

AUSTRALIA'S FUTURE IN RESEARCH AND INNOVATION

Joint Select Committee on Trade and Investment Growth

University of Newcastle



The University of Newcastle (UON) recognises that the process of innovation is critical for vibrant, growing, transitioning economies and welcomes the opportunity to contribute to discussions about how best to maximise innovation and secure Australia's future economic prosperity through research and innovation and to respond to the Joint Select Committee on Trade and Investment's inquiry into *Australia's Future in Research and Innovation*.

UON makes the following recommendations which will be discussed in detail below:

The Government should:

- A. Incentivise the uptake of established successful models of collaboration which encourage industry collaboration with universities.
- B. Support the establishment of Regional Innovation hubs that harness the talent of university staff and students, and industry partners to create new jobs and drive economic and social innovation.
- C. Fund enhanced international mobility and exchange schemes for both researchers and HDR students.
- D. Develop a model for International Cooperative Research Centres based on a structured intergovernmental partnership within which universities can leverage national government and international industry investment to support areas of national priority.
- E. Enhance R&D concessions and other incentives for direct investment in research for collaborative research projects including proof of concept funding.
- F. Incentivise industries to actively engage with universities and/or provide 'internships' for academics and HDR students to have meaningful short-term placements in industry settings

Introduction

There has been considerable debate on what is needed to ensure that Australia remains competitive in the global knowledge-based economy, and is recognised as a valuable contributor to the ever increasing rates of scientific discovery and technological innovation. Australia offers a strong creative environment, a social sense of solving some of the world's most pressing issues, a culture that embraces diversity and a lifestyle to attract some of the world's best talent. Integrating these elements and aligning them to Government investments and programs and national, state and regional innovation goals, will ensure economic growth and prosperity in the knowledge based economy of the future, and is fundamental to the question posed by the Committee – *how the research and innovation sector can better assist in overcoming Australia's geographic, economic and labour challenges, with a focus on commercialisation including, how technology imports and exports could be further facilitated*.

UON advocates building upon Australia's strong foundation for research excellence as a platform for growth and change. Universities play a critical role by "*providing high-level skills, world class research base and a culture of inquiry and innovations*".¹ Universities are also an integral part of the supply chain to industry through "*the application and exploitation of research capability; the enterprise and entrepreneurial culture that is developed amongst its students; and the applicability of the knowledge and skills of its graduates*".²

¹ Wilson, Professor Sir Tim, (2012) A Review of Business-University Collaboration

² A Review of Business-University Collaboration 2012

In the context of a knowledge-based economy, however, the research sector cannot operate effectively in isolation. The best innovation systems are those where new industries and opportunities are delivered through collaboration across research, industry and government. Each of the key stakeholders has an important role to play in maximising Australia's strengths and driving innovation.

Systemic changes are necessary to bring about and drive exchanges and relationships among industry, enterprises, government and academia, promote the learning and sharing of ideas, contribute to Australia's economic growth and respond to global market demands. With appropriate incentives, investment and strategies, the Government can play a key role in leveraging collaboration between Australia's advanced university research capacity and both existing and emerging industry partners both domestically and overseas.

For this reason, UON applauds the Government's commitment through the National Innovation and Science Agenda (NISA) which provides a framework for Australia's innovation policy based on four key pillars:

1. Culture and capital – bringing our cultural change through investment;
2. Collaboration – enhancing funding incentives for university partnerships with industry coupled with investment in research infrastructure;
3. Talent and skills - supporting all Australian students to embrace the digital age and attracting more entrepreneurial and research talent from overseas;
4. Government – as an exemplar and leading cultural and technological change.

NISA brings with it a much needed roadmap to tackle the geographic, economic and labour challenges Australia faces, as noted by the Joint Select Committee on Trade and Investment, and is a way to better position ourselves as one of the most innovative economies in the world, signalling our strengths and capabilities in the research sphere. However, long-term stable investment in science and research is critical now and in the future; the extent to which NISA and associated reforms will be successful relies on a sustained ongoing commitment from all levels of Government and across all parties, one that is enhanced, rather than diminished over time and successive governments.

UON has had the benefit of a copy of the submission from Universities Australia and supports the key themes raised in that paper, namely:

- Continuing and predictable investment in the higher education research sector and the incentivisation of industry to engage with the research sector is critical to ensuring economic prosperity and boosting trade and investment growth;
- A whole of government approach to creating an ecosystem in which research and innovation can flourish is needed to encourage industry engagement, and build international connections and a highly skilled workforce;
- The National Science and Innovation Agenda sets out the a comprehensive plan as to how this ecosystem will be achieved; however, a long term, wide-ranging commitment is needed to enable the ecosystem to develop;
- Strategic programs to increase participation in international research and industry collaborations will greatly enhance Australia's competitiveness and productivity but we need to take advantage of all international collaboration opportunities and incentivise it appropriately.

UON makes the following recommendations and additional comments directed to the issue of strengthening the relationships between innovative businesses and our research organisations. As noted by the Joint Select Committee on Trade and Investment, Australia ranks poorly against other OECD countries in terms of research and business collaboration, despite our strong record of research excellence.

The Need for a Systemic Approach to Research and Innovation

In order to move forward, it is critical that we pursue a multi-level relational approach rather than a stand-alone transactional incentive approach. Collaboration is a key contributor to research and commercialisation opportunity and associated productivity, however, fixing part of a system is not going to solve the problem. While incentivisation of research and industry collaboration is critical, it must be supported by an entire innovation ecosystem, including research and research outputs, business incubation and acceleration capacity, an angel and venture capital environment and a framework for the set up and development of start-ups, spin-offs and aligned businesses, along with strong marketing and manufacturing capabilities.

Australian business and industry is risk adverse when it comes to working with universities and this has limited their involvement in discovery. This is in stark contrast to the United States where there is a strong innovative culture and venture capital support for new ideas. A similar capacity is urgently needed to provide a rapid response to emerging trends and support for critical high risk research endeavours. Models which could help to provide this capacity include: Waterloo; Pittsburgh; Oxford; Imperial College; Harvard; Stanford; or a smaller scale version of the EU Horizon 2020 Program.

Looking at the example of Waterloo, it exemplifies a university-led regional innovation hub with a focus on connecting industry and ideas through researchers sharing with industry fresh approaches and cutting-edge research. The University's community-based research and technology park, David Johnston Research + Technology Park, is supported by a comprehensive partnership between the University, the Government of Canada, the province of Ontario, the Waterloo region, the City of Waterloo, Communitech, and Canada's Technology Triangle. The Research Park is home to thousands of ICT industry researchers and technology jobs and has directly generated an economic impact of \$602 million in spending, \$428 million in GDP, and \$319 million in labour. Waterloo illustrates the possibilities of utilising innovation as a catalyst for significant economic and social returns. Within 10 years, a regional economic engine of \$30 billion has developed. In 2011, the University of Waterloo received \$297 million from the Government of Ontario but generated \$2.6 billion in spending impacts and more than \$1.4 billion in labour income, indicating the scope of a regional innovation system to generate significant returns on investment.

There are also examples of home grown models of successful research/industry collaboration that could be applied more widely. UON has been recognised and acknowledged as a role model for university/industry collaboration and partnership. For example, the Newcastle Institute for Energy and Resources (NIER) is an initiative based on best practice industry/academic collaboration, world-class competitive research and outcome-focused solutions. The NIER model has been highly effective and could be applied more broadly.

Similarly, the Australian Coal Industry's Research Program (ACARP) combines resources and expertise from individual producers and shares the risks and benefits across the industry. Funded by Australian black coal producers through a five cents per tonne levy paid on saleable coal, ACARP highlights the considerable leverage of combined R&D expenditure to address wider industry problems. The main

benefits of the model are: an annual round of research regardless of the state of the economy; all projects are judged on their end game which provides a long term commitment to developing and funding a research proposal; and there must be a commercialisation pathway to deliver back to the whole sector on a royalty-free basis. Researchers can come from a variety of sources and there is no restriction on leveraging other government schemes.

The development of strong collaborative model(s) supported by an innovation ecosystem can be achieved through an increased Government focus on regions (particularly regions beyond the capital cities) as “the critical nexus for innovation based economic growth”³. In this context, universities play a critical role in the development and maintenance of links with the world’s best knowledge and are uniquely situated to bring these connections and global knowledge to Australian industry. Government coordination and support is needed to incentivise opportunities for international engagement and drive international innovation and discovery, on the scale needed to propel Australia forward as a competitive economy

Government support for the development of regional innovation hubs would see the local university play a pivotal role in developing innovative solutions together with industry for regional and global problems. Innovation is the bridge between new ideas and commercial opportunities and it encourages and enables new industries to find their appropriate scale. An ‘innovation hub’ would act as the critical convergence point for stakeholders including business, industry and universities, and an economic multiplier for regions. Ideas generated by university researchers do not always reach their full potential in terms of economic development because they are not fully translated into new products or services. Equally, entrepreneurs may not get the chance to succeed because local capital providers are unaware of the investment opportunity. This is the gap which Innovation Hubs would help to fill.

Regions that support a web of linked knowledge creators, managers, and capital, are more likely to become innovation centres. Such an approach would not only encourage greater connections between academic research and market opportunities but if done successfully can lead to the development of new industries, job creation, new start-up businesses, investment in state of the art research facilities and infrastructure, and the attraction and retention of world class researchers, innovators, entrepreneurs and angel investors and venture capitalists. Hubs would act as not only a beacon for investment, but also ensure that ideas have a space for development and industries a catalyst for growth.

In this respect, UON notes that through NISA, the Government has signalled its commitment to foster the development of an entrepreneurial and innovation culture across industry and address the poor engagement and commercialisation between academia and industry. This framework provides a mechanism for the systematic exchange of research ideas and personnel between universities and industry as well as a range of specific opportunities for greater engagement and innovation. Many of the pieces are already in place for this to happen. Initiatives such as the Industry Growth Centres and Cooperative Research Centres (and in the case of UON, Newcastle Institute for Energy and Resources, Hunter Medical Research Institute and Priority Research Centres) provide models to generate industry engagement on specific issues and challenges.

NISA builds on this approach and sets out a range of initiatives that together provide a strong Government-supported foundation for university/industry collaboration and create linkages within Australia. These include:

³ Council on Competitiveness - Measuring Regional Innovation: A Guidebook for Conducting Regional Innovation Assessments

- A new \$200 million CSIRO Innovation Fund to co-invest in new spin-off companies and existing start-ups that will develop technology from CSIRO and other publicly funded research agencies and universities
- A new Biomedical Translation Fund to co-invest \$250 million with the private sector to increase the capital available for commercialising medical research within Australia and help ensure that our deep strengths in this area are leveraged to drive future growth;
- Streamlining and refocussing a greater proportion of research block grant funding toward collaboration and an additional \$127 million in research block grant funding;
- Non-academic impact and industry engagement measures, piloted through the ARC in 2017 and fully implemented by 2018;
- A new application round for the Cooperative Research Centre program in February 2016 and the expansion and relaunch 'Research Connections' as Innovation Connections;

These initiatives recognise our need for collaboration on a domestic level, however many of the significant challenges confronting Australia are shared with other countries: environmental, economic, education and healthcare issues. These would all benefit from a collaborative approach to applied research, and a formal mechanism to support universities working with industry partners and other stakeholders internationally to commercialise outcomes and ensure their sustainability. NISA addresses this issue in part by:

- Providing access to landing pads in Silicon Valley, Tel Aviv and three other locations, and leverage the expertise of the Australian diaspora in key markets;
- Funding Australian collaborations with international research-industry clusters, such as Leading-Edge Clusters and Fraunhofer Institutes in Germany;
- Establishing a new Cyber Security Growth Centre; and
- Investing \$26 million to build capability in quantum computing (building a silicon quantum circuit).

In seeking to build frameworks sufficiently robust to support an evidence-based approach to tackling international challenges, and to grow capacity and sustainability in innovation and research translation, UON supports the Government's greater emphasis on strong international partnerships. In order to increase the number and quality of partnerships between Australian researchers and their international counterparts, Government support for comprehensive international exchange programs, such as Germany's D.A.A.D. , building on programs offered at the institutional level, would help to expose Australian researchers to new ideas and cutting edge technology and developments and would facilitate short and long term exchanges between leading international and Australian industry and researcher groups.

Incentivising exchange programs for both researchers and RHD students on the scale that is needed, would enable the sharing of ideas and technology across proximate geographical borders and critically provide a mechanism to access the large scale research infrastructure which is needed to drive discovery and innovation. Within our region, smart partnerships with areas with similar challenges and priorities is one way to address the *"cost, complexity and pace of scientific achievements ... [and a mechanism] through which the unique capabilities, interests and resources of various stakeholders can be brought together for great success"*.

In this regard, UON recommends extending the Cooperative Research Centre (CRC) model. While multinational or international industries can invest in Australian CRCs, there is no formal model of an 'International CRC' in which universities in another country would attract funding from that country to be part of an 'International CRC'. Such a CRC would encourage the development of partnerships between

relevant Australian and international research institutions and would recruit the interests of industry and business partners of both the Australian and international universities. In such a model, the Australian government would provide funding which could be leveraged by Australian universities to solve research problems of relevance to Australian industry partners and similarly the funding invested by foreign governments would be leveraged by their universities to solve research problems of relevance to their industry partners.

Importantly an International CRC would provide a structured model within which industries could also choose to partner with universities within the International CRC. The intention of International CRCs would be to leverage the strength of the collaborative model, but without seeking to harmonise the rules in each country around funding for research collaborations between universities and industry. Such a structure builds on and connects to the industry growth particularly in relation to the development of global supply chains and market access.

Recognising the Value of Research

UON argues that an integral component of any innovation systems should be the national recognition of the invaluable work of researchers and educators, whether through recompense or prestige, by all levels of Government, universities, industry and community. This requires a shift away from the current singular focus on what “research can do for industry” towards a more collaborative and supportive approach, that recognises and values the contributions of research and education, particularly basic or curiosity driven research. For example, the curiosity driven research leading to the Human Genome Project and the development of the internet and mobile electronic devices could not have foreseen the myriad of opportunities that they have generated, including the explosion of new industries and a raft of technological advances that have since resulted. Care must be taken to ensure that university research (and education) is not driven solely by the dictates of industry.

This is one area where the Government can play a decisive role particularly around aligning the motivations for universities and industry.⁴ Universities are primarily driven to create new knowledge and educate, whereas industry is focused on capturing valuable knowledge that can be leveraged for competitive advantage and can contribute to a company's performance, competitiveness and advancement towards its goals. Australian industry is also more likely to adopt or modify existing innovations rather than develop new innovation, hence the perceived lower need for engagement between academia and industry.

Similarly, researchers often lack the experience and knowledge required to better engage with industry and understand the needs of the private sector. This is particularly so as the benefits of much research are not always able to be realised in the short-term. Scientific discovery requires both time and financial resources to advance to a stage of market readiness. A greater understanding of the benefits of entrepreneurship and innovation within universities as well as industry knowledge and understanding of the benefits of academic partnership is required. At the university level, this needs to be supported through development, implementation and investment in a culture of innovation and entrepreneurship. If we understand the unique motivators and barriers of each stakeholder group in the Australian system at an individual and collective level, we will better appreciate how interactions and cooperation can be achieved between these groups. This will result in investments in capacity and capability building, building awareness of the benefits, rewarding each stakeholder group using a combination of extrinsic (e.g. financial, allowable tax

³ The term 'industry' includes all potential future workplaces, from industry to business, government and NGO's.

expenditures, tax-rebates etc.) and intrinsic (national programs that recognise, celebrate and reward achievements) elements. However, it is critical that institutions are not drawn into traditional competitive approaches to improve commercialisation outputs, rather that there is holistic and multi-level engagement between stakeholders that is cooperative and collaborative. While there should be greater emphasis on the needs of the end-users, this should be balanced against ensuring that collaborative relationships are able to deliver outcomes more broadly to the Australian public as well as providing benefit to industry.

Strategic industry and university research collaborations provide a myriad of benefits for participants. For academics, these benefits can include the opportunity to address challenging research questions with real-world applications, to see their research have tangible impacts and gain access to new skills, data or equipment. Industry can improve performance through developing new techniques or technologies, de-risk investment in research, and extend the capabilities and expertise available to it. Investment in collaborative Research and Development (R&D) also delivers real benefits to Australia, driving growth and productivity improvements for business and industry and high quality research outputs. Despite these benefits, however, there remain barriers to research and industry collaboration including:

- Poor integration of university research with industry;
- Lack of clear or facilitated communication pathways for industry and universities to share knowledge, capacity and opportunities;
- Lack of recognition in promotions for researchers with excellence in innovation associated with industry collaboration, driven in part by the external funding mechanisms that focus on research income and publications;
- The perception that universities are overly bureaucratic and cannot be nimble when engaging in collaboration with industry;
- The performance of the macro system is affected by limited capacity (and capability) of people for investment in such collaborations, which leads to a lack of awareness of the medium to longer-term economic and social benefits.
- Limited incentives to encourage industry to collaborate with universities beyond short term, individual projects;
- Cost barrier given risk in undertaken research for SMEs to engage in collaborative research;
- There is a lack of incentivisation (intrinsic and extrinsic) for the key players by the Government in particular tax incentive for R&D and university collaborations.

In light of the challenge facing Australia's economy, it is clear that universities will need to increase their level of collaboration with industry including effectively communicating the benefits of collaboration and translational research. However, this is equally true of industry. It is imperative that administrative burdens around the competitive industry-related grant programs are removed or reduced to enable collaboration to occur through: the speedy resolution of funding rounds from application to outcome; less onerous application forms and processes; and more frequent opportunities to seek funding, so that opportunities can be seized when they become available.

Introducing flexibility to reduce the industry cash input requirements in ARC Linkage Grants enables less "cashed up" firms to participate in research activities and facilitate more meaningful R&D.

The competitive grant process adds a significant time barrier between the identification of a research project, the funding decision and the commencement of the research work. Industry need to see solution

based projects able to be activated in a timely fashion, with flexibility needed to support quicker engagement between industry and universities. The move to continuous applications for ARC-LP outlined in the NISA will help to bring about this nimbleness and is in line with countries such as Canada that have gone to “on-demand” programs for industry-academic collaboration. Introducing a mechanism whereby industry could fund or contribute towards a pilot project and have this contribution count towards a competitive grant application would also facilitate collaboration commencing whilst the competitive application is under assessment. Potential access to government support might be enough to kick start an industry/academic collaboration, and encourage the collaboration to continue if a competitive application is unsuccessful.

The perception that collaborating with industry, or spending time in industry, is damaging to an academic career path persists and detracts from the attractiveness of such activities for academics. In addition, commercial research endeavours take time, money and human resources and there needs to be investment over the longer term by Government, industry and universities to support the commercialisation of research or the exploitation of knowledge. Funding for POC is very difficult to obtain, thus limiting the capacity for research outcomes to progress to commercialisation. Introducing a greater focus on competitive research programs supporting early stage commercial research endeavours will make this activity more attractive for researchers. The NHMRC Development Grant scheme is one such program with the aim to support health and medical research within Australia at the proof-of-principle or pre-seed stage that specifically drives towards a commercial outcome within a five-year timeframe. The ARC does not have a similar targeted scheme, although such work could be funded in collaboration with industry under the Linkage Projects scheme as long as new knowledge is generated, and involves risk or innovation. A recommendation from the Miles review of the CRC Program included that the assessment should be based on an identified industry priority and have clearly articulated and tangible goals, including commercialisation potential. As such this could provide another avenue for funding early stage commercial research endeavours.

Critically any such change in focus of the competitive research programs should not exclude blue sky and pure academic research. It is vital that the importance of basic research is not ignored or downplayed. Without the underpinning activities of basic research the commercialisation processes will very quickly drain the well of innovation leaving nothing to commercialise.

Increasing Industry Relevant Research Training

The changing landscape of research training in Australia sees considerably more HDR graduates employed in areas outside of academia following the completion of their training. As Australia embraces the knowledge economy, HDR students will play an integral role in driving innovation and in turn, contribute to Australia's economic growth. Accordingly, we need to ensure that research training is not only relevant today but also is well supported to meet future need. This will require:

- A research training system that develops HDR skills and experiences with enough flexibility to meet the specific training requirements of different disciplines and fields and prepare graduates for a variety of career pathways (both industry and academia) upon completion, rather than ‘work ready’ graduates for specific jobs/roles;
- Much greater cross-pollination of industry and HDR students through industry placements and engagement mandated and supported by Government, for example, Doctoral Training Centres;
- Australian research students to be exposed to, and be able to share new knowledge and technology with, first-rate international partners through the prioritisation of existing research exchange programs; and

- A greater focus on HDRs as a career pathway for underrepresented groups, including putting in place the necessary structures and supports to increase their participation at the school level to create a pipelines of HDR students.

It is vital that students are exposed to industry collaboration, where relevant to their program. Development of industry awareness at an early stage of their research careers will assist in building capacity and long term collaborations. Government incentives for industries to actively engage with universities and/or provide 'internships' for academics and HDR students to have meaningful short-term placements in industry settings are as important as the tax incentives recommended above.

UON notes that the UK has had Knowledge Exchange funding for 10 years (10% of research budget); there is no comparative funding in Australia. The impact element in the REF was introduced to provide a further incentive as a catalyst for culture change and encourage university-business interaction, and has been a key incentivising driver for industry-university engagement. Even so, it is unlikely that knowledge exchange and impact would be so high on the agenda for UK institutions without the Higher Education Impact Fund (HEIF), Impact Accelerator and REF funding sources. These significant funding sources are key to driving researcher and institutional behaviour. There is no equivalent funding in Australia, leaving individual institutions to pursue this agenda within limited resources.