



SUMMARY OF RECOMMENDATIONS

Recommendation 1:

The Government should drive research priorities that:

- a. *Explicitly articulate a role for public good in addition to a focus on commercial returns;*
- b. *Ensure a balance between, and an ongoing commitment to, basic and applied research;*
- c. *Ensure a balance between STEM and HASS research priorities and encourage an environment of integration where possible.*

Recommendation 2:

The Government should incentivise collaboration between researchers, and industry be “incentivized” to facilitate greater engagement through:

- a. *The modification of the rules for competitive grants to support researchers to engage and work more closely with industry in the development and administration of research projects, recognising that this may not be feasible for all fields of research;*
- b. *The introduction of industry engagement metrics as part of Excellence in Innovation for Australia around industry partnerships, for example, recurrent funding from industry, with a phasing in period to test its relevance and practical applications before it affects funding.*

Recommendation 3:

The Government should increase the proportional weighting for industry income in the metrics for the Research Block Grants, for example, for both RTS and JRE, Category 3 funding (Industry and other) should have higher proportional weighting than Category 2 and 4 funding, and for SRE, Category 3 income should be included in the income threshold.

Recommendation 4:

The Government should maintain and strengthen R&D tax concessions but also provide targeted tax concessions to encourage companies to set up operations in regional Australia, remove regulatory burdens for start-up businesses and incentivise angel investors through the tax system.

Recommendation 5:

The Government should incentivise the uptake of successful models of collaboration to entice industry to collaborate with universities including the University of Newcastle’s Newcastle Institute for Energy and Resources (NIER) and Australian Coal Industry’s Research Program (ACARP) models.

Recommendation 6:

The Government’s roadmap for long term research infrastructure should include a strong focus on regions signalled by investment in technology hubs and facilitating overseas industries to set up R&D centres in regional Australia in partnership with world class research universities.



Recommendation 7:

The Government should explore support for a range of knowledge exploitation options. Examples may include: The establishment of proof of Concept funds, accelerator programs, incubator centres, Industry Innovation Clusters and opportunities to engage International Business and Academia in best practice to facilitate opportunities for open dialogues between industry and universities.

Recommendation 8:

The Government should establish the Industry Doctoral Training Centre model more broadly across Australia by recasting the RTS block grants to support their implementation.

Recommendation 9:

There should be greater inclusion of university research and innovation leaders with relevant skills and expertise as non-executive directors on industry boards.

Recommendation 10:

The Government should introduce metrics to measure the impact of innovation in addition to commercialisation including measures aggregated over the past 2 years for which data are available:

- a. *Engagement*
 - *Advisory activity; and*
 - *Consultancy income.*
- b. *Non-Academic Collaboration in Academic Research*
 - *Number of papers with industry co-authors; and*
 - *Industry supported HDR students.*
- c. *Contract Research with non-Academic Clients*
 - *Value of contract research.*
- d. *Global Engagement*
 - *Non Australian research income from industry or government sources.*
- e. *Commercialisation (measures aggregated over the last 8 years)*
 - *Commercialisation and entrepreneurial activities including IP applications: summed provisional patent applications, registered design applications and plant breeders' rights applications*
 - *Commercialisation income.*

Recommendation 11:

The Medical Research Future Fund should include:

- a. *An end user/end use component as part of the criteria for assessment; and*
- b. *A broad remit for the use of the funds to enhance collaboration between industry and the research.*

Recommendation 12:

Universities should take a leading role in driving industry engagement and collaboration by:

- a. *Prioritising industry-university partnerships by requiring an industry collaboration component in all academic performance frameworks.*

UNIVERSITY OF NEWCASTLE SUBMISSION BOOSTING THE COMMERCIAL RETURNS FROM RESEARCH



- b. Incentivising engagement between industry and university faculty and academic staff through the internal allocation of research funding;*
- c. Ensuring that there is a systematic exchange of research ideas and personnel between universities and industry and that time away from academia does not impede promotion by including industry engagement as a factor for consideration in academic career progression processes;*
- d. Developing and support a vibrant entrepreneurial culture on campus, ensuring that PhD research qualifications are supplemented by business, entrepreneurship and scientific management skills and establishing research internship programs that provide opportunities for the transfer of students' skills from theory to real-world application;*
- e. Developing programs that support the initiation and expansion of on-campus entrepreneurship capacity, in institutions that have demonstrated and/or are willing to make strong commitments to entrepreneurship, by fostering the adoption of global best practices in student entrepreneurship; reducing barriers for student and recent graduate entrepreneurs to pursue their entrepreneurial aspirations; integrating with regional business support resources; and provide experiential learning opportunities for the next generation of innovators;*
- f. Connecting with Australian industries through collaborative research projects or funding proof-of-concept endeavours;*
- g. Evaluating results of student entrepreneurs and student-led start-up companies: number of start-up companies; number of jobs created; VC/angel invested into clients etc.*
- h. Evaluating the culture of entrepreneurial activity including number of students exposed; number of students trained; number of recent graduates starting businesses; number of workshops; webinars; networking events; and*
- i. Understanding the economic impacts including number of student and recent graduate entrepreneurs engaged; number of student and recent graduate-led start-ups engaged and created; incremental sales revenues; jobs created; follow-on investments.*

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The University of Newcastle (UON)¹ recognises that the process of innovation² 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 the *Boosting the Commercial Returns from Research* Discussion Paper (the Discussion Paper).

As part of the Government's broader reform agenda, *Industry Innovation and Competitiveness Agenda: An Action Plan for a Stronger Australia*, which is predicated on strengthening Australia's competitiveness and ensuring economic growth and prosperity, the Discussion Paper gives greater focus to supporting the translation of research into commercial outcomes as a key driver of innovation.

As a starting point, UON advocates building upon Australia's strong foundation for research excellence as a platform for growth and change. The research sector in Australia is already an internationally recognized research environment, producing in 2013, 3.85% of the world's research output from 0.3% of the world's population. Similarly, the Australian Research Council Excellence in Research for Australia National Report for 2012 noted that that in a number of disciplines³, Australian research is rated well above the world standard. Universities play a critical role in "providing high-level skills, world class research base and a culture of inquiry and innovations"⁴ and are an integral part of the supply chain to industry though "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"⁵.

UON recognises that in the context of a knowledge-based economy, the research sector cannot operate effectively in isolation; the triangulation of industry, the research sector and government is critical to a successful innovation system, especially as a mechanism for transfer of science and technology into the commercial sphere.⁶ The best innovation systems are those where new industries and opportunities are delivered through collaboration across researcher, industry and government partners. The diversity of perspectives and the particular expertise of each party combined has the potential to support new thinking and entrepreneurship. For example, studies have shown that collaboration between business and research organisations more than triples the likelihood of business productivity growth (Chubb, 2014). Each of the key stakeholder groups has an important role to play in maximising Australia's strengths and driving innovation.

¹ An overview of the University of Newcastle is set out in Appendix A.

² Innovation for the purposes of this paper is defined as the process involved in translating world-class research into products and processes with 'real world' application.

³ Chemistry, biology, the health and medical sciences and certain areas of the humanities, arts and social sciences.

⁴ Wilson, Professor Sir Tim, (2012) A Review of Business-University Collaboration

⁵ A Review of Business-University Collaboration 2012

⁶ Innovation Canada: A Call to Action – Review of Federal Support to Research and Development – Expert Panel Report



Against this backdrop, UON believes that the Government's reform agenda, if carefully applied, will be instrumental in building the right ecosystem for innovation in which research sector/industry⁷ relationships to flourish. This includes bringing together all the elements that an agile, innovative society needs including people with the right talent, training and attitudes, research excellence and appropriate incentives, investment and strategies to leverage collaboration between Australia's advanced university research capacity and industry and government. It will be important, however, to focus on prioritising market driven research and research outcomes rather than the complexities of interactions between the sectors which can vary considerably depending on regional and sociocultural factors. Focus should also be on the needs of the end-users but this should be balanced against ensuring that collaborative relationships are able to deliver outcomes more broadly to the Australian public in addition to providing benefit to industry.

Role of Government

As an overarching initial comment, UON notes that the Chief Scientist is currently preparing a set of draft research priorities to focus Australian research and align national research excellence with Australia's industrial strengths (both existing and emerging), global trends and community interests. In this regard, UON argues that emphasis should be given to ensuring:

- The research priorities and practical challenges associated with them are not narrowly construed to only those with commercial application; rather that they should also reflect the importance of engagement with industry for mutual benefit and for the benefit of society. To avoid undervaluing areas of research focus in favour of a commercial outcome, the Government's priorities for applied science and research should explicitly articulate a role for public good in addition to a focus on commercial returns.
- A balance between applied and basic research. Even though, in many cases, the potential of basic research may never be commercially realised; there are a great many examples where basic research has informed and been integral to the development of applied research, driving innovation and commercialisation; and
- Science, Technology, Engineering and Mathematic (STEM) research priorities are balanced by a concomitant focus on Humanities, Arts and Social Sciences (HASS) research disciplines. Caution should be exercised to ensure that, if commercialisation is a key new driver, 'social research' outcomes are not lost as relying much more heavily on economic outcomes risks restricting growth in the equally important areas of social development.

⁷ Industry for the purposes of this submission refers to multi-sectoral groups across the broad range of industrial sector classifications from extraction, processing, delivery and sale of goods to healthcare, community and government.



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- c. Ensure a balance between STEM and HASS research priorities and encourage an environment of integration where possible.*

As to the specific issues raised on pages 22-24 of the Discussion Paper, UON makes the following comments:

Creating Stronger Incentives for Research-Industry Collaboration

The current research funding environment generally does not provide any impetus for academics to undertake industry led work or similar engagements. It is critical, therefore, that collaboration between researchers and industry be “incentivized” to facilitate greater engagement, otherwise it will be difficult to achieve the paradigm shift recommended in the Discussion Paper. In this sense, the term incentivized is used loosely to include recognition, monetary (funding) and other benefits.

Modification of the rules for competitive grants would compel researchers to engage and work more closely with industry in the development and administration of research projects. However, this approach presupposes that for all areas of research there is an industry partner(s) to engage with, and an end-use application in reach, which is not always the case, and it may also unduly limiting the scope of research to areas with a potential for commercialisation.

The Excellence in Research for Australia which ranks according to research income, RHD load and completion and publications and upon which Research Block Grant funding is based and allocated, is a static measure of success. It does not promote the value of industry based engagement, nor does it include measures of “impact” of research and innovation by recognising contributions that better society including business improvements, economic stimulation or inventions that improves or saves lives. The effect is that universities are tied to metrics that have little tangible value for industry and in the same way, industry’s focus on commercial outcomes can ignore the need for, and value of, basic research. This approach has stifled industry/university participation and for this reason, UON welcomes the inclusion metrics that recognize partnerships and impacts to the Australian economy.

From a university perspective, however, striking a balance between current measures with those relating to industry engagement, knowledge transfer and commercialisation requires careful thought. Care should be taken to avoid an industry collaboration or impact measure that



encourages perverse behaviours for example, using solely the number of patents as a measure of commercialisation is likely to mean an increase in the number of patents rather than an increase in the commerciality or end use applications associated with those patents. Including measures that recognise the value of the collaboration such as recurring funding from industry due to successful collaboration, will be important. This might involve restoring full block funding for industry research as that occurs for competitive funding from government. However, it should also be recognised that for some research areas, the availability of industry partners with a research and development budget to invest is much more limited. For this reason, care should also be taken to avoid a one size fits all metric for industry engagement, the development of an industry engagement metric should be considered and relevant to the field of research and/or area of industry. For example, for the health sector, which includes public hospitals, primary care and other NGO, a focus solely on commercial returns might be problematic. While translational research yields some commercial returns, it also improves health outcomes and reduces waste, both of which can be economically measured and represent real returns to Australia, in terms of greater productivity from the population and cost savings to the health budget. Encouraging closer relationships with industry in this sector is welcomed but equally, sight should not be lost in relation to the critical role for health and medical research and narrowly focus policy and programs solely towards commercial returns.

Given the significant role they will ultimately play in the allocation of government funding, regardless of the industry engagement metrics identified, the Government should ensure that the system does not lurch from one limiting measure to another. Metrics should be seen as enablers for genuine collaboration and a trial or phasing-in period will help to determine whether the metric(s) is relevant and operates in practice in the way it was intended.

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- a. The modification of the rules for competitive grants to support researchers to engage and work more closely with industry in the development and administration of research projects, recognising that this may not be feasible for all fields of research;*
- b. The introduction of industry engagement metrics as part of Excellence in Innovation for Australia around industry partnerships, for example, recurrent funding from industry, with a phasing in period to test its relevance and practical applications before it affects funding.*

Another option would be reconfiguring the metrics upon which Research Block Grants (RBG) are based. Currently the Government incentivises universities through their engagement in Category 1 research (national competitive grants schemes); more so than their engagement in Category 3 industry-related research. For example, there is no proportional weighting for



Category 3 income in the metrics for RBGs; all income contributes without any loading. In the case of Joint Research Engagement (JRE), consideration should be given to Category 3 income comprising a higher proportion (say 50%) of the total percentage for income. Increasing the weighting given to industry collaboration would provide impetus for the research sector to pursue greater collaboration with industry. Similarly, including Category 3 income in the income threshold for Research Training Scheme (RTS) would provide further impetus for university/industry collaboration.

Similarly, incentives that support entrepreneurial activity, and investment in building 'critical mass' in research assets and the onward translation of research, are critical. Without the existing R&D tax concession or matching funding through ARC Linkage Projects, there is no incentive for industry to seek research support from universities. It does, however, require the industry partner to have a clear idea about what R&D they might require, which in any event may still be pursued internally. The challenge is when the industry partner does not understand how R&D may assist their business or what capacity there is the research sector to improve their products or services. UON also recommends that focus be given to targeted tax breaks for companies setting up in regional Australia, the removal of regulatory burdens for start-up businesses and incentivizing angel investors through the tax system.

Recommendation 3:

The Government should increase the proportional weighting for industry income in the metrics for the Research Block Grants, for example, for both RTS and JRE, Category 3 funding (Industry and other) should have higher proportional weighting than Category 2 and 4 funding, and for SRE, Category 3 income should be included in the income threshold.

Recommendation 4:

The Government should maintain and strengthen R&D tax concessions but also provide targeted tax concessions to encourage companies to set up operations in regional Australia, remove regulatory burdens for start-up businesses and incentivise angel investors through the tax system.

In addition to R&D incentives, fresh programs are needed to entice industry to collaborate with universities. 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, for example as part of the Industry Growth Initiative.



UON's Hunter Medical Research Institute is another successfully model for collaboration between research, government, industry and community, upon which other institutes have been modelled. HMRI is notable for its success in the area of translational health and improved health outcomes for patients and the wider community, which has generated considerable ongoing philanthropic support.

However, successful industry/research sector collaboration does not necessarily require a Government driver, for example, the Australian Coal Industry's Research Program (ACARP) is highly successful mining research program which is funded by Australian black coal producers through a five cents per tonne levy paid on saleable coal. ACARP combines resources and expertise from individual producers and shares the risks and benefits across the industry, highlighting what can be achieved by pooling research funds with the benefit of considerable leverage of R&D expenditures to address wider industry problems.

UON believes that the model is transferrable to other settings. It sets out a clearly understood levy based on market share, led by all industry players above a certain threshold for mutual benefit. The leverage for industry is that if it manages its own fund, and if it does not agree to continue, it will be regulated by Government, who will then determine the priorities. Industry agrees to and commits in kind in-kind support and can claim an R&D tax return based on their pro-rata input. In addition, there must be a commercialisation pathway to deliver back to the whole sector on a royalty-free basis.

The benefits include: there is an annual round of research regardless of the state of the economy; all projects are judged on their end game which provide a long term commitment to developing and funding a research proposal. If a proposal reaches success at pilot scale, a means is found to support the full scale commercialisation, with 50% from government. Researchers can come from a variety of sources and there is no restriction on leveraging other government schemes.

Recommendation 5:

The Government should incentivise the uptake of successful models of collaboration to entice industry to collaborate with universities including the University of Newcastle's Newcastle Institute for Energy and Resources (NIER) and Australian Coal Industry's Research Program (ACARP) models.

Supporting Research Infrastructure

Universities provide a platform for innovation based economic growth at more localised level drawing upon the local interface that already exists between government, industry, business and education which could be used to drive research, innovation and change, building on existing strengths, expertise and partnerships. The capacity to draw on this local expertise and the

UNIVERSITY OF NEWCASTLE SUBMISSION BOOSTING THE COMMERCIAL RETURNS FROM RESEARCH



strength of these collaborative relationships to translate research to productive end use applications, be it economic, social, environmental or health, is enormous.

This is particularly important as Australia struggles with the conversion of research and innovation capability into outputs. Focus on region economic growth can provide an appropriate mechanism to address this deficit through localised networks of innovators, regional clusters, and research-intensive universities.

Looking to international successes, the Waterloo region, or 'Canada's Technology Triangle', exemplifies a university-led innovation hub in which the University of Waterloo works closely with the local region in developing a strong culture of entrepreneurship and innovation embedded in the community. As the University of Waterloo was building its regional networks, it was simultaneously expanding its global research partnership networks, enhancing its global reputation and attracting the best global talent to the region to work on ground-breaking research and innovation, all in partnership with local, national and international business regions. Within 10 years, a regional economic engine of \$30 billion has developed. In addition, strong angel and venture capital funds have been established in the region which create a sustainable ecosystem of research-driven innovation and innovation-driven business (SME's to multinationals such as BlackBerry and OpenText) that is recognised globally, but more importantly has greatest benefit regionally.

The outcomes of the Waterloo regional innovation system include:

- 531 new companies started in the last 3 years in the region.
- Waterloo has the 2nd best performing economy in Canada.
- 631 patents granted per million people, which is 3 times the national average.

Waterloo illustrates the possibilities of utilising innovation as a catalyst for significant economic and social returns. 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.

Employment in the region has grown by five per cent since 2011, and is forecast to exceed provincial growth in 2015. The University's community-based research and technology park, David Johnston Research + Technology Park, is supported by a comprehensive partnership among 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 how planned investment in a localised innovation system can deliver a transformed economy and greater opportunity.

In Pittsburgh, a collaboration between the city’s research and innovation assets, including its two universities, alongside industry and government, delivered a long-term, sustainable renewal for Pittsburgh and its region. New innovation nodes, such as the Centre for Robotics founded in 1979, were established to deliver real world, real time solutions to complex industrial and social problems. Today, the Robotics Institute employs over 500 scientists who work across the health, defence and commercial sectors. Several spin-out companies have been formed to commercialise the output of the Institute. By the mid-2000s, Pittsburgh’s success was nationally recognised and its outcomes have been dramatic: its economy is growing at the rate of 4.6 per cent annually, against a national average of 2.5 per cent for US metropolitan economies – “and it is Pittsburgh’s new economy, not its old economy that is driving much of this growth.”

UON believes that it is important that the roadmap for long term research infrastructure referred to in the Discussion Paper, include a strong focus on regions (and not just region that are capital cities) as “the critical nexus for innovation based economic growth”.⁸ This will 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.

Focusing on investment in setting technology hubs and attracting overseas industries to set up their R&D centres in Australia, will better position Australia to address global challenges in existing and future growth industries.

Recommendation 6:

The Government’s roadmap for long term research infrastructure should include a strong focus on regions signalled by investment in technology hubs and facilitating overseas industries to set up R&D centres in regional Australia in partnership with world class research universities.

Providing Better Access to Research

UON has contributed to the consultation on the draft IP toolkit, but in and of itself, it is not the solution. It will be more important to facilitate opportunities that encourage open dialogue and educate both parties on the benefits of open innovation and dispel the strongly held views that

⁸ Council on Competitiveness - Measuring Regional Innovation: A Guidebook for Conducting Regional Innovation Assessments



IP blocks research activity and ability to publish. Additionally, other vehicles of knowledge exploitation must be used in order to provide diverse avenues for economic stimulation.

The research sector needs to better understand the drivers of business within their sector or field of expertise. Building an enormous patent portfolio and locking away publicly funded inventions does not lead to commercial outcomes. The opportunity to either provide open access to these opportunities or, at a minimum, display an open register of protected knowledge should be explored to the fullest extent.

Recommendation 7:

The Government should explore support for a range of knowledge exploitation options. Examples may include: The establishment of proof of Concept funds, accelerator programs, incubator centres, Industry Innovation Clusters and opportunities to engage International Business and Academia in best practice to facilitate opportunities for open dialogues between industry and universities.

Increasing Industry Relevant Research Training

While it is noted that research training arrangements will be the subject of a separate review, UON notes that, as outlined above, universities, particularly at the post-graduate level, need to ensure that students have the opportunity to engage in research while at the same time providing experiential learning opportunities with industry. The United Kingdom’s Industry Doctoral Training Centres, which deliver a four-year doctoral training programme targeting a specific area of research. Their success comes from providing:

- A PhD program that includes a strong research component;
- High quality training including the building of transferable skills relevant to employment post degree;
- A supportive environment and cohort allowing personal growth and professional development;
- Challenging programs with considerable industry exposure and engagement.

Establishing the Industry Doctoral Training Centre model more broadly across Australia would produce graduates with much closer ties to, and understanding of, industry needs. This would provide a strong foundation for university/industry collaboration if leveraged by Government investment, for example by recasting the RTS block grants to support the implementation of the Centres.

Another way that industry training can be incorporated at the undergraduate level is through Work-Integrated Learning (WIL), a curriculum innovation that gives students the opportunity to integrate theoretical knowledge with practice through engagement between universities, industry, and communities. WIL supports deepening relationships between universities and



external stakeholders that bring educational benefits and expanded job opportunities for students, enhanced outcomes for employers, and opportunities for research partnerships.

The University of Newcastle's WIL program now includes ninety percent of programs so students of all disciplines have an opportunity to take part in work integrated learning, industry-based scholarships, and innovative programs around leadership, service learning, volunteering and mentoring. The University sends nursing, allied health, and medical students to developing countries as well as local healthcare settings; arts and humanities students engage in curatorial and communication activities with local and international partners; business students gain experience working with partners in China as well as major regional industries including the Port Corporation; and engineering and architecture students engage with agencies such as Hunter Water, developing breakthrough technologies and in one case, saving the company \$140,000 per year.

It is important to recognise that an SME with less than 20 staff is not looking for a PhD student but in most cases it is only looking to employ its first graduate. In this sense, the real challenge is not universities sponsoring industry experienced PhD candidates to drive improved research engagement but investing in undergraduate cadetships to assist SMEs to build capacity to engage with the higher level research capabilities of a University. This requires effective engagement is in the translation of problems and solutions between the parties but is this capability better to be embedded with the business activity rather than universities.

Another initiative that has been successful at UON has been a collaboration between Newcastle Innovation with the Medical Research Commercialisation fund which involves Newcastle Innovation Business Development staff undertaking annual work placements with the Fund manager (Venture Capital Firm), the learning of which are shared with all academic colleagues.

Finally, reciprocal arrangements that see non-executive directors from a local university sitting on industry boards akin to the current arrangements where industry executives sit on university boards. This arrangement would provide a better understanding of industrial problems and data and at the same time it will expose the university representative to management in industry which can be translated to more significant industry and University partnerships.

Recommendation 8:

The Government should establish the Industry Doctoral Training Centre model more broadly across Australia by recasting the RTS block grants to support their implementation.



Recommendation 9:

There should be greater inclusion of university research and innovation leaders with relevant skills and expertise as non-executive directors on industry boards.

Measurement of Outcomes

An industry relevant measure is important to identify the impact of research sector/industry collaboration. Other jurisdictions across the world have explored how to effectively measure innovation and there is a considerable body of knowledge. For example, in Ontario Canada, the Ministry of Research and Innovation developed an “Ontario Innovation Scorecard.” This report will include important conventional innovation metrics, such as dollars invested, publications, patents, licences, start-up companies, highly qualified people trained and venture capital investment. It will also focus on measuring investment impacts including, for example, wealth created per person and distribution of prosperity, the global share of knowledge-based firms, firm births and deaths, investment, and public support for innovation, education, immigration and the trade balance for knowledge-based firms.

Possible measures for assessing the impact of innovation (more broadly than just commercialisation) include:

- **Engagement** (aggregated over the past 2 years for which data are available)
 - Advisory activity; and
 - Consultancy income.
- **Non-Academic Collaboration in Academic Research**
 - Number of papers with industry co-authors; and
 - Industry supported HDR students.
- **Contract Research with non-Academic Clients**
 - Value of contract research.
- **Global Engagement**
 - Non Australian research income from industry or government sources.
- **Commercialisation** (measures aggregated over the last 8 years)
 - Commercialisation and entrepreneurial activities including IP applications: summed provisional patent applications, registered design applications and plant breeders’ rights applications; and
 - Commercialisation income.

Most importantly, universities need to be able to demonstrate an active role in facilitating economic growth not just commercialising intellectual property. Focus, therefore, should be on measuring outcomes that reflect factors critical to industry competitiveness.



Through Newcastle Innovation, UON has participated in the National Survey for Research Commercialisation (NSRC) since its inception and a number of UON discoveries and commercialised technologies have been feature in the summary of survey outcomes over the years including Hunter Immunology, Viralytics and Mobilife.

While the NSRC is one of the only measures of knowledge transfer and commercialisation performance, it does not measure the impact, engagement or research outcomes of universities. UON notes that NSRC is currently under review and consideration should be given to:

- Aligning the survey with emerging research commercialisation policy and performance measurement trends in Australia and overseas;
- Streamlining the survey to achieve improved accessibility and reduce administrative burden; and
- Improving data integrity and usability through changed survey design and collection methods.

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Capitalising on the Medical Research Future Fund

UON welcomes the Government's investment in medical research but suggests that an end user/end use application component will be important in helping to translate research findings into benefits for Australians and Australian health care generally.



A model to consider is the NSW Medical Devices Fund which encourages and supports investment in the development and commercialisation of medical devices and related technologies. It does this by through providing support in taking local innovation to market and increasing the uptake of NSW medical devices by the health system where they are cost effective and contribute to improved patient outcomes. Support is provided to individuals, companies, public and private hospitals, medical research institutes, universities, other public sector research organisations and the medical devices industry.

The focus is on the potential end use for the device and has been an important mechanism in industry and researchers in bridging the valley of death.

Additionally, in terms of the process through which the funds will be administered, UON recommends a broad remit to enable the funds to be freely accessed for the purpose of enhancing collaboration between industry and the research. Allowing the fund to be managed by a venture capital or private equity firm risks imposing rules that discourage open innovation and perpetuation of a conservative investment approach. UON recommends that consideration be given to using it along the lines of a proof-of-concept fund or gap funding model.

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- b. *A broad remit for the use of the funds to enhance collaboration between industry and the research.*

The Role of Universities

Partnerships between industry and universities can accelerate innovation and help deliver solutions to pressing economic and social challenges; however, this requires rethinking what it means to be a research university and expanding the notion of a centre of research excellence to one that includes industry engagement and collaboration. Universities must take a strong leadership role in facilitating the innovation agenda, building an internal culture that incentivises industry collaboration, quite separately from any industry leveraged collaboration, and changing the way academics perceive and engage in industry collaboration. This can be achieved by:

- a. High level commitment to making industry-university partnerships a strategic priority and ensuring that the goals and benefits of partnering are clear to the entire institution. Requiring an industry collaboration component in all academic performance frameworks (relevant to the field of research) would signal this commitment.
- b. Incentivising engagement between industry and university faculty and academic staff through the internal allocation of research funding, for example, funding unique training opportunities



for graduate students and postdoctoral fellows in the form of applied, industrial research projects. The only caveat is that this should not be at the expense of basic research.

- c. Ensuring that there is a systematic exchange of research ideas and personnel between universities and industry and that time away from academia does not impede promotion by including industry engagement as a factor for consideration in academic career progression processes.
- d. Developing a vibrant entrepreneurial culture on campus, ensuring that courses reflect post-study opportunities, providing business and entrepreneurial training for graduate students and post-doctoral fellows.
- e. Providing a foundation of cutting-edge research, business, entrepreneurship and scientific management skills for newly awarded PhDs and establishing research internship programs that provide graduate students and postdoctoral fellows with the opportunity to transfer their skills from theory to real-world application. Differentiating Australia's value proposition in this sense will help to retain and recruit the top national and international undergraduate students by connect academic study with valuable work skills at the same time as giving industry access to a highly qualified uniquely trained pool of talent, international networks and linkages.
- f. Developing programs that support the initiation and expansion of on-campus entrepreneurship capacity, in institutions that have demonstrated and/or are willing to make strong commitments to entrepreneurship, by fostering the adoption of global best practices in student entrepreneurship; reducing barriers for student and recent graduate entrepreneurs to pursue their entrepreneurial aspirations; integrating with regional business support resources; and provide experiential learning opportunities for the next generation of innovators.
- g. Exploring new ways to connect with Australian industries through collaborative research projects or funding proof-of-concept endeavours to provide seed money and expert mentoring for new businesses based on university technologies in addition to entrepreneurship education at universities to educate students and university researchers. In addition, greater focus should be placed on creating a fertile environment for spin-off companies and existing SMEs.
- h. Evaluating results of student entrepreneurs and student-led start-up companies: number of start-up companies; number of jobs created; VC/angel invested into clients etc.
- i. Evaluating the culture of entrepreneurial activity including number of students exposed; number of students trained; number of recent graduates starting businesses; number of workshops; webinars; networking events; and

- j. Understanding the economic impacts including number of student and recent graduate entrepreneurs engaged; number of student and recent graduate-led start-ups engaged and created; incremental sales revenues; jobs created; follow-on investments.

Recommendation 12:

Universities should take a leading role in driving industry engagement and collaboration by:

- a. Prioritising industry-university partnerships by requiring an industry collaboration component in all academic performance frameworks.*
- b. Incentivising engagement between industry and university faculty and academic staff through the internal allocation of research funding;*
- c. Ensuring that there is a systematic exchange of research ideas and personnel between universities and industry and that time away from academia does not impede promotion by including industry engagement as a factor for consideration in academic career progression processes;*
- d. Developing and support a vibrant entrepreneurial culture on campus, ensuring that PhD research qualifications are supplemented by business, entrepreneurship and scientific management skills and establishing research internship programs that provide opportunities for the transfer of students' skills from theory to real-world application;*
- e. Developing programs that support the initiation and expansion of on-campus entrepreneurship capacity, in institutions that have demonstrated and/or are willing to make strong commitments to entrepreneurship, by fostering the adoption of global best practices in student entrepreneurship; reducing barriers for student and recent graduate entrepreneurs to pursue their entrepreneurial aspirations; integrating with regional business support resources; and provide experiential learning opportunities for the next generation of innovators;*
- f. Connecting with Australian industries through collaborative research projects or funding proof-of-concept endeavours;*
- g. Evaluating results of student entrepreneurs and student-led start-up companies: number of start-up companies; number of jobs created; VC/angel invested into clients etc.*
- h. Evaluating the culture of entrepreneurial activity including number of students exposed; number of students trained; number of recent graduates starting businesses; number of workshops; webinars; networking events; and*
- i. Understanding the economic impacts including number of student and recent graduate entrepreneurs engaged; number of student and recent graduate-led start-ups engaged and created; incremental sales revenues; jobs created; follow-on investments.*



APPENDIX A - ABOUT THE UNIVERSITY OF NEWCASTLE

The University of Newcastle, which ranked as the number one young university in Australia in the Times Higher Education Top 100 Under 50 Years Old 2014, is one of Australia's most research-intensive universities. Ninety per cent of the University's research is ranked as being of world-standard or better, and the University ranked 7th in Australia for the amount of world-class research undertaken. Key research capabilities include:

- Two internationally recognized flagship institutes: the Hunter Medical Research Institute (HMRI) and the Newcastle Institute for Energy and Resources (NIER) which have flourished in a culture of transformative research connected to industry, business and government. HMRI serves as a regional research hub, bringing together researchers, clinicians and industry. This collaborative model facilitates a two-way knowledge exchange between clinicians and researchers and is consistent with national and international trends towards health research hubs. NIER engages with major international, government and industry partners and links them with researchers across the social sciences, health, and engineering and science disciplines to deliver multidisciplinary projects which address the energy reform agenda. NIER has attracted over \$48 million in research contract funding in the past.
- Fifteen Priority Research Centres bring together research groups and world leaders in diverse fields ranging across health and medicine, education, science and mathematics and engineering.
- Five thematic based clusters provide a mechanism to drive regional development where researchers partner with industry, business, all three levels of government and the community to provide multidisciplinary solutions to complex problems. These cross-disciplinary hubs and clusters use a variety of unique forums for information sharing and for driving new knowledge and pull together expertise from a range of diverse fields to solve issues facing a particular industry sector. The Clusters include: Food; Defence; Global eHealth; Creative Industries; and the Aboriginal and Torres Strait Islander Research Cluster (ATSIRC). The Defence Cluster network facilitated UON's successful application to join the Australian Military Aligned Rapid Prototype Development and Evaluation Program. Members of the Food Innovation Cluster were instrumental in the University securing membership of the Commonwealth Government's Food Industry Innovation Precinct and subsequently being awarded in excess of \$2 million to establish an Industry Transformation Research Training Centre in 2013.
- The University is also a leading partner of business and industry in the area, encouraging through innovation the translation of research into 'real world' solutions, which has resulted in significant economic benefit locally and internationally:
 - The Jameson Cell is arguably the most valuable Australian invention of the past twenty years. Discovered and developed by UON Laureate Professor Graeme Jameson, the



Jameson Cell is a radical device for the separation of valuable particles from unwanted waste using the froth flotation process, which is widely used to separate valuable minerals from host rock. It contributes billions of dollars a year to Australia's export income, and for the period 1990-2011, the cumulative total value of export coal recovered by the Jameson Cell in NSW and Queensland was AU\$22.1 billion. In 2011 alone it was AU\$4.3 billion.

- The award-winning Reflux Classifier technology, developed by UON Professor Kevin Galvin in collaboration with commercial partner Ludowici, is an industrial machine that separates fine particles from water using a system of inclined channels to recover valuable material, generating both environmental and cost benefits. This technology is now being used worldwide, particularly in separating the low density metallurgical coal from the higher density coal, thus achieving a very high grade product. The role of the Reflux Classifier was noted as one of the factors governing the strong appeal of the company for corporate takeover, when the capitalisation of Ludowici increased from \$100M to \$350M, almost overnight.
- GRANEX™ was invented in 2006 by Professor Moghtaderi and Dr Doroodchi of the Faculty of Engineering and Built Environment and was subsequently patented and developed into a commercial product in partnership with Granite Power Limited and Newcastle Innovation Limited, the commercial arm of the University of Newcastle. GRANEX™ is a novel heat engine that generates emission free electricity from low-medium temperature heat sources. It can be deployed in various industrial, transportation and commercial applications as well as geothermal and solar-thermal settings. GRANEX™ delivers higher thermal efficiencies than conventional power plants and increases the amount of electricity that can be generated from low grade heat sources including industrial waste heat. GRANEX™ delivers reduced power generation costs (\$60-\$80 per MWhr), green (social/environmental) benefits, avoids exposure to energy price increases and carbon pricing, and leads to no additional fuel or water consumption.
- The Central Coast and UON Food Innovation Cluster has led to a new relationship with Coca Cola Amatil (Australia), Sanitarium Health & Wellbeing Company, Sunrice and Batlow Fruit Co-operative Limited to form an ARC Training Centre in for Food and Beverage Supply Chain Optimisation. This collaboration is focused on ensuring safe, sustainable, and cost-effective, food supply chains which will be essential for Australia's agriculture and food-related exports to increase.
- The UON administered Phase II drug trial of Tenecteplase, which explored the effectiveness of clot-busting drug Tenecteplase, more commonly used for heart attacks, as an alternative to conventional stroke treatments, has been successful in delivering rapid treatment benefits for stroke victims. Results from the Phase II trial conducted by HNELHD researchers



in the HMRI Stroke Research Program between 2008-2011 found two-thirds of patients treated with Tenecteplase showed major neurological improvement within a day, compared with 36 per cent for those administered Alteplase. This has improved recovery times and reduced the length of stays in hospital with a consequential reduction in health care costs.

- The Priority Research Centre for Asthma and Respiratory Diseases’ work in tackling two major chronic respiratory diseases in Australia, asthma and Chronic Obstructive Pulmonary Disease, which are a significant health and economic burden to the community. The Australian Government is expected to save millions of dollars annually due to changes in the prescribing of inhaled corticosteroids based on a review by researchers within the Centre.