Innovative Research Universities

Innovative Research Universities Submission: Senate Standing Committee on Economics Inquiry into Australia's Innovation System

The inquiry into the Australian innovation system provides an opportunity to review the policy settings and programmes that underpin the Australian research effort and innovation environment, testing their effectiveness in supporting the outcomes required of industry, universities, other research bodies, and Government.

The Innovative Research Universities' (IRU's) guiding themes to the complex suite of issues the Inquiry is to pursue are:

i. that Australian research and innovation is inextricably part of global developments: we contribute to world innovation, we receive from it and our ideas, products and people traverse the world;
ii. the need for effective, coherent, long term incentives for industry driven research and translational research which balances the long standing stimulus for pure research;
iii. the importance of an open, effective research and innovation system that encourages and supports valuable research wherever it may arise;
iv. the need for an effective long term research infrastructure program, aligned to research needs within the global context; and
v. the importance of developing a skilled research workforce across all industries.

The IRU looks forward to supporting the Committee in its inquiry. We provide below our first submission targeting the guiding themes listed above. We expect to follow up over the course of the Inquiry with further submissions and other public statements addressing the need to reshape the research and innovation ecosystem across Australia.

1. Being part of global innovation networks

Term of reference b, c, e, and i

Placing Australia securely within the network of global research and innovation is essential. This involves being positive about the Australia's capability to continue to be a significant player in world terms and realistic that we will be one among many players in an ever more complicated set of global research and innovation networks.

Australia produces about three percent of world research output.[1] As benchmarks for comparison Australians represent only 0.3% of the world's population[2] and Australian economic activity is around 2.1% of world GDP.[3] Hence Australia's research output is relatively strong but as a small contributor to the global research effort it cannot operate independently of research across the world.

Conducting high level research increasingly requires the involvement of teams of researchers working within multiple institutions across many countries. This has led to international research collaborations growing at a significant rate.

[1] Office of the Chief Scientist, http://www.chiefscientist.gov.au/2012/04/can-australia-afford-to-fund-translational-research/
[2] ibid
[3] World Bank estimates of GDP 2013, http://data.worldbank.org/data-catalog/GDP-ranking-table

The paradox is that while many research issues increasingly require the interaction of considerable resources to be pursued effectively, the rapid changes in digital technology and their impact on communications means that researchers from all universities can be effective members of world wide networks. While researchers remain part of local networks and respond to issues of local importance, the co-location of researchers with related research interests is less important than previously.

Historically collaborations have been primarily with developed nations in Europe and North America. Changes in the balance of economic activity mean current growth is greater in Asian and other currently smaller economies. In part this is due to significant recent investments in research capability by East and South governments seeking to raise economic output.

So far, Australia has maintained its relative position through our ability to contribute to the Asian growth economies. On current trends China will be the highest volume collaborating country with IRU researchers by 2020 as measured by joint publications, overtaking both the United Kingdom and United States as shown in Table 1. Collaborations with other Asian nations are increasing at similar rates. IRU members, with a foundation commitment to engagement with Asia, are especially well placed to benefit from this changing global research dynamic.

Table 1: IRU Publications 2009-2013: Collaborations with international researchers

Collaborating Country	2009	2010	2011	2012	2013	2020 Proj.
United States	666	739	897	984	1115	2745
United Kingdom	513	484	607	664	756	1490
China	215	266	369	424	573	3185
Germany	156	200	272	316	322	1145
Canada	201	223	304	305	319	716

Source: SCOPUS

The longer term issue is whether Government programs should retain an internal to Australia focus. Over time there will be greater need to stimulate better outcomes through more programs that encourage global interaction and through joint programs with other countries, particularly those in Asia.

The tie between effective local outcomes in Australia and connection to global innovation and markets is explored further in the sections below.

Opportunities for the Committee to explore

i. Establish an Asian research and innovation network with participation from governments, universities, research organization and innovation active industry throughout the region to:
   - act as a vehicle to promote research and innovation, breaking down current barriers and national mindsets,
   - work to understand the connections and differences among research priorities across the region,
   - support a multilateral research funding scheme to support major research projects undertaken within the region (perhaps based on the EU Horizons 2020 model), and
   - support enhanced mobility of researchers at all levels within the region.

ii. Invest in information and communication technologies that allow larger research projects by geographically dispersed teams.

iii. Encourage international research and innovation through Government research programs.

iv. Support researcher mobility between countries, including at the postgraduate student level, building on the growing undergraduate interchange highlighted by the New Colombo Plan.

2. Effective incentives for industry driven and translational research

Terms of reference b, c, e, and h

Australia's future depends in part in the capacity to generate new industries to replace those that are in decline.

Australian business' use of universities and public research agencies is currently among the lowest in the OECD,[4] suggesting that Australian firms are not accessing the latest research produced in Australia's universities to increase their profitability. Further, Australia has a low proportion of researchers in industry compared to public sector research organisations.[5] This may place Australian businesses at risk of being overtaken by international competitors translating the latest discoveries into new and innovative products and adapting their production processes and internal operations to improve profitability.

This is despite considerable, long-term and bipartisan Federal government investment in building links between businesses and researchers.

The key findings of *The Role of Science, Research and Technology in Lifting Australian Productivity* (ACOLA report) suggest universities have an essential role in maximising innovation and productivity across the Australian economy. Working together will have "significant benefits for boosting business competitiveness and enhancing the impact of publicly funded research."

The issues to address are:

i. lack of response to incentives to increase industry driven research;

ii. the disincentives for industry driven research from national and international reputation measures;

iii. lack of support for researchers moving between industry and university and the reverse; and

iv. lack of recognition for translational research.

Lack of response to incentives to increase industry use of university research

The current context has raised concerns about the potential for improvement. The Report of the National Commission of Audit included arguments that the Government should play a targeted role in fostering collaboration between industry and public sector research organisations but was sceptical of the value of clusters, calling for the abolition of the Cooperative Research Centres and Industry Innovation Precincts programmes. The Government has been keen to allay concerns that it does not support investment in better industry use of research and support for innovation. It understands that there is a difference between supporting an ailing industry to continue and incentives to generate the innovations that could lead to a new growth industry.

The 2014 budget brought together many existing Australian Government programs to support industry into the new Entrepreneurs' Infrastructure Programme, with an overall reduction in total

[4] Australian Innovation System Report 2012 http://www.industry.gov.au/science/policy/AustralianInnovationSystemReport/AISR2012/chapter-5-links-and-collaboration/collaboration-performance/index.html

[5] Office of the Chief Scientist, http://www.chiefscientist.gov.au/2014/02/keynote-address-universities-australia-higher-education-conference/

investment. This reflected calls in the Report of the National Commission of Audit for the consolidation of schemes which have the same intended outcome. The guidelines for the programme appear to err in over emphasising the deficit of a company without the funding rather than being an incentive to reward innovative activity.[6]

While the 2014 budget consolidation of programmes makes sense, the ACOLA report was critical of frequent changes to programmes that foster industry driven research. This is in contrast to programmes in other countries, such as the Canadian Industrial Research Assistance programme, which have operated essentially unchanged for decades. Certainty gives industry in particular the confidence to invest in innovation.

Schemes that target universities through the Australian Research Council's (ARC's) **Linkage Programme** offers incentive for researchers to work with industry, but ultimately awards more than half of its funding in the Linkage Projects scheme, for example, to projects undertaken in collaboration with public sector organisations.

The **Joint Research Engagement** (JRE) research block grant intends to reward "collaborative research activities between universities, industry and end-users" by removing Australian competitive grant income from the calculation of grant amounts. However, less than half of the JRE calculation is based on income from industry sources and the JRE itself is only one part of the research block grant programme of which other aspects are heavily reliant on Australian competitive grant income for the calculation of funding amounts.

The **Research and Development (R&D) Tax Incentive** is the main element of demand responsive Government support for the use of research to stimulate innovation. The IRU is not an expert in its operations. Feedback from business potentially eligible is that the process by which firms register for the incentive is highly complex and drawn out, often requiring use of accounting support to complete successfully. Further, the proposed changes to target the incentive to smaller to medium size businesses on an Australian scale, seems to miss that on the world stage few Australian businesses are large.

What is needed is the consolidation of the suite of existing programmes into a small number of significant programmes designed to create strong incentives for universities and for industry respectively to strengthen industry driven research as the fundamental input to future innovation.

Issues and opportunities for the Committee to explore

v. The effectiveness of various schemes and funding mechanisms targeted at growing industry driven research

vi. The potential for an industry demand driven funding program to match industry inputs to university research.

Significant disincentives for universities to work for and with industry

A significant disincentive for industry driven university research is the way in which university research performance is assessed. This is not just an Australian issue, it is global.

Rating systems, both national (for example, Excellence in Research for Australia (ERA)) and international (various university rankings systems, most notably the Academic Ranking of World Universities) use research publications and citations to assess a university's research volume and quality as a major component. Work with industry may not result in these publications.

[6] See the IRU comments at http://www.iru.edu.au/policy.aspx

The argument is not to remove or confuse ERA but to balance it with assessments of the value of other research outcomes, which address the benefits from the research and ultimate use.

The Excellence for Innovation in Australia trial demonstrated that assessing the longer term impact of university research via case studies is possible and useful. Regular impact assessment at the national level would be one step to provide the balance needed.

Opportunities for the Committee to explore

vii. Enhance the incentives driving university research practice to ensure that universities, and individual researchers, are more disposed to conducting R&D with, and for industry, including:
    a. Introduction of a national research impact evaluation administered by the Department of Industry, with methodologies and measurements distinct from those used in ERA to assess university capability when working with industry;
    b. incentives for university schemes recognising and rewarding industry driven research.

Australian researchers have limited experience in and exposure to industry

Australia has one of the lowest proportions of researchers working in business in the OECD, at less than 30%.[7] By contrast, in the United States, Korea and Japan more than 70% of researchers are based in business. This is driven by a lack of effective ways for individuals to create a career that moves between industry and university.

Options to improve the flow of researchers across university and industry employment

viii. Creation by universities of an 'industry focused researcher' stream for people with significant industry achievement and academic credentials, to ensure university based researchers who focus on industry driven research have effective career progression.

ix. Government to work with industry to improve opportunities for those individuals to work in industry including government support for joint appointments, underpinned by investments from both business and universities in building and sustaining relationships.

x. Develop and publicise best practices and streamlined processes on intellectual property and employment terms and conditions for joint appointments.

xi. Encourage short term mobility of researchers, especially research postgraduates, between universities and industry with a specific scheme set up for this purpose, possibly including industry bursaries.

Translational Research

A distinctive feature of IRU research is its translational or transformational aspect. Translational research integrates the exploration of research questions with their application, maintaining a high level of interaction between the two. It may also take existing products or processes and apply these to different issues in innovative ways. It is distinct from applied research in focusing on the effective interaction of research and application, rather than application being a mere side event with limited direct consequence to the research.

Translational research has the potential to deliver immediate and substantial benefit to individuals, communities and industries. It brings together researchers from varied fields as well as spurring joint work across researchers, industry and government. However, current Government settings undervalue translational research.

---

[7] Office of the Chief Scientist, http://www.chiefscientist.gov.au/2014/02/keynote-address-universities-australia-higher-education-conference/

Opportunities for the Committee to explore

xii. Value translational outcomes and potential through inclusion in:

a. funding distribution mechanisms;
b. the assessment of national competitive grants; and
c. a national research benefits evaluation (see viii(a) above).

3. Open and Competitive Research Funding

Terms of reference b and e

Open and competitive allocations have been a key element of research funding for some decades, supporting significant growth in the quality and extent of Australia's research, including a doubling of most measured outputs in the past decade. The competitive pressure encourages all universities to improve research outcomes both those universities which have been established for some time and newer institutions developing a strong research profile. Evidence of the success of this approach is that all IRU members are listed in various international university rankings systems along with many other younger Australian universities.

In any competitive system some institutions will be more successful at attracting funds than others. Much depends on an institution's capability, focus and internal infrastructure. The major granting bodies, the ARC and National Health and Medical Research Council (NHMRC) fund projects and fellowships on the merit of the application.

It is sometimes argued that Australian research presence is too small to sustain more than a few research groups in a particular field against world competition.[8] As set out in section 1 above Australia is a strong contributor to world research and innovation outputs driven by our system of support for all capable researchers. The changes in communication make international research easier than previously, reducing the importance of physical co-location with like-minded researchers.

The response to the need for greater global interaction should not be to fall back on a small number of research fortresses but to remain open to interaction, keeping Australian based researchers in the global network.

What is important is to ensure that the research eco-system in Australia can support researchers from all regions, to enhance the links from local areas to the world beyond. The potential for regions to flourish in the future will be strongly associated with capacity to provide products and services attractive to markets beyond Australia as a mechanism for local development.

Opportunities for the Committee to explore

xiii. Continue to commit to Australia's successful open and competitive research funding system.

4. Supporting Research Infrastructure and Ecosystems

Term of reference b, e, f

Major research infrastructure

There is no ongoing, long-term government investment in major research infrastructure. As research projects grow larger and research questions more complex, it becomes more important for investments in national, widely accessible research infrastructure to support the national research effort.

[8] Ian Young, http://vcdesk.anu.edu.au/2014/07/30/imagining-an-australia-built-on-the-brilliance-of-our-people/

The previous government was unable to commit to a long term renewal of the National Collaborative Research Infrastructure Strategy (NCRIS), leaving it as a challenge for the current government to do so for the coming decade.

A successful Strategy will:

- be based on regular, major, renewal of the road map for infrastructure creation and renewal;
- be coherent with research infrastructure globally, ensuring Australian based researchers' access to internationally based resources not available here and international researchers access to Australian based infrastructure which is rare or unique;
- have a known, long term commitment of resources to implement the evolving road map;
- ensure a broad distribution of the loci of major resources to stimulate research capability across Australia;
- guarantee access to infrastructure by researchers from across Australia and internationally pursuing research of all kinds, including that driven by industry needs;
- balance areas of nationally strong research capability with support for research capability across developing fields; and
- underpin the operational costs of funded infrastructure, where user charges are not sufficient.

Regional research ecosystems

IRU members are the main counter to the tendency for Australian research and researchers to concentrate in the inner circle of Australia's capital cities. IRU members were established as research intensive universities in the outer urban areas of Australia's capitals and in major provincial cities to stimulate economic, social and personal advancement.

The universities' research and their creation of graduates in regions where higher education participation and attainment is low strengthen the social and economic prosperity of the region, linking them to global opportunities. The focus of IRU members in northern Australia on links to the neighbouring Asian countries is one notable example.

To achieve the outcomes expected of the universities requires an effective research ecosystem that supports the researchers linking them to researchers elsewhere in Australia and the world.

Research conducted for, in and by researchers based in Australia's peri-urban and regional areas will encourage the creation of localised research ecosystems, characterised by engagement between research organisations, industry, government and communities, addressing significant local issues as well as problems of national and international importance.

Regional research ecosystems present multiple benefits to the communities in which they are based:

- addressing issues of immediate relevance to the local community with input from the community and local governments;
- linking regional business to global value chains in areas where the region has comparative advantage;
- economic investment arising from the development of research centres, facilities and infrastructure; and
- attracting high-skilled, high-income workers to regions (encouraging researchers to move away from major cities also works to alleviate infrastructure pressures there).

Opportunities for the Committee to explore

xiv. Renew the national research infrastructure strategy encompassing the listed characteristics.

xv. Ensure research systems are supported across all regions of Australia.

5. The research workforce

Term of reference b, e, g, h

The need to increase mobility between universities and industry workforces has been explored in Section 2 above.

Increasing the number of research students

The number of Australian students undertaking higher degrees by research has been relatively flat for at least a decade. At the same time, international enrolments have increased substantially, particularly in STEM fields as shown in Table 2.

Table 2: Postgraduate Research students 2004-2013 by Citizenship and Discipline
(Equivalent Full Time Student Load)

Citizenship	Discipline	2004	2007	2010	2013	% Change 2004-2013
Domestic	STEM Fields	10,989	10,621	10,542	10,594	-4%
	Other Fields	16,057	16,191	16,978	18,093	13%
	Total	**27,046**	**26,812**	**27,520**	**28,687**	**6%**
International	STEM Fields	3,048	4,124	6,791	9,386	208%
	Other Fields	3,278	3,723	5,363	6,212	90%
	Total	**6,326**	**7,847**	**12,154**	**15,598**	**147%**

Source: Department of Education Higher Education Statistics Data Cube
Note: STEM Fields include Natural and Physical Sciences; Agriculture, Environment and Related Studies; Information Technology and Engineering and Related Technologies

The Government's proposal to reduce the Research Training Scheme (RTS) by 10% would mean that not only has Government support for research training not increased since the Scheme was created in 2001 it would now decrease. The decision to allow universities to offset a reduction in the RTS by charging research students treats them solely as students consuming resources for a potential payoff following graduation. It ignores the important, active, contribution research students make to research output whether individually or as part of research teams.

A thorough rethink of the place of research students is required and the mechanisms by which Government supports their development and supports their living costs. This should be done to ensure coherence with undergraduate funding where universities are funded for all students who enrol.

This would encourage universities to increase enrolment and give them the capability to differentiate based on factors such as the area of research, the stage of the research degree the person has reached, the extent to which the student's project is externally funded and the personal circumstances of the student.

STEM Education

There has been considerable concern for over a decade that the number of graduates in Science, Technology, Engineering and Mathematics (STEM) fields is insufficient to support a high-technology, advanced manufacturing and services driven economy.

The introduction of demand driven funding has seen a significant increase in enrolments in STEM fields, through encouraging universities to respond with funding at a level appropriate to the likely costs. The IRU comment "Demand driven system fuels growth in science and technology students", March 2013 identified the growth in STEM subjects between 2009 and 2011, growth which has continued in 2012 and 2013 as shown in Table 3.

Table 3: Domestic Bachelor students by discipline: 2009-2013
(Equivalent Full Time Student Load)

Discipline Group	2009	2011	2013	Change 2009 to 2013	% Change 2009 to 2013
Health	64,649	75,485	84,583	19,934	31%
Natural and Physical Sciences	63,029	70,773	80,936	17,907	28%
Creative Arts	42,589	47,224	54,040	11,451	27%
Engineering and Related Technologies	26,983	30,118	33,571	6,588	24%
Agriculture, Environmental and Related Studies	5,909	6,621	7,290	1,381	23%
Education	39,911	42,238	47,135	7,224	18%
Society and Culture (excluding law)	103,806	111,213	118,993	15,187	15%
Information Technology	14,838	15,350	16,945	2,107	14%
Law	26,265	26,948	28,446	2,181	8%
Management and Commerce	59,524	60,531	64,152	4,628	8%
Architecture and Building	11,151	11,624	11,251	100	1%

Source: Department of Education Higher Education Statistics Tables

The impact of the proposed changes to undergraduate funding on the STEM disciplines is unclear. As with all disciplines universities and other providers will determine revenue needed against the willingness of students to contribute. The proposed funding for STEM disciplines is notably lower than current rates, with strong concerns that this will cause universities to reduce enrolments unless there is considerable student willingness to pay notably higher fees. This is particularly so if universities pass on the reducing funded for STEM disciplines onto the students of those disciplines rather than share the reduction in Government funding more evenly across all students.

Opportunities for the Committee to explore

xvi. Revamp Government support for research training to align to growth in research training.

31 July 2014