree in relevant areas of the social sciences. Whilst this is a very welcome trend the growth in student numbers has not been matched by growth in the capacity of the universities to provide support and supervision to these students. Universities – with apparently increased workloads, administrative requirements and student numbers – are struggling (and sometimes failing) to provide adequate supervision and guidance. Further, all too often supervisors do not have an active and current research profile (perhaps due to the demands of their academic workload, as well as the challenges of obtaining research funding), which restricts what they can offer to students. Thus students may be taught research methods and supervised in a research project by an academic who has limited research experience, is not actively researching/publishing and does not have enough time to provide the required guidance.

Opportunities for research careers are particularly problematic in the social sciences. Early-career researchers require many more opportunities to develop their research skills, including through post-doctoral fellowships. These opportunities are rare.

The Government of South Australia would, therefore, strongly support mechanisms that:

1. increase opportunities for research in the social sciences
2. provide career paths for young researchers and
2. enable academics to build and maintain an active research profile.

### **Challenges Australian universities face in training, recruiting and retaining high quality research graduates and staff: focus on the health sector**

The investment in people in the health and medical research sector is recognised as an important component of building the broader research community. There are a number of pertinent comments to be made in relation to the health sector:

- The retention of key/leading researchers in health fields is a significant issue, one that can have an impact upon receipt of funding from national and international sources. Support could be given to the employment of ‘strong performers’ with a track record of gaining national and international research grants. This would then have a flow-on effect, and potentially assist in recruiting additional new researchers. In addition, greater recognition should be provided to researchers who are recognised as being ‘key achievers’.
- The ageing of the current academic and research population in health sectors is a significant issue. The modal age of university lecturers and researchers, particularly in nursing, is higher than the average age practising in the profession, with the potential that teaching and service knowledge is less contemporary than the practice knowledge. It is clear that Australia and South Australia must provide a dynamic research environment that will attract and retain young researchers who will in turn attract funding and contribute to building research capability.
- Succession planning is very important, as it is often difficult to identify the next generation of research leaders. A plan should be put in place to attract early career researchers, including the development of incentives to retain existing research expertise. This should occur through encouraging PhD and postdoctoral students to remain in South Australia. However, finding ongoing research positions is a major challenge.
- The attraction of high school and university students to science based courses is critical to their capacity to opt for careers in health professions.
- Strategies that maintain and/or increase the number of research-active core staff in hospitals and universities will have a positive impact on recruitment and retention of clinicians as well as improving health outcomes.
- Health and medical research underpins the practice of medicine, healthcare, service delivery and advancement of health. As such, it is important that all the spheres of Government recognise the important role that clinicians play, both as teachers and, through their clinical duties, in supporting research outcomes.
- The motivation of top clinicians to work, or continue to work in the public health sector is significantly influenced by the possibility of conducting research as well as teaching. As such, consideration needs to be given to supporting industries that offer future employment opportunities in health and medical research. In addition, support for key research positions must be included within hospital’s operating budgets to secure ongoing funding for long-term research positions.
- At a very practical level, encouragement is required for young clinicians to undertake research careers, both in relation to ongoing training and protection from excessive clinical responsibilities. An investment in future generations represents an area which will ultimately lead to long-term benefits for health and medical research in South Australia and Australia and will allow growth of the areas discussed above. There are many issues that impact on attracting clinicians to research. These include the following:



- Availability of research training – under current research training schemes, clinicians must take a substantial reduction in income to undertake meaningful research training, for example in a higher research degree program. This especially applies to doctors but also to the other clinical professions. Implementing competitively funded research registrar PhD/MD scholar positions that facilitate motivated clinicians to undertake research training would improve the number of clinicians.
- Early career support - a practical and successful example of investment in clinician researchers has been the National Health and Medical Research Council's (NHMRC) Practitioner Fellowship program. This program part funds a clinician researcher (in partnership with funding for a clinical position) to undertake research that has direct relevance to his/her area of practice. It is recognised by the NHMRC as being extremely successful and has led to significant advances in clinical practice with flow on benefits to communities. However the program budget is small and is increasingly able to support only very well established clinician researchers. Expanding this program aiming at earlier career clinician researchers would allow clinician researchers to have funded and dedicated research time and provide a means for bridging the gap in research career support for clinicians who have an excellent trajectory in research, but are not yet at the level required to be successful in the current Practitioner Fellowship scheme. These researchers currently fall through the system as there is no early career scheme to support them.
- Infrastructure support – clinical, health services and population health research require different infrastructure supports to basic biomedical supports. In particular they require office, computing, and data linkage supports, rather than the traditional medical laboratory/animal house/analytical/molecular biology/microscopy technical equipment supports. Planning for these in health facilities is usually seen as low priority, yet the importance of the proximity of these researchers to the clinical coal face is fundamental in engaging other clinicians as well as undertaking the research. Improved planning for these types of infrastructure needs to be incorporated in the same way as for basic biomedical research in health facility planning.
- Consideration must however be given to issues such as salary, job security and value of research. Resolution of these issues may increase the attractiveness of research as a career. Medical students need to be provided with role models of successful researchers, and provided with the opportunity to be involved in research balanced against clinical workloads. Again, an expansion of the Practitioner Fellowship model would support this.
- The most recent research literature related to workforce reform in the university and health service sectors is largely drawn from United Kingdom and Canadian sources. It would benefit both sectors if collaborative research efforts could be made in the area of workforce reform in the Australian context (State/Territory

and national). This area of research is distinct from, but linked to the area of health and medical research.

- Research into education models that resulted in reformed curricula and teaching methodologies that better reflected the requirements of the industry would be very useful, especially in the health sector.

### **Australia-wide challenges in training, recruiting and retaining high quality research staff**

As the Commonwealth Government is the major provider of funding for research training, we also hope that this inquiry will offer solutions to the challenges we face in recruiting, training and retaining quality research staff, not only in our universities but also in our research hospitals and state government agencies such as the South Australian Research and Development Institute.

The following are identified as priority examples for program reform and greater investment to develop Australia's innovative systems 'human capital':

1. Better coordinated national Science, Technology, Engineering, Maths (STEM) educational and training policy, spanning primary to tertiary sectors. Specific focus must be made of the quality/capacity and recognition/rewards to STEM teachers and development and maintenance of their teaching materials, in particular that which will engage the young.
2. Greater defined support for 'early stage' career researchers, young promising scientists and researchers seeking to advance their career. (The State Government continues to support our local universities in seeking Federation Fellowships (2 awarded to South Australian universities this year), and we look forward to the new Federal Government implementing the 1000 mid-career Future Fellowships to retain the best and brightest in research.)
3. Programs such as the Australian Government's proposed Researchers in Business initiative that could support early-career researchers to build strong links with end-users, be they business, government or NGOs. Researchers participating should be given every incentive to work outside of institutions and should not be penalised for taking breaks in their research careers to pursue innovative projects which is a current deficiency in existing fellowship schemes that also impacts on researchers taking parental leave.
4. As a small country, Australia can benefit from introducing flexible schemes that encourage Australian researchers, policy-makers and innovators to engage internationally with world-leading experts in their field. There are some limited schemes for doing this already within the research arena (e.g. EU framework grants and ARC Linkage International). There should be greater scope for programs such as research/industry commercialisation programs and CRCs to allow a greater portion of eligible expenditure, not just on research, to occur overseas – schemes that exclusively generate benefit to Australia can lead to an insular mindset.

5. Building Australia's 'international alumni' as national ambassadors in both academe (through international scholarships/fellowships) and business supporting Australian business connections. There should be measures to build relationships with individuals overseas such as maintaining contact with expatriate Australians to encourage them to share knowledge and outcomes, to more formal mechanisms to repatriate international workers such as through a 'mobility portal' similar to that operated by the European Union.
6. Increased support for the development of further Practitioner Fellowships that allow clinicians to undertake research in their area of practice. This could occur through the NHMRC or other funding sources.