INDUSTRY RESEARCH COLLABORATION

Discussion Paper

Thinking business

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FOREWORD

With investment shifting away from the mining and resources sector, a strong dollar and relatively high business costs, Australia is facing a serious productivity challenge. This challenge has put significant pressure on Australian businesses. A strong and sustained focus on microeconomic reform, and accelerating the move to producing higher value products and services, is vital in putting the Australian economy on a stronger footing.

The knowledge created by our research institutions provides significant opportunities to increase the value-add of products and services delivered by the Australian economy. An obvious area for accelerated action is to improve the frequency and effectiveness of collaboration between businesses and researchers, ensuring strong commercial outcomes from such endeavours.

As demonstrated in other jurisdictions, a powerful driver for productivity growth is innovation through collaborative research and development (R&D). North America is the prime example of the success of collaborative R&D; where trillions of dollars in wealth has been created on the back of collaborative R&D, including the establishment of global brands such as Google and Hewlett-Packard.

Australia has a clear competitive advantage in the production of research, both in terms of spend and quality. Australia spends approximately $30 billion annually on R&D across all sectors, and is ranked 11th in the world by the 2013 Global Innovation Index for innovation inputs (acknowledging Australia's excellence in terms of publications and percentage of GDP spent on R&D). However, when it comes to our efficiency in converting research dollars into innovation and commercial success, we perform poorly – ranking 116th out of 142 countries.

As a part of our Thinking Business: Industry-Research Collaboration Project, the Sydney Business Chamber and the NSW Business Chamber (the 'Chambers') have identified practical solutions to improve the conversion of Australia's considerable research expertise into commercial success. This paper provides a road map for government, industry and the research sector to improve the effectiveness and frequency of industry-led collaborative research, harnessing Australia's considerable research expertise to find innovative solutions for industry problems.

The priority of the paper is to boost the frequency and effectiveness of collaboration that is driven by the business community for a commercial purpose.

The Chambers wish to thank PricewaterhouseCoopers ('PwC') for the preparation of the paper, as well as contributors from over 60 organisations who provided valuable feedback and insights on this important topic. The Chambers also acknowledge the efforts of the NSW Department of Trade and Investment in working on the preliminary roundtable and continuing stakeholder engagement process, and its commitment to assist in implementing some of this paper's recommendations. However, overall responsibility for the recommendations in this paper rests with the Chambers.

The Chambers look forward to working with key people in industry, the research sector and government, to implement the recommendations from this paper.

Honourable Patricia Forsythe
Executive Director of the Sydney Business Chamber

Mr Stephen Cartwright
CEO of the NSW Business Chamber

EXECUTIVE SUMMARY

Many Australians are grappling with the question: what will drive growth in our economy after the end of the resource investment boom? The answer is innovation that enables industry to produce higher value product/service combinations than is currently the case. Moving higher up the value-added curve is an imperative for all businesses and is especially evident in knowledge intensive industries such as biotechnology, technology and health. The key enabler to drive innovation is collaboration, with 92% of Australian business leaders believing their firm would be more successful at innovation through partnership and collaboration than if they went about it alone (General Electric, 2013).

However, we are lagging behind our peers globally and are not considered a leader of innovation. Our efficiency in converting research dollars into innovations is poor, with Australia ranked 116th out of 142 countries for innovation efficiency.

Furthermore, Australia is ranked last out of 33 countries in the OECD for collaboration (OECD, 2013). To achieve collaboration levels in line with the average of the top five OECD countries, Australia would need to obtain a fivefold improvement in industry-research collaboration with small and medium sized enterprises (SMEs) and a sixteen fold increase with large firms. Without change we will continue to lag behind our global peers on innovation.

To help identify solutions to improve the conversion of Australia's considerable research expertise into commercial success, the Chambers commissioned PwC to develop a roadmap to improve the effectiveness and frequency of industry-led collaborative innovation. The solutions included in the roadmap were co-developed with more than 100 stakeholders across industry, research and government.

Innovation can help build a productive, sustainable economy for Australia

80%

More than 80% of Australian business leaders believe innovation is the main driver for creating a competitive economy and the best way to improve the country's productivity.

78%

Innovative Australian businesses are 78% more likely to report increases in productivity over the previous year compared to businesses that don't innovate.

The key imperative to drive innovation is collaboration

242%

Australian businesses that engage in collaborative innovation with research organisations are 242% more likely to report increases in productivity, compared with non-innovating businesses; this is a threefold increase in the likelihood of productivity growth from collaboration.

70%

Businesses which engage in collaboration are 70% more likely to develop products that are new to the world.

Western Sydney has a unique opportunity to harness the benefits of collaborative innovation to help address the critical job deficit facing the region.

There are four key enablers that are required to develop the foundations for successful industry-research collaborations

1 The ability to recognise and apply external knowledge

2 Shared purpose

3 Mutual trust

4 Strong leadership

To improve Australia's collaboration performance, we must address a number of structural challenges and cultural differences

Structural

- There are a small number of researchers working in business enterprises, which creates translation problems. Knowledge when created by research organisations is rarely in a form or format that can immediately be adopted and applied in a commercial situation.
- SMEs do not possess the same level of resources as large firms and as a result are not often geared up for innovation. Without the right internal capabilities, SMEs can experience difficulties understanding what the right problems are to solve, how research organisations can help to solve their problems and what to expect when engaging with research organisations.
- Australia has a large area of landmass, but low population density – leading to proximity challenges for companies seeking to collaborate with the best and brightest researchers in the country. This creates substantial search costs, including time, labour and the opportunity cost of delaying research.
- There is fragmentation and instability of government programs that support innovation within Australia. With more than 220 programs supporting innovation across State and Federal Governments, it is reasonable to expect that many businesses, especially SMEs, are unaware of the assistance available for innovation.

Cultural

- The reward systems inside universities are not set up for commercial activity, which can hamper industry-research collaboration. Researchers are limited by the excellence in research framework, which defines impact primarily in terms of academic publications.
- Competitive neutrality provisions can limit opportunities for collaboration, as there are parameters around how much can be charged for research services. Prices can be perceived by companies as too prohibitive, particularly if the benefits are not well understood.
- Academics, particularly early career researchers, have high demands on their time. As such, researchers find it hard to manage industry partnerships on top of their existing workloads.
- A common complaint of industry is that researchers lack business exposure and an appreciation of commercial imperatives. Equally, researchers point to a lack of understanding by industry about how to effectively engage with them.
- Industry timeframes are driven by economic and product cycles, while academic research project durations depend largely on the time required for graduate degree programs and publications.
- Intellectual property agreements can vary substantially across research organisations, increasing complexity for those companies seeking to collaborate.

To address the barriers to effective collaboration, we have developed six practical recommendations:

1 Establishing good practice forums on corporate engagement and commercialisation (see page 30)

The forums will be a series of events, which share best practice solutions for overcoming many of the challenges associated with corporate engagement and commercialisation of research. The purpose of the forums are to provide a practical way for companies and researchers to share their own specific experiences – both successful and unsuccessful. This could help create an internal knowledge base to improve the effectiveness of industry-research collaborations.

2 General guidelines for engaging with companies and researchers (see page 32)

The guidelines will aim to help companies and researchers prepare for industry-research collaboration, and will include a standardised intellectual property agreement for short-term engagements. The purpose of the guidelines are to outline answers to central questions that face companies and researchers aiming to achieve healthy, productive collaborations.

3 SME capability development workshops (see page 36)

A series of workshops designed to help build capability in motivated SME organisations to better prepare them for innovation and collaboration with research organisations. The purpose of the workshops are to break down the barriers to participation by addressing research constraints and lack of absorptive capacity.

4 Work integrated learning forums (see page 38)

This will be a series of forums that engages with companies to provide input into university curriculums. The purpose of the forums are to increase exposure of students and researchers to real life company problems and culture to reduce translation gaps.

5 Creation of a marketplace for research expertise (see page 40)

Development of a marketplace to bring willing buyers and sellers of research closer together. The marketplace will become a central point for problem owners and problem solvers to commence the search process. It is proposed to include a combination of an online platform and an intermediary service to contextualise requests for expertise. The purpose of the marketplace is to address the match-making challenge.

6 Government reform (see page 42)

Reform should be directed towards achieving an innovation system that is effective in promoting commercialisation outcomes to drive productivity improvements, economic growth and job creation in Australia. Terms of reference for government reform could include:

- Initiatives to incentivise and promote collaboration between research organisations and industry.
- Review of government procurement policies to encourage and reward local, collaborative innovation.
- Review of the neutrality provisions within the context of how much research organisations can charge for commercial services.
- Investigate opportunities to improve access to government funded innovation programs and to improve information sharing between government departments.
- Investigate oppurtunities to consolidate government innovation programs to reduce fragmentation, duplication and complexity, while providing improved stability.
- Investigate opportunities to encourage more motivated SMEs to collaborate with research organisations.
- Initiatives to encourage more mobility between companies and research organisations.
- Initiatives to address declining rates of STEM related course completion.

BY ACTING NOW, WE CAN HELP TO IMPROVE AUSTRALIA'S INNOVATION PERFORMANCE AND FUTURE PROSPERITY

"And if we are to prosper, if Australia is to be successful in transforming to a new economy that can meet the challenges of the 21st century, then research and innovation needs to be at the very heart of Australia's economic, industry, social, national security and foreign policy" – *Australia's Chief Scientist*

Harnessing our innovation potential is vital if Australia is to build on its current advantages and sustain prosperity in the future. Innovation allows us to increase our competitiveness, create high quality jobs and achieve greater value for what we make and export. To harness our innovation potential, it is of fundamental importance that we address the most significant flaw in Australia's innovation system – collaboration.

Despite the motivations and desire of both companies and researchers to engage in more substantial levels of collaboration, this has not translated into action. To drive action, we need to change the culture of how we as Australian's undertake innovation. This will require a coordinated and integrated approach involving multiple stakeholder groups. Only a clear vision with a feasible roadmap and commitment from all stakeholders will ensure success.

To that end, we believe that the roadmap outlined in this paper sets the challenge to companies, researchers and government organisations to commit to action. We believe that by implementing the recommendations outlined in this paper, it could help drive the momentum required to change embedded behaviours. The collective impact of these recommendations will be increased when all solutions are combined together.

The Chambers plan to work with identified stakeholder groups (including sponsors) to facilitate the development and roll-out of the proposed pilot programs outlined in this paper.

Alister Berkeley
Principal
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INTRODUCTION

"Research is the transformation of money into knowledge. Innovation is the transformation of knowledge into money"
Dr. Geoffrey Nicholson (Inventor of the Post-it note)

1.1 Reinvigorating the Australian economy

Much of Australia's prosperity over the last decade has been derived from its natural resources. At the same time, the strong economic growth during the resources boom has created structural challenges for Australian businesses that have left many of them at a comparative disadvantage in the global economy.

Our relatively strong currency, high labour costs and rising energy prices have contributed to Australia having one of the highest manufacturing cost structures in the world – around 30 percent higher than the U.S. (BCG, 2014). Furthermore, the manufacturing sectors contribution to GDP has almost halved between 1980 and 2013[1] (CEDA, 2014).

To remain globally competitive, Australia can no longer focus on high volume, low value production. The future lies in advanced, high-end manufacturing where Australia has a competitive advantage[2]. This transition will require a stronger focus on knowledge intensive innovation.

META, a national industry-led organisation has been formed to reinject life back into Australia's manufacturing sectors. They have recruited 300 manufacturers, researchers and partners who have committed their professional expertise to build a prosperous future for Australia manufacturing.

This is one approach that is being taken to reinvigorate manufacturing in Australia and support the transition to more advanced production.

Internationally advanced manufacturing has improved the competitiveness of Western economies against low-cost competitors. This is driving a manufacturing renaissance in countries such as Germany and the USA.

Further growth opportunities are emerging in knowledge based industries such as biotech, technology and health. Australia is well positioned to export its capabilities in these industries and create new jobs to replace those in declining sectors.

The latest Scientific American, Worldview Scorecard 2013 ranked Australia number seven in biotechnology in the world[3] (AusBiotech, 2014). Furthermore, Australia has established global pre-eminence in medical and health sciences research, with 95% of work in this area at or above world standard (Department of Innovation, Industry, Science and Research, 2013).

1.2 Driving productivity growth through innovation

To create productivity growth in Australia and drive prosperity, we need to commercialise more of our research through innovation and collaboration. This will be the driver for new job

1 This has gone from 13.2% (1980) to 6.8% (2013).

2 Advanced manufacturing includes the full suite of activities from concept, research and development (R&D) and design stages, all the way through to post sales service. It is all about adding value to the production line and is very much about securing a place in the global value chain (CEDA, 2014).

3 This was up from number ten in 2012.

creation, enabling residents of Australia to improve their standard of living.

Innovation is recognised worldwide as a key contributor to productivity improvement and economic prosperity. More than 80 percent of Australian business leaders believe innovation is the main driver to creating a competitive economy and the best way to improve our country's productivity (General Electric, 2013).

Moreover, innovative Australian businesses are 78% more likely to report increases in productivity over the previous year compared to businesses that don't innovate (Department of Innovation, Industry, Science and Research, 2013).

As a result of this strong link between innovation and growth, many governments are committing resources to innovation. For example, Singapore has earmarked $500 million in investment and development in 3D printing and robotics over the next five years (Shan, 2013).

1.3 Emphasising collaboration and sharing

One of the greatest challenges facing companies and their leadership today is the range and depth of innovation required to drive both top and bottom line growth.

With product cycles shortening and the competitive landscape becoming more intense through globalisation, it is becoming increasingly difficult for individual businesses to achieve excellence across a wide range of disciplines. As a result, there is an increasing shift from proprietary models of knowledge creation to an open source model that emphasises collaboration and sharing[4].

P&G for example develops more than 50% of its new products through external collaboration (P&G, 2014). Merck & Co have also emphasised the importance of collaboration to their business, noting that by producing only 1% of the global biomedical research, they must actively reach out to research organisations[5] and companies to tap into the remaining 99% (Merck & Co, 2000).

A recent survey by GE indicates that 92% of Australian business leaders strongly agree their firm would be more successful at innovation through partnership and collaboration than if their company went about it alone (General Electric, 2013). But despite the importance placed on collaboration, it remains the most significant flaw in Australia's innovation system.

As such, a new approach is required to fundamentally change the culture of innovation in our country. Australia's world class research is of limited value to the growth of our economy unless it enters the commercial market. Without action, we will continue to lag behind our global peers on innovation.

1.4 Objectives of the discussion paper

The objective of this discussion paper was to document a set of practical recommendations and implementation steps that outline how industry-research collaboration can be improved within the context of available resources. These recommendations could provide the basis for the development of a number of pilot programs that may be rolled out in NSW over the next 6 to 12 months.

While the outcomes of this discussion paper have application for businesses and research organisations across Australia, Western Sydney has been specifically identified by the Chambers' as a region that can clearly benefit from a closer relationship between industry and the research sector.

With biotechnology and biomedicine industries developing rapidly across the Greater Western Sydney region, linking these businesses with the considerable knowledge and expertise that our research organisations contain, could provide a boon for knowledge jobs within the region.

1.5 Our approach

This discussion paper is the result of an extensive review of relevant literature, one on one interviews and a roundtable event with participants across industry, research and government. In total we carried out consultation with more than 100 stakeholders to co-develop solutions to improve the effectiveness of collaboration.

Our approach was firstly to understand the opportunities available, foundations on which successful collaborations are based, barriers to effective collaboration and the roles of key stakeholder groups in Australia's innovation system (Section 2 – Findings). This provides the context to understand, assess and increase industry-research engagement.

The body of the discussion paper makes reference to a number of case studies that demonstrate the positive outcomes of collaboration. The case studies are presented in more detail in the appendices to the paper.

The next step was to develop a set of practical recommendations to improve the effectiveness of collaboration (Section 3 – Recommendations). Recommendations were subsequently validated with stakeholders to gauge the level of support, establish buy-in, identify resource requirements and help understand the implementation challenges.

The outcome of this process was a number of proposed pilot programs, which could be rolled out in NSW over the next 6 to 12 months. These pilot programs have been prioritised based on perceived benefits and ease of implementation to help focus resources on those initiatives that are likely to deliver the best value relative to investment.

Once implemented, the success of the pilot programs should be measured through feedback from participating stakeholders. This can enable improvements to be made for future programs as well as helping to validate the benefits of roll-out on a larger scale.

While it is not suggested that the pilot programs could address the large gap in collaboration performance on their own, they are the first step in driving the momentum required to change embedded behaviours.

4 Refer to Appendix A for a case study on open innovation.

5 Research organisations include universities or other higher education institutions and research institutes (public and privately funded).

FINDINGS

This section outlines the key findings of this discussion paper on industry-research collaboration. The findings have been based on an extensive review of relevant literature, one on one interviews and a roundtable event involving stakeholders across industry, research and government.

2.1 Opportunities

"It is the long history of humankind (and animal kind, too) those who learned to collaborate and improvise more effectively have prevailed"

Charles Darwin (Originator of the biological theory of evolution)

Figure 1: Benefits resulting from complementary resources of research and industry

What Research Offers	What Industry Offers
▪ Access to expert knowledge.	▪ Challenging problems to solve.
▪ Patent rights.	▪ Access to company data to bring market relevance to research.
▪ Highly skilled graduate students.	▪ Commercialisation expertise, including development, engineering, manufacturing and marketing.
▪ Access to public funding such as government grants.	▪ Employment and work integrated learning opportunities for post-docs and students.
▪ Cutting edge scientific equipment.	▪ Sponsored funding to carry out research.

Collaborative innovation can lead to a number of direct and indirect **benefits for research organisations, companies and society**

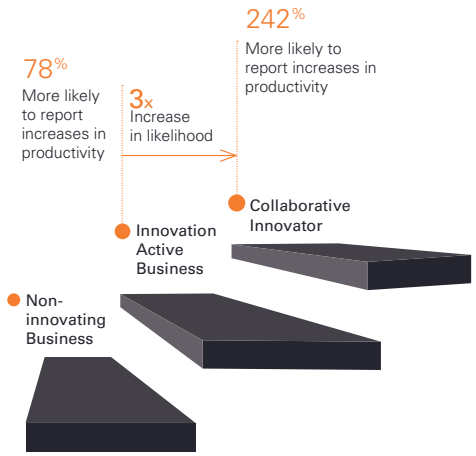
DIRECT

- Propensity to bring new products to market e.g. lifesaving drugs.
- Improvements in cost efficiency resulting from pooled resources and capabilities.
- Reduced financial risk through leveraged funding.

INDIRECT

- Improved education to employment outcomes for students.
- Job creation.
- Increase in the tax base.
- Improved standard of living.

Figure 2: Impact of collaboration on productivity



Source: Data sourced from Australian Innovation System Report. 2013

2.1.1 The collaboration imperative

Collaboration between industry and researchers is increasingly becoming a critical component of efficient national innovation systems. There is good reason for this, with research and industry sharing complementary resources that can lead to wide-reaching benefits[6] for research organisations, companies and society (see figure 1). For example, agreements to undertake collaborative research could provide research students with employment and work integrated learning opportunities. Likewise, there are opportunities for companies to obtain access to public funding, which can help to reduce financial risk.

Globally, industry-research collaboration has contributed to productivity improvements and greater levels of new to the world product developments[7] – all of which have a measurable impact on bottom line performance[8].

Australian businesses that engage in collaborative innovation with research organisations are 242% more likely to report increases in productivity compared with non-innovating businesses (Department of Innovation, Industry, Science and Research, 2013). This is a threefold increase in the likelihood of productivity growth gained from collaboration (see figure 2).

Research suggests that businesses which engage in collaboration are 70% more likely to develop products that are new to the world (Koutsogeorgopoulou & Barbiero, 2013).

These linkages also have a measurable impact on bottom line performance, with Loof and Brostrom (2005) finding that income from new product sales is considerably greater for firms that have joint projects with research organisations than for non-collaborating firms.

2.1.2 Transforming the economy in Western Sydney

Western Sydney has a unique opportunity to harness the benefits of collaborative innovation to help address the critical job deficit facing the region. In 2011 there was a predicted shortfall of approximately 200,000 jobs relative to the available Western Sydney workforce. On current trends this 'jobs deficit' is predicted to grow to around 320,000 by 2031 (Urbis, 2012).

The Western Sydney jobs deficit translates into a heavy commuting strain on the region's transport infrastructure as workers access jobs in Central Sydney and other parts of the metropolitan region.

A study by the Institute of Sustainable Futures at Western Sydney found that removing the need for workers to commute to the Central City could save the public an average of $4,000 to $5,600 per worker each year (Patty, 2014).

This creates an opportunity to harness the benefits of collaborative innovation and create more jobs in Western Sydney. The growing knowledge economy in the region and significant infrastructure investment planned over the next 10 years will help to support the transformation of Western Sydney.

6 Refer to Appendix B, C and D for relevant case studies of the benefits of successful collaboration.

7 Refer to Appendix E for a case study on collaboration in an international context.

8 It is noted that there is a correlation, not necessarily causation. There are a number of factors that contribute to productivity; however the likelihood of reporting productivity growth has been shown to increase with collaboration.

A growing knowledge economy

There is a significant commercial opportunity to take advantage of the region's growing biotechnology and biomedicine industries. These industries comprise pharmaceuticals, medical devices, diagnostics and therapeutics.

The health care sector, which is a driver for purchases of pharmaceuticals and medical devices, was one of the region's hot spots for growth, increasing by 5.4% FY12-FY13 (see figure 3).

Demand could further be increased as a result of the $20 billion dollar medical research fund (subject to parliamentary approval), which was recently announced as part of the Federal Governments Budget 2014-15 (Australian Government, 2014a) – the largest of its kind in the world.

Western Sydney is home to a number of the world's leading biotechnology and biomedicine companies, such as Baxter Healthcare, Resmed, GE Healthcare, Novartis and Pfizer. These companies are supported by a network of leading edge research facilities, medical institutes and universities at the forefront of research and innovation.

The health and medical research precinct in Westmead contains the largest concentration of health services in Australia: four major hospitals and three research institutes with over 1,640 patient beds. It employs over 16,000 people and treats over a million patients each year (Campion, 2013). This acts as an important conduit to link Sydney's most significant concentration of biotechnology and biomedicine companies with the growing populations and labour markets of Western Sydney.

Better connectivity between industry and research organisations can also help to reinvigorate the region's manufacturing sector. Western Sydney is home to about 8,500 manufacturing companies and is well placed to transition from assembly line production to more advanced manufacturing.

A number of new facilities have opened in the region to realise the opportunities of advanced manufacturing. This includes Dincel Construction System's $28 million manufacturing plant at Erskine Park and Byron Groups multi-million dollar facility in Smithfield.

As more companies in Western Sydney transition to advanced manufacturing, this is likely to lead to an increase in demand for applied research. Fostering deeper relationships with the region's research organisations will help local manufacturers to build the capacity to develop high-value, globally competitive products and services. This will ultimately lead to greater productivity and job creation for the region.

As noted by Zoran Angelkovski, CEO of META:

> "Every Australian manufacturer who is competing for survival in a global marketplace recognises the need to establish new collaboration opportunities for manufacturing, to build a solid future for our nation and our economy".

Figure 3: Industry growth in Western Sydney 2001 – 2013

	CAGR FY01 – FY13	Growth FY12 – FY13	GVA FY13 ($M)	GVA% FY13
Manufacturing	0.4%	-2.1%	13,222	14.5%
Health Care and Social Assistance	4.3%	5.4%	6,803	7.5%
Financial and Insurance Services	4.5%	6.0%	6,610	7.3%
Construction	5.1%	2.5%	6,275	6.9%
Wholesale Trade	1.5%	3.1%	6,274	6.9%
Transport, Postal and Warehousing	4.4%	3.3%	5,766	6.3%
Public Administration and Safety	2.5%	1.8%	5,603	6.2%
Retail Trade	3.3%	4.1%	5,274	5.8%
Education and Training	1.5%	1.8%	4,999	5.5%
Electricity, Gas, Water and Waste Services	1.5%	0.2%	3,588	3.9%
Professional, Scientific and Technical Services	1.9%	2.5%	3,453	3.8%
Administrative and Support Services	-0.7%	5.7%	3,029	3.3%
Rental, Hiring and Real Estate Services	-2.1%	0.2%	2,220	2.4%
Accommodation and Food Services	1.0%	-0.9%	2,095	2.3%
Other Services	-2.4%	-5.5%	1,965	2.2%
Information Media and Telecommunications	-0.5%	-3.2%	1,575	1.7%
Mining	7.2%	4.3%	958	1.1%
Arts and Recreation Services	2.3%	2.3%	697	0.8%
Agriculture, Forestry and Fishing	0.3%	1.1%	376	1.4%
Not Classified	2.4%	2.3%	10,266	11.3%

Hot Spots *Average Growth* *Cold Spots*

Source: PwC's Geospatial Economic Model (GEM), Feb 2014
GVA = Gross Value Added. CAGR = Compound Annual Growth Rate

"If I had an hour to solve a problem I would spend the first 55 minutes determining the right question to ask, for once I know the proper question I could solve the problem in 5 minutes"

Albert Einstein (Nobel Prize winner)

Significant infrastructure investment

The Commonwealth and New South Wales Governments are set to invest $3.5 billion over the next 10 years in major infrastructure upgrades (see figure 4) that will transform the region's economy (Australian Government, 2014b).

The Federal Government has also announced that Badgerys Creek will be the site for a new airport in Western Sydney. Transport connectivity is important in supporting both high-productivity and labour market participation more generally (Kelly & Mares, 2013).

The addition of an airport to the region will also increase export opportunities into growing markets in Asia. All of these factors are important to create the enabling conditions to foster innovation.

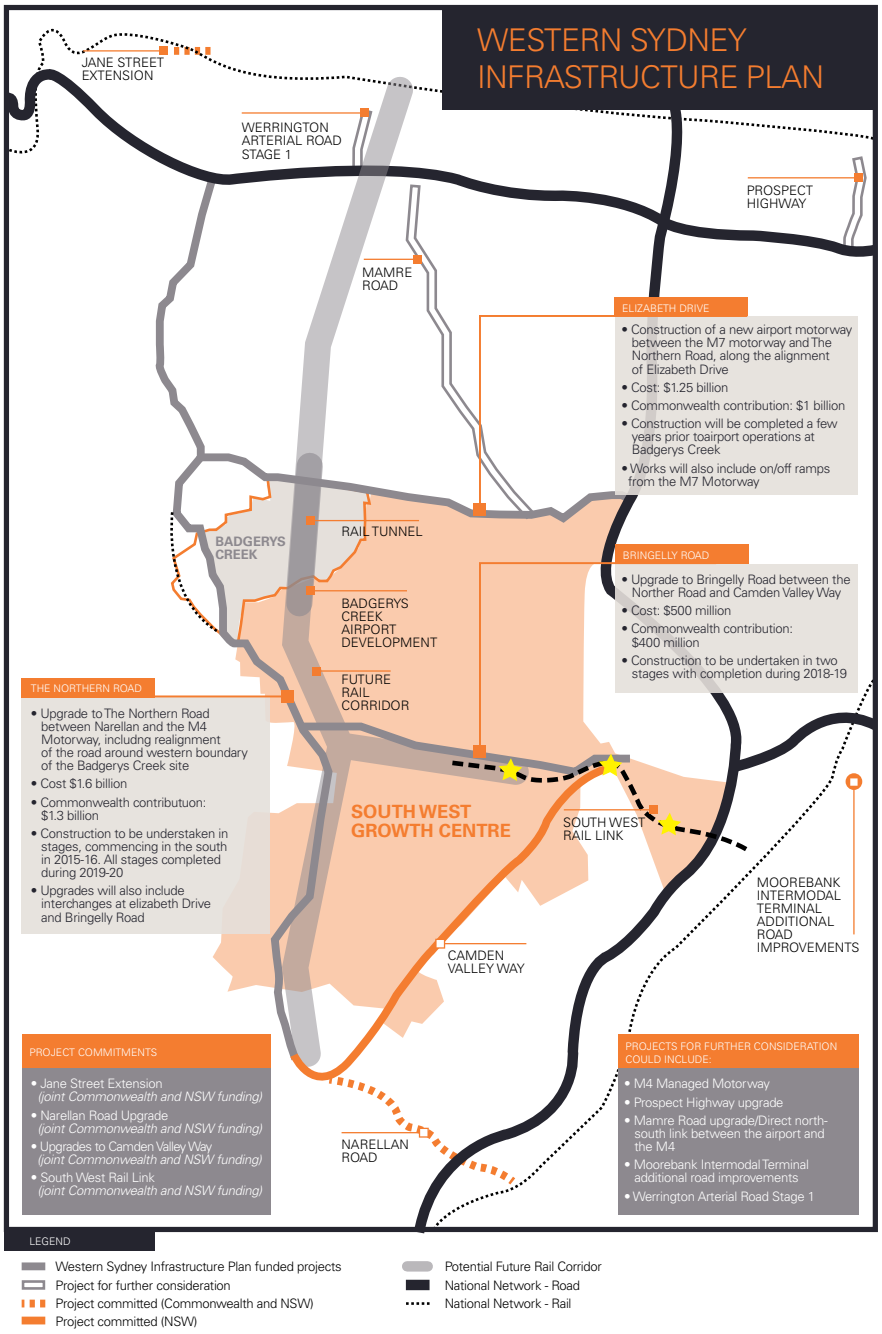
2.2 Foundations for successful collaboration

Through our research of existing literature and interviews with stakeholders, we identified four key enablers that are required to develop the foundations for successful industry-research collaborations.

2.2.1 Ability to recognise and apply external knowledge

The strength of local industry-research partnerships is conditioned by a firm's ability to build an internal knowledge base and research capacity to effectively capture and deploy the knowledge acquired from universities and other research institutes – this constitutes the firms absorptive capacity.

Figure 4: Western Sydney Infrastructure Plan 2014 – 2023



Source: Australian Government – Delivering Western Sydney's Transport Infrastructure for the 21st Century (2014)

"We have strategically chosen the universities we want to work with because they are more attuned to the commercial outcomes we require. In return, we invest in their students, which is a win-win for both parties"

Industry Interviewee

Absorptive capacity can be defined as the ability of a firm to recognise the value of new external information, assimilate it, and apply it to commercial ends (Cohen & Levinthal, 1989). The ability to evaluate and utilise outside knowledge is largely a function of the level of prior related knowledge.

At the most rudimentary level, this prior knowledge includes basic skills or even a shared language, but may also include knowledge of the most recent scientific or technical developments in a given field.

Absorptive capacity enables a company to identify and articulate their specific needs in a way that can easily form a demand for research services. Furthermore, companies with absorptive capacity are more equipped to identify and evaluate experts, including the costs and benefits of collaboration. High absorptive capacity is therefore a precondition for co-operation between companies and research organisations (Arvanitis et al, 2005).

2.2.2 Shared purpose

Industry-research collaboration needs to support the missions and motivations of each partner. It is important that everyone understands and agrees to the purpose of the collaboration, the degree of commitment required, and the expectations of partners involved in the effort. The industry stakeholders we interviewed were more likely to experience positive outcomes when expectations were established early, such as timelines, budgets and key milestones.

In order to encourage greater industry-research collaboration and improve the absorptive capacity of firms to benefit from the knowledge transfer process, firms and research organisations need a shared understanding of how research contributes to the development of market focused innovations.

2.2.3 Mutual trust

To create sufficient demand for research services, companies need to have confidence the partner they collaborate with has the capabilities to solve their problem. This requires trust – a crucial building block to successful collaboration.

Developing trust takes time and investment up front. Similar to marriage, there is a lot of dating that goes on beforehand to determine compatibility. Parties may want to see evidence of past success to reduce the risk of engagement.

A higher level of trust leads to more information and resource sharing. It also enhances the willingness of parties to participate in joint commercial ventures where risks may be high.

To help make it easier for companies to engage with the research sector and gain access to high quality intellectual property ("IP"), The University of New South Wales ("UNSW") has been championing 'Easy Access IP' across the country. Easy Access IP is a selection of intellectual property that is made available to companies to develop for free, using a simplified one page agreement.

The objective is to reduce the traditional barriers of engagement and build trust to foster long-term relationships. Since 2011, UNSW has developed 27 partnerships from Easy Access IP, which have also led to follow-up projects being funded through government leveraged funding[9].

2.2.4 Strong leadership

Leadership is widely seen as a critical ingredient to bring parties together and mobilise them to move collaboration forward. To get beyond just talking about collaboration, organisations need leaders that become catalysts for change. They need to be the ones on the ground level creating and sustaining commitment to collaboration through their own actions.

9 For more information see http://www.nsinnovations.com.au/easy-access-ip.

2.2.5 Selecting the right model

As noted by a large number of stakeholders we interviewed, there are a wide range of different models of collaboration, and engagement with research-intensive organisations is not for everyone. It is important to match the right model with the purpose of collaboration.

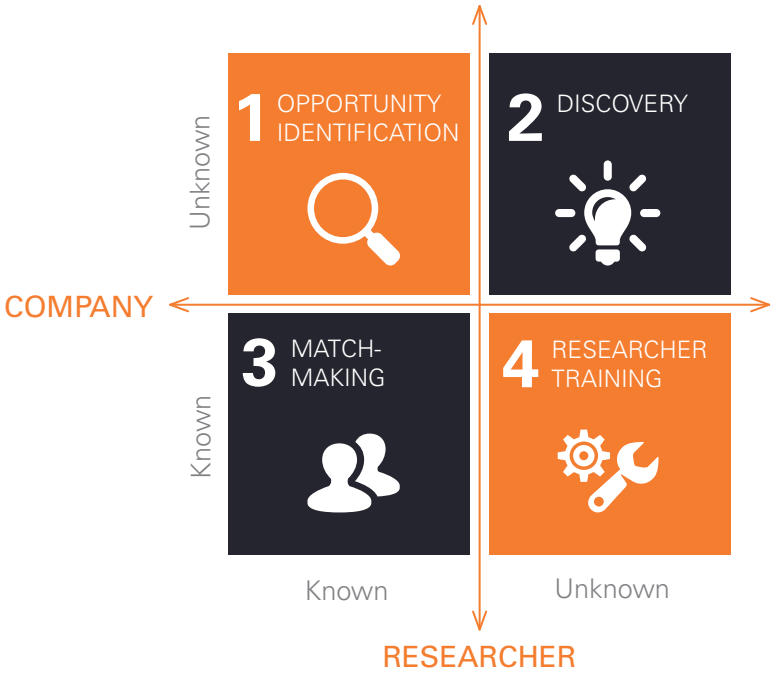
One such approach for dealing with the varying models of collaboration is outlined in figure 5. This model outlines four quadrants that reflect differing levels of understanding of a problem by companies and researchers. The level of understanding of a particular problem will determine the appropriate course of action.

The four quadrants are:

1. Opportunity identification
   In this quadrant, researchers have the expert knowledge to understand and solve a company's problem. They should identify companies that have interesting problems worth solving and connect them with an expert e.g. researchers in business program[10]. Companies will require a certain level of absorptive capacity to understand, integrate and apply the knowledge for commercial purposes.
2. Discovery
   Where real world applications are not immediately apparent, researchers should carry out blue-sky discoveries in their field of interest. The objective is to develop scientific breakthroughs.
3. Match-making
   This quadrant is the focus of industry-led research collaboration, where the problem is well understood by both parties. The objective is to match companies with compatible and motivated researchers.
4. Researcher training

10 A good starting point to identify companies with interesting problems is data from government programs e.g. Enterprise Connect, Commercialisation Australia and the ATO. However, it is noted that changes would be required to make more information available to the public and to improve information sharing between government departments.

Figure 5: Framework for connecting problem owners with problemsolvers



Where a researcher lacks an understanding of the problem, they should develop expertise in an industrial context. This can include work integrated learning opportunities.

2.3 Barriers to effective collaboration

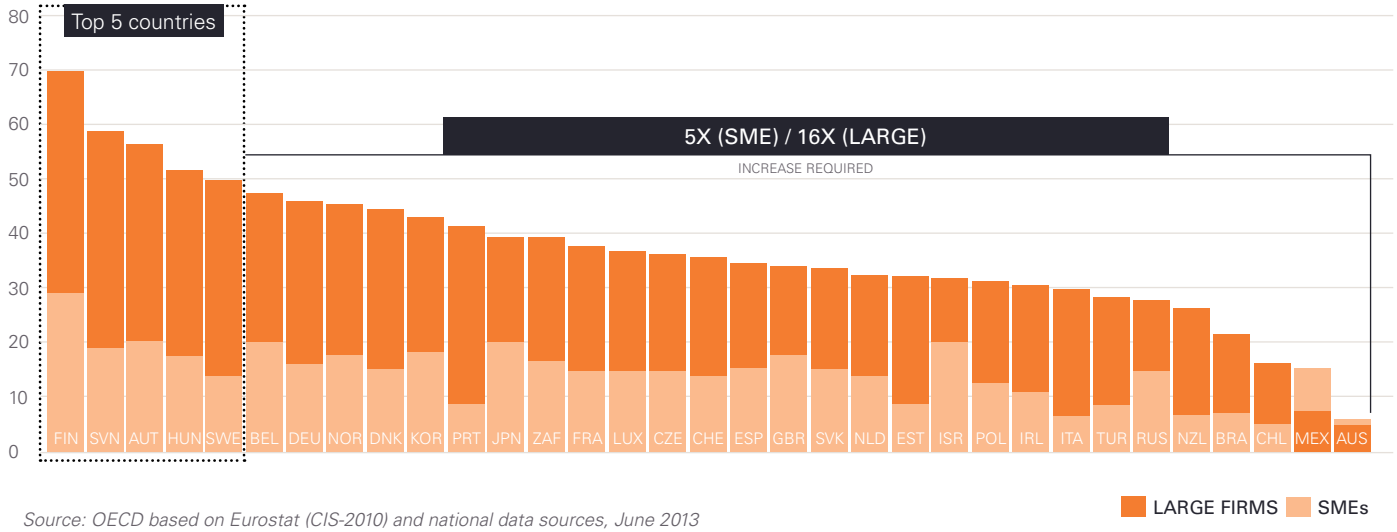
2.3.1 Australia's track record of underperformance

Australia's gross expenditure on research & development reached a historical high of $30.8 billion in 2010-11 (Department of Innovation, Industry, Science and Research, 2013). This significant spend has been a contributing factor (among others) to the Global Innovation Index 2013 ranking Australia 11th in the world for innovation inputs. But when it comes to our efficiency in converting research dollars into innovations, we perform poorly – ranking 116th out of 142 countries for innovation efficiency.

So what is driving this inefficiency? Most research and development expenditure by businesses in Australia is not used to fund research in higher education institutions, thus constraining knowledge exchange. Indeed, between 2008 and 2010, the share of higher education research funded by business fell from 4.9% to 4.1% (Westacott, 2013). The private sector spend is mostly focused on business model innovation, commercialisation and adoption of innovation from other sources, such as suppliers, customers and consultants.

Furthermore, only 4.6% of innovation-active businesses in Australia collaborated with universities or other higher education institutions and 3% with public research institutes 2010-11 (ABS, 2012). As a result, Australia was ranked last out of 33 countries for collaboration (OECD, 2013).

Figure 6: Firms collaborating with higher education or public research institutions by size



Source: OECD based on Eurostat (CIS-2010) and national data sources, June 2013

To achieve collaboration levels in line with the average of the top five OECD countries, Australia would need to obtain a fivefold improvement in industry-research collaboration with SMEs and a sixteen fold increase with large firms (see figure 6).

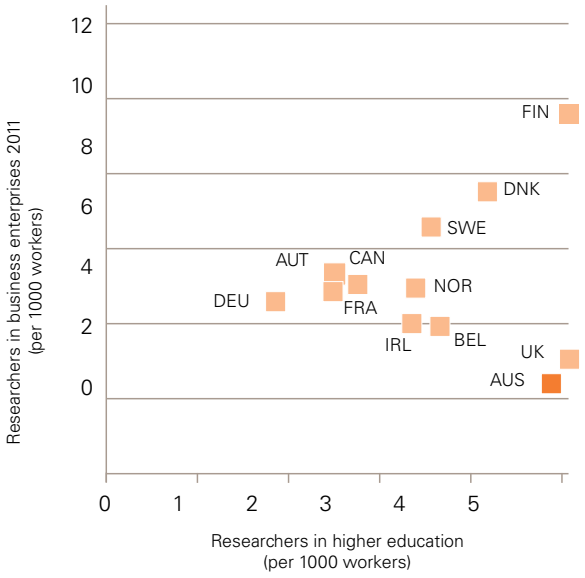
To improve the participation of businesses collaborating with researchers, it is important to understand and address the barriers. We have identified a number of structural challenges and cultural barriers that have contributed to Australia's low levels of collaboration.

2.3.2 Structural challenges

2.3.2.1 Small number of researchers working in business enterprises

The Australian higher education sector was responsible for employing around 60% of the nation's research personnel in 2008, followed by the business sector 31% and government sector 9%. As a result, we have one of the highest proportions of researchers in higher education, but the lowest in business enterprises (see figure 7).

Figure 7: Researchers in business enterprises vs. researchers in higher education



Source: Pettigrew, 2012

"PERIODICALLY ACADEMICS SHOULD SPEND SOME TIME INSIDE A COMPANY TO GAIN INDUSTRY EXPERIENCE"

RESEARCH INTERVIEWEE

Because of the separation between problem owners (companies) and problem solvers (researchers) it creates a number of translation problems. Knowledge when created by research organisations is rarely in a form or format that can immediately be adopted and applied in a commercial situation.

As a result, this can hold companies back from investing in more significant collaboration because they perceive that the research sector lacks an appreciation of the commercial imperatives.

"Before an SME innovates on the product level, they need to get their business model right first"

Research Interviewee

Figure 8: Innovation activity in Australian businesses by firm size

	Micro 0-4 Persons	Small 5-19 Persons	Medium 20-199 Persons	Large 200+ Persons
Innovation Characteristics				
Distribution of total business numbers	85.1%	10.1%	3.8%	0.3%
Businesses with any innovative activity (innovation-active	30.5%	49.6%	61.9%	65.9%
Collaborate with universities or higher education institutions	5.2%	4.0%	4.2%	8.0%
Collaborate with public research institutes	N/A	6.6%	1.9%	6.0%
Export to overseas markets	5.7%	8.4%	13.7%	34.6%
Innovation Expenditure				
No expenditure	40.8%	33.8%	31.5%	26.2%
$1 to less than $50,000	50.5%	49.6%	39.3%	11.8%
$50,000 to less than $100,000	4.0%	8.8%	12.0%	8.3%
$100,000 to less than $1,000,000	4.7%	7.6%	13.6%	29.4%
$1,000,000 to less than $5,000,000	–	0.1%	3.5%	18.3%
$5,000,0000 or more	–	0.1%	0.1%	6.0%

*Source: Australian Government Department of Industry, Innovation, Science, Research and Tertiary Education. (2012), ABS. (2012). Cat 8158.0. *Subject to expense classification by reporting entity for the 2010-11 Business characteristics survey.*

2.3.2.2 Resource constrained SMEs

Australia has a very high proportion of small and medium-sized firms (99.7% of all businesses), which presents a number of challenges for collaborative innovation.

SMEs do not possess the same level of resources as large firms, and as a result are often not geared up for innovation. Many SMEs are lifestyle companies that do not have the motivations to innovate, while others can lack the management capability and absorptive capacity to effectively capture and deploy the knowledge acquired from research organisations.

Without the right internal capabilities, SMEs can experience difficulties understanding what the right problems are to solve, how research organisations can help to solve their problems and what to expect when engaging with research organisations. At the same time, only a minority of SMEs have problems interesting enough to excite the curiosity of researchers.

SMEs innovative capacity and ability to develop new products and services varies significantly based on their size and the industry in which they operate. As illustrated in figure 8, the level of businesses innovating, collaborating, exporting and spending on innovation increases with size. Furthermore, differences exist across industries such as biotech, which engages in comparatively higher levels of patenting activity than other sectors, as well as facing increased regulatory burdens. Because of these differences, a one-size fits all approach to collaboration is unwarranted.

2.3.2.3 Geographic dispersion

In terms of surface area, Australia is simply vast; the sixth largest country in the world by area. At the same time, we are ranked 51st in terms of population size, making us one of the least densely populated countries in the world[11]. This creates proximity challenges for companies seeking to collaborate with the best and brightest researchers in the country.

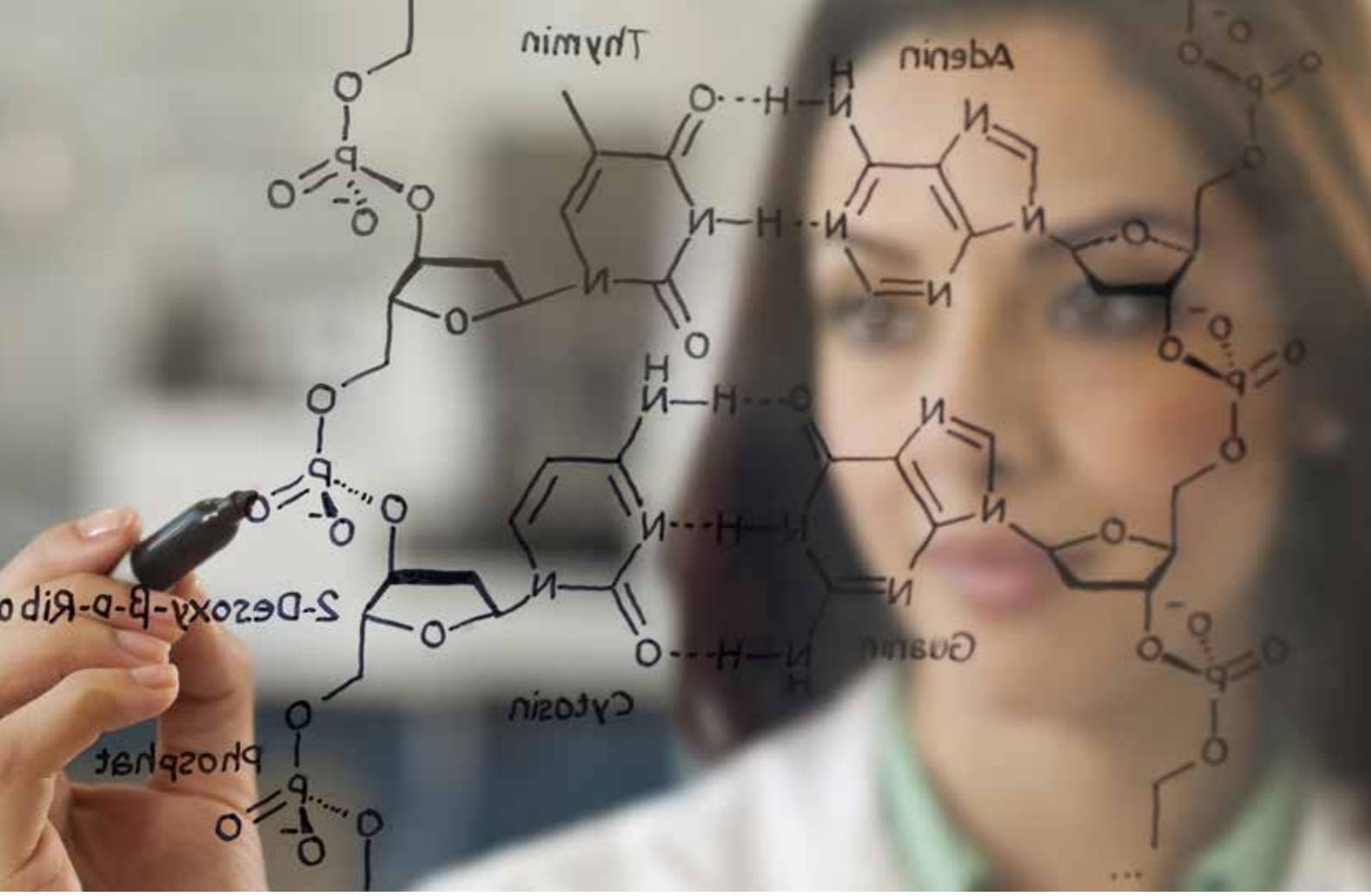
Proximity matters when it comes to business collaboration, especially for SMEs. Informal networks and personal interaction cannot easily be sustained over long distances. Even large companies may find it more efficient to work with researchers in their own locality (HM Treasury, 2003). As a result, companies can end up engaging with researchers that are not the most suitably qualified or motivated people to meet their needs. If this leads to a bad experience because of incompatibility, the company might reconsider future engagement with research organisations.

The alternative approach of searching the country to find the most suitably qualified researcher can lead to substantial search costs, including time, labour, and the opportunity cost of delaying research. It is a challenge for research organisations across the country to document all the areas they have expertise in, which can be communicated in a meaningful way. Companies therefore find it difficult to understand which of the 43 universities and more than 50 research institutes across Australia contains the expertise they need to solve their problems[12].

> "Personal interaction is a key driver for me to engage in collaboration"
>
> *Industry Interviewee*

11 Only Mongolia, Western Sahara, Suriname, Mauritania and Botswana have fewer people per square kilometre than Australia (World Population Review, 2014).

12 Refer to Appendix F and G for case studies on current and planned solutions to the 'match-making' problem.



2.3.2.4 Fragmentation and instability of government programs that support innovation

Fragmentation

In a 2008 review of the nation's innovation system in Australia, Cutler (2008) noted:

> "Two hundred and twenty one programs supporting innovation in firms were identified comprising 31 percent Australian Government and 69 percent State and Territory Governments".

This reflects the fragmented nature of government support programs for innovation in Australia. Fragmentation can make it difficult to allocate public resources in a strategic manner and can result in wasteful duplication of effort and sub-optimal scale of many support programmes.

Moreover, it is reasonable to expect that many businesses, especially SMEs, are unaware of the assistance available for innovation.

Instability

Government programs supporting innovation in Australia are often abandoned before they can be fully evaluated. This includes the recent announcement that the Federal Government will cut eight research and innovation funding bodies, including the $213 million grants program Commercialisation Australia, and the Innovation Investment Fund, which co-invests in venture capital funds.

Furthermore, the Industry Innovation Precincts Programme that was designed to bring together relevant industry and research capability is to close on 31 December 2014 – only 18 months after being announced as part of the previous budget (2013-14)[13].

The current system of frequent changes in policy and incentives results in confusion and leaves industry in a position of uncertainty. This can lead to higher costs, including wasted time on applications that end up going no-where and the opportunity cost of deferring new product development.

13 Stability is a key criterion of successful support mechanisms used around the world. For example, the US Small Business Innovation Research (SBIR) scheme has been in place for over 30 years.

"There has not been enough transparency or stability of government funded innovation programs over the years. This has an impact on the decisions I make about future R&D investment"

Industry Interviewee

2.3.3 Cultural differences

2.3.3.1 Mismatched incentives

"What gets measured gets done"

Peter Drucker
(Father of modern management)

Focus on publications

The reward systems inside universities are not set up for commercial activity, which can hamper industry-research collaboration. At the individual level, researchers are limited by the excellence in research (ERA) framework, which defines impact primarily in terms of academic publications. This sends a signal to researchers that the key consideration is publication of theoretical research, rather than seeking to collaborate with the private sector.

"There is no incentive for me to engage with industry because I don't receive any remuneration or recognition for it"

Research Interviewee

Universities themselves use publications in high ranking journals as a key metric to determine promotions of researchers, as it helps to drive government funding and rankings. But high-ranking journals tend to publish work of a theoretical nature that is of limited value to companies.

The pressure to publish can also be a contentious point for industry because it can impact the registration of patents. Kevin Cullen, the Director of NewSouth Innovations notes "If you come up with a cure for cancer, the worst thing you can do is publish it, because then no one will ever be cured because the proprietary position that a pharmaceutical company needs to invest the $1bn in taking it to market is gone."

In the publish or perish world, industry trained professionals can be discouraged from entering academia. Professional experience is not generally taken into consideration for promotions and many can be restricted from certain grant funding schemes because they do not have a previous track record in publications. This is a lost opportunity as experienced professionals can help to reduce the translation gap between industry and research.

"We have recently had difficulty trying to organise short-term projects with a university because the timing does not align with their need to publish"

Industry Interviewee

Fixed funding model

Every university in the country is funded exactly the same for its undergraduate students regardless of the quality or type of educational experience. This fixed funding model leads to limited diversification in the type of education provided. It has created incentives for universities to cram hundreds of students into lecture theatres and constrains innovation. The ANU Bachelor of Philosophy degree exposes gifted young students to research from the very first days; they work in the laboratories and offices of well renowned researchers. But the degree is funded as if students were put in a class of 300 and occasionally exposed to practical sessions (Young & Evans, 2014).

Competitive neutrality pricing

The essence of competitive neutrality is the principle that, for those areas in which government competes with the private sector, it should do so on an equal footing. As stated in the Commonwealth's Competitive Neutrality Policy Statement:

'Competitive neutrality requires that government business activities should not enjoy net competitive advantage over their private sector competitors simply by virtue of public sector ownership'.

This policy extends to universities, and puts parameters around how much can be charged for research services. This can limit opportunities for collaboration between industry and research as prices can be perceived as too prohibitive, particularly if the benefits are not well understood. Companies might also be apprehensive about providing work integrated learning opportunities for students because of the competitive price constraints.

"We have a tendency to overvalue intellectual advances. Everyone seems to think they are sitting on the next Facebook"

Research Interviewee

2.3.3.2 Time constraints

Academics, particularly early career researchers, have high demands on their time. In addition to their core teaching role, researchers balance the pressure of publications and grant applications. As such, researchers find it hard to manage industry partnerships on top of their existing workload. The search process to find a suitable industry partner can be time consuming and is seen as a low priority relative to other commitments.

Many of the researchers we interviewed indicated that their main priority after teaching was to apply for grant funding. They have their head down in paperwork, trying to get research funding to keep their job. Some of the competitive grant applications involved complex legal and contract negotiations, which are a drain on researcher's time.

"Universities live and die by competitive grants, which are very onerous and time consuming to complete"

Industry Interviewee

Figure 9: Operational focus of industry and research

Industry

- Market driven.
- Emphasise return on investment.
- Extremely cost conscious.
- Oriented to profit.
- Particularly sensitive to timing.

Research

- Advancement of knowledge.
- Academic freedom.
- Publication of results.
- Education of students.
- Relaxed time frame and milestones.

With researchers constantly thinking about where their next grant is going to come from, this can have an impact on the level of engagement for both current and future industry partnerships. As noted by one of the research interviewees: "Sometimes the perception that we are not business ready is a result of our level of engagement. We are either thinking about the next grant application we need to get in, or lack motivation because we entered into the partnership for the wrong reasons (i.e. financial)".

SMEs can also experience time constraints because of internal resource limitations. They often do not have dedicated resources that manage external relationships with research organisations. As a result, SMEs find it challenging to balance their time between day to day operations and engagement with research organisations. This further constrains the ability to identify the appropriate collaboration partners and to understand the process of engagement[14].

2.3.3.3 Organisational differences

In spite of their common interest in working together, companies and research organisations have different cultures that can compromise the success of long-term partnerships if not well understood (see figure 9).

A common complaint of industry is that researchers lack business exposure and an appreciation of commercial imperatives. They are not perceived as being market or outcomes focused, which runs counter to the drivers of engagement by business. Equally, researchers point to a lack of understanding by industry about how to effectively engage with them.

Industry timeframes are driven by economic and product cycles, while academic research project durations depend largely on the time required for graduate degree programs and publications. Research organisations are not well suited for doing research that business immediately needs. The strength of the research sector is blue-sky discovery and proof of concept, where it is at an early stage of innovation and there is a lot of work to be done to bring a product to market.

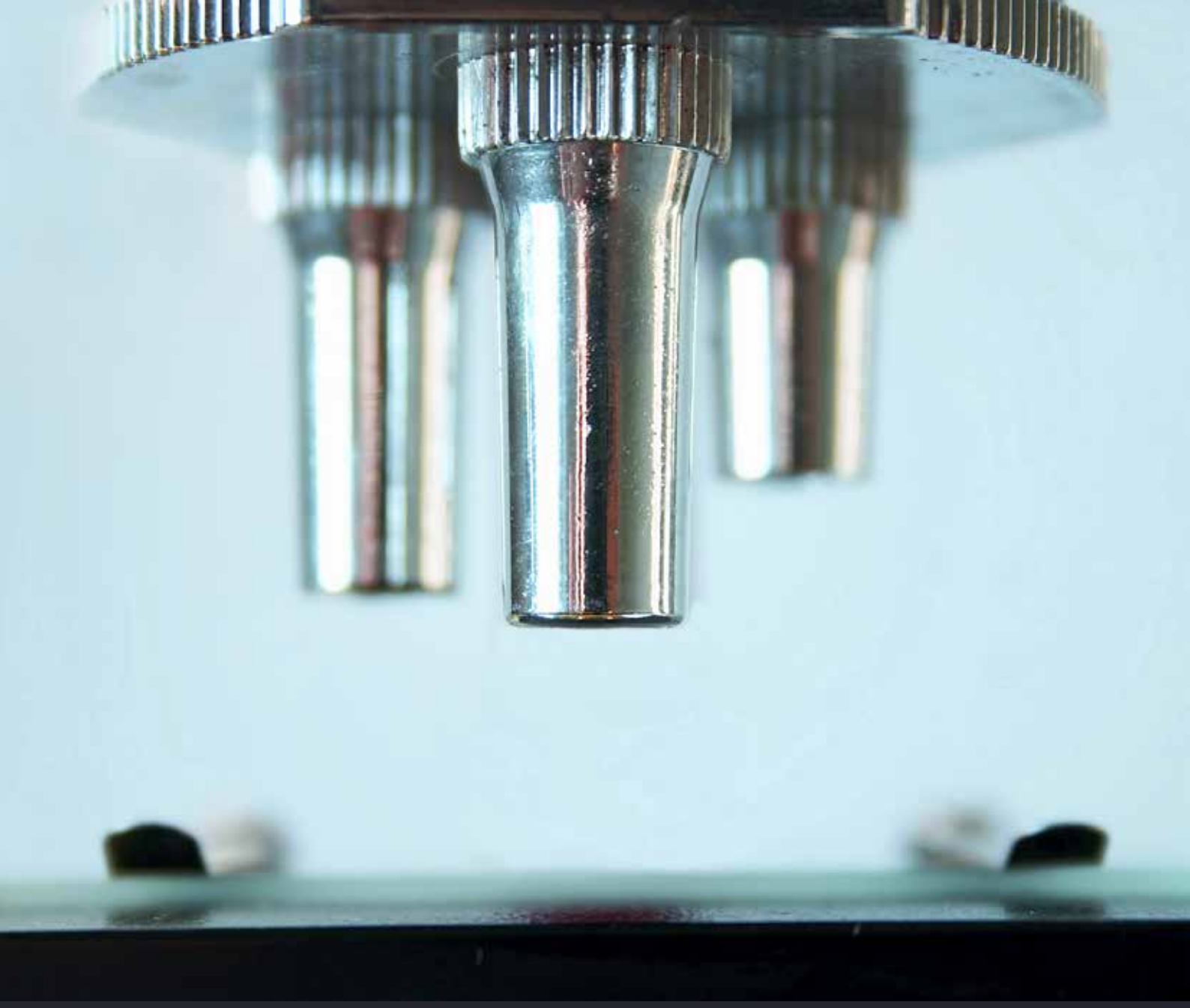
The long-term orientations of research can become a barrier to participation for SME organisations, which require cost effective and short-term results. Furthermore, many SMEs participation in grant funding programs is limited due to their lack of financial and human resources. Many grant programs come with requirements for matched funding and commitments over a long time horizon (normally 5 years)[15].

Companies and researchers report that negotiations on the terms and conditions of intellectual property ownership can be extremely lengthy and costly. Agreements can vary substantially across research organisations increasing complexity for those companies seeking to collaborate.

Furthermore, the lack of standardisation and onerous requirements of lengthy contracts can lead to delays in intellectual property registration. For companies, agreements need to be established in a commercially timely manner to start making a return on their investment in research & development.

14 Companies and researchers can benefit from an intermediary service such as UniGateway, which facilitates introductions between willing buyers and sellers of research expertise.

15 An initiative to help reduce the barriers for SMEs participation in Australia is the Victorian Government's Voucher Scheme (http://www.business.vic.gov.au/grants-and-assistance/programs/technology-voucher-program/program-information). Internationally the United States has gained success through its Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs.



"TIMELINES HAVE IMPLICATIONS FOR PROJECT FUNDING. IF MILESTONES ARE DELAYED, I MIGHT LOSE MY ALLOCATED BUDGET, WHICH CAN'T BE ROLLED OVER DIFFERENT YEARS"

INDUSTRY INTERVIEWEE

"I would like to see government implement a minimum percentage of local content in products they procure. This will lead to more competition and fuel collaborations, both local and international"

Industry Interviewee

2.4 Roles of key stakeholder groups

'A high-performing innovation system should ensure that actors within the system are connected and able to effectively collaborate, thereby maximising the flow and exchange of resources and ideas'

Australian Innovation System Report (2013).

With a greater understanding of the barriers to effective collaboration, it is important to consider the roles that each stakeholder group plays within Australia's innovation system (see figure 10). This will help to identify what stakeholder groups are best placed to lead the implementation of the practical recommendations that are outlined in section 3.

2.4.1 Government

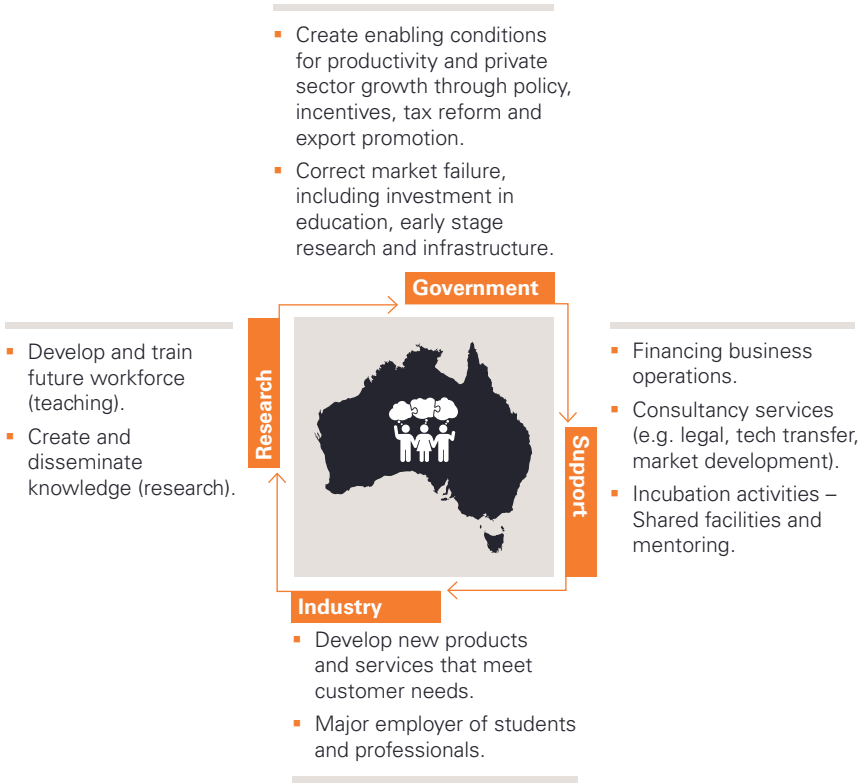
The Government can contribute to the innovation performance of Australia by creating the enabling conditions to encourage innovation and to correct market failures that exist in the national innovation system.

Government intervention occurs when markets are not working efficiently. In simple terms, the market may not always allocate scarce resources in a way that achieves the highest total social welfare. Indeed, private sector producers are unlikely to supply public goods to people because they cannot be sure of making an economic profit.

This phenomenon where markets don't operate efficiently is often referred to as market failure. Government intervention may seek to correct for the distortions created by market failure and to improve the efficiency of how markets operate. For example, governments may intervene to correct market failures in the innovation system by investing in fundamental building blocks such as infrastructure, education and basic research and development.

Internationally the United States has benefited from demand-led procurement of defence related products that stimulates innovation. While this is not replicable in Australia, government procurement that improves competition within the goods and services markets leads to greater efficiency and encourages innovation. In 2012, procurement contracts from all levels of the Australian Government totalled $41 billion (PwC, 2013b). The opportunity is there, but the challenge is accessing this important market.

Figure 10: Roles of stakeholder groups within Australia's innovation system



Growing science, technology, engineering and mathematics education (STEM) will further propel innovation and future economic growth. However, Australia has a declining rate of STEM related course completion and a lack of skilled personnel is cited as the most significant barrier to industry innovation.

In 2012 only 16% of all courses in Australia completed in tertiary education were STEM related, despite 75% of the fastest growing occupations requiring STEM related skills and knowledge (PwC, 2014b).

2.4.2 Support services

A number of support services are made available in the private sector to help businesses implement their innovation and growth plans. This can include access to capital to fund ventures, technology transfer and commercialisation support (e.g. support to develop go-to market strategy).

2.4.3 Industry

Commercialising innovations is the task of industry. Companies seek to differentiate themselves from their competitors by bringing new products to market that serve unmet customer needs. The profits that result from successful product launches enable companies to invest in growth that leads to further job creation.

2.4.4 Research

When companies are motivated to innovate, demand is created for world class knowledge – much of which resides within research-intensive universities (78% of the basic research in the country). Australia's research institutions are highly regarded as creators of knowledge, ranked as the 8th best in the world according to the Global Competitiveness Report 2013-14.

Research organisations also play an important role in the development of highly qualified and skilled personnel to facilitate innovation. Australia produces some of the best skilled workers in the world, ranked 3rd by the Global Innovation Index 2013 for knowledge workers.

Figure 11: Strategic goals of universities in NSW focusing on external partnerships

SYDNEY	Establish an office of community engagement…. Cultivate meaningful and sustainable community partnerships.
UNSW	Developing and expanding research linkages with industry in Australia and internationally, and encouraging strategic collaboration…
MACQUARIE UNIVERSITY	Lead the field in productive research partnerships and collaborations both within and outside the academy…
UTS	Leverage our environment to connect students, staff, alumni, and industry to create sustained opportunities for collaborative learning.
	Increase the number and concentration of funded research partnerships.

On the other hand, since the 1990s the strategic mission of universities has moved beyond the tradition of teaching and research toward a 'third mission' – business and community engagement.

This transition can be seen in NSW, with many local universities now placing business and community engagement as one of their strategic goals (see figure 11).

Internationally, MIT, Stanford and Yale all now state that their main reason for engaging in technology transfer is to improve the public good – that is, to create the greatest possible economic and social benefits from the research, whether they accrue to the university or not.

2.4.5 Where to next?

"Realistically, genuine competitiveness,…. comes from innovation, productivity, cost control and so on. It comes from those things more than from the inflation target you might choose, I would say"

Glenn Stevens (Governor of the Reserve Bank of Australia)

The business case for enhancing collaborative innovation between industry and the research sector has been made clear. Indeed, Australia's prosperity in a competitive world increasingly depends on knowledge and skill. Firms that engage in high levels of knowledge-intensive activity will drive productivity growth and job creation in Australia.

As firms move to more open sources of knowledge creation, collaboration is increasingly becoming important. As noted in this paper, collaboration can lead to wide-reaching benefits including cost efficiencies, reduced financial risk, improved education outcomes, and an increased likelihood of productivity growth and new product development.

However, to access the opportunities of collaboration, we need to address a number of structural challenges and cultural barriers. To address these barriers, it will require a coordinated and integrated approach involving multiple stakeholder groups. The implication of inaction is a deterioration of our innovation performance.

To that end, the following section outlines practical recommendations to address the barriers to collaboration and enable Australia to access the associated opportunities and benefits.

"FOR SOME COMPANIES THE SEARCH PROCESS CAN BE LIKE GROPING IN THE DARK"

SUPPORT INTERVIEWEE

PRACTICAL RECOMMENDATIONS

In this section, we outline six practical recommendations that have been co-developed with more than 100 stakeholders to address the identified barriers to effective collaboration. These recommendations include:

1	Establishing good practice forums on corporate engagement and commercialisation (see page 30)
2	General guidelines for engaging with companies and researchers[16] (see page 32)
3	SME capability development workshops (see page 36)
4	Work integrated learning forums (see page 38)
5	Creation of a marketplace for research expertise (see page 40)
6	Government reform (see page 42)

In developing the recommendations, we have focused our attention on improving the effectiveness of industry-led research collaboration for the purposes of solving industry identified problems. This focus has been determined by feedback from industry and research sector stakeholders.

Given the fiscal constraints across State and Federal Governments, it was important that recommendations had minimal budgetary impact. As such, recommendations have been prioritised based on the perceived benefits and ease of implementation[17]. It is noted that implementation of all proposed solutions is likely to yield the greatest benefits.

Implementation steps have been provided to facilitate the development of pilot programs. Over the coming months, the Chambers plan to work with identified stakeholder groups (including sponsors) to facilitate the development and roll-out of the proposed pilot programs outlined in this paper. It is expected that the roll-out could take place in NSW over the next 6-12 months.

Stakeholders interested in participating in the planned programs are encouraged to contact the Chambers.

Key: ■ *High* ■ *Medium* ■ *Low*

16 This includes the development of a standardised intellectual property agreement for short-term engagements.

17 Perceived benefits and ease of implementation have been rated according to three categories – low, medium and high. Key considerations in ease of implementation include marketing, people, technology, finance and level of stakeholder support.

3.1

Establish good practice forums on corporate engagement and commercialisation

VISION

To bring companies and researchers with a common interest together to share best practices on corporate engagement and commercialisation.

GOAL

To increase the number and quality of personal interactions and engagement between researchers and companies by sharing learnings on how to overcome the key barriers to effective industry-research collaborations.

What

It is recommended to establish good practice forums on corporate engagement and commercialisation. The forums will be a series of events, which share the best practice solutions for overcoming many of the challenges associated with corporate engagement and the commercialisation of research. The forums serve as a practical way for companies and researchers to share their own specific experiences – both successful and unsuccessful. Areas of interest for stakeholders include outcome based case study presentations by researchers and companies involved in collaborative innovation[18], export facilitation government grants applications, and intellectual property transfer and negotiations.

Why

The findings from this discussion paper indicate that in spite of the common interest in co-operating, companies and researchers face a number of barriers that can hold both parties back from investing in more significant collaboration. Time constraints, geographic dispersion, fragmentation and organisational differences make it difficult for organisations to stay abreast of all the knowledge required to effectively engage in successful collaboration. These challenges were shared by many of the stakeholders interviewed, while the results of collaboration often varied. There is an opportunity to distil learnings from those organisations that have developed novel ways to overcome the key challenges of corporate engagement and improve overall outcomes.

The purpose of the good practice forums are to serve as a practical way for companies and researchers to share their own specific experiences. This could help create an internal knowledge base to improve the effectiveness of industry-research collaborations. Being able to recognise and apply external knowledge is a key foundation for collaboration and is largely a function of prior learnings.

There are a number of current examples of forums that share best practice processes, including the Law Society of NSW online forums for legal professionals, QuEST forum for ICT professionals and the Northwestern University annual best practice forum for university personnel[19]. Furthermore, UniQuest (one of Australia's leading research commercialisation companies) runs commercialisation workshops for its researchers to help share best practice processes. The workshops are run one to two times per year and conclude with a three minute pitch by researchers about the business case for their project. This is a way of developing commercial acumen.

Based on the success of the above parallel examples, it is anticipated that the good practice forums will lead to a number of benefits including:

- Promoting the exchange and application of best practices on industry-research engagement and commercialisation.
- Leveraging the experience of past learnings, which enables organisations to identify opportunities that can reduce the transaction costs involved in corporate engagement.
- Facilitating a culture of continuous improvement.
- Building an internal knowledge base to help recognise and apply knowledge from research organisations.
- Personal interaction with organisations that share common interests and challenges.
- Saving time and money by sharing best practice initiatives within a group environment.

18 This includes a background on the engagement, how challenges were overcome, benefits and key learnings.

19 Refer to the following for more information:
Law Society of NSW (http://www.lawsociety.com.au/resources/forums/index.htm)
QuEST forum (http://www.questforum.org/best_practices/overview.html)
NorthWestern University (http://www.northwestern.edu/changemanagement/bpf/index.html).

How

To help with the implementation, a number of action steps have been outlined below. It is recommended that the implementation of these guidelines should be led by a combination of industry and research stakeholders. This aligns with the requirements of the good practice forums and the roles of each stakeholder group in Australia's innovation system.

Implementation steps		Perceived benefits ■ Ease of implementation ■
1	*Define and develop a clear purpose, vision and goals for the good practice forums*	See draft vision and goals above.
2	*Define the target community (potential members)*	The first step to establishing a forum is to correctly identify the target community (members) from the outset. Typically the criterion for this assessment is to start with individuals and organisations that share a common interest.
3	*Establish a working party*	Participants could include: ▪ Facilitator (peak, industry or membership body)*. ▪ Thought leader / subject matter expert. ▪ Sponsor(s) – upstream seller / buyer of services from industry. ▪ Research personnel that aligns to the forums target community. ▪ Cross section of industry representatives – by sector and size. ▪ Supporters such as professional service firms and financial institutions. ▪ Government agencies/department representatives that align with the agenda of the forum. ** Given the need to build connection points, the selection, appointment and role of the facilitator is critical.*
4	*Design forum content*	The working party needs to establish itself and build content on: ▪ Topical matters (interesting, unique, practical) with open idea exchange. ▪ Case studies – outcomes based learnings, best practice examples of collaboration and commercialisation (local and international), and learnings from unsuccessful collaborations; presented by those involved in the collaboration. The working party should: ▪ Seek input from the target community about relevant topics to cover at forums. ▪ Encourage social engagement and participation in the format of the forums.
5	*Choose a venue*	▪ Arrange a suitable venue to run workshops, which contains the required resources e.g. tables, projector, media outlets. ▪ Find a sponsor to reduce costs – could be shared and rotated between research organisations in NSW to expose participants to different thought leaders and respective approaches to knowledge exchange.
6	*Plan and promote a forward events calendar*	Establish a forward events calendar with strategic marketing and communication tools used to engage with the target forum community members. Place details of the events on marketplace for easy access (see recommendation 3.5).
7	*Facilitate forums*	▪ Registration desk for welcoming attendees. ▪ Subject matter expert and facilitator to run event.
8	*Evaluate*	▪ Seek feedback from attendees to help with future planning of forums.

3.2

General guidelines for engaging with companies and researchers

VISION

To break down the barriers of cultural differences between researchers and companies to better prepare them for collaboration.

GOAL

To provide answers to central questions that face researchers and companies aiming to achieve healthy, productive collaborations.

What

It is recommended to develop a set of guidelines to help companies and researchers prepare for industry-research collaborations. Areas of interest as expressed by stakeholders interviewed include an overview of the various forms of collaboration available (e.g. access to facilities, contract research and licensing), situations in which each method of collaboration makes sense, how to identify good partners, benefits and challenges, and the key organisational differences between companies and research organisations. Stakeholders also indicated that guidelines should include a standardised IP agreement for short-term engagements to help simplify the negotiation process across multiple entities[20].

Why

The findings from this discussion paper indicate that there is a lack of understanding between companies and researchers about how to effectively manage organisational differences when engaging in collaborative research. Feedback from both industry and research stakeholders suggest there is a lack of understanding on how to engage, when engagement makes sense and what to expect from the collaboration (including benefits).

At the same time, stakeholders indicated that non-standardisation of intellectual property agreements across research organisations leads to complexity, delays and increased transactions costs. All these factors create barriers to effective industry-research collaborations, which need to be addressed.

The purpose of the guidelines are to outline answers to central questions that face companies and researchers aiming to achieve healthy, productive collaborations. The guidelines are designed to help break down the cultural barriers between companies and researchers, by improving the understanding of organisational differences and expectations.

There are a number of current examples of industry-research guidelines that are currently in practice that have helped to break down the cultural barriers of collaboration, including the Georgia Tech Researcher Guidebook, Stanford Researcher Guide to Working with Industry and the European University Association Responsible Partnering Guidelines[21]. Additionally, the Lambert Toolkit in the UK consists of a set of nine different model agreements (for varying types of collaboration) for research organisations and companies seeking to undertake collaborative research projects.

Based on the success of the above parallel examples, it is anticipated that the guidelines will lead to a number of benefits including:

- Improved awareness of the various models of collaboration available and when to use them.
- Greater appreciation of the organisational differences between companies and researchers, which helps to manage cultural barriers.
- Better understanding of the best practice processes for industry-research engagement (particularly for resource constrained SMEs).
- Assisting companies and researchers to manage expectations more effectively.
- Increased transparency and trust.
- Reduction of transaction costs (incl. legal fees, negotiation time and opportunity costs) from standardisation.
- Reduced chance of delays in IP negotiation.

20 Refer to www.ipo.gov.uk/lambert for more information.

21 Refer to the following for more information:
Georgia Tech Researcher Guidebook (http://www.industry.gatech.edu/files/UIDP-Researcher-Guidebook.pdf).
Stanford Researcher Guide to Working With Industry (http://web.stanford.edu/group/ICO/docs/res_ind_guide.pdf)
European University Association Responsible Partnering Guidelines (http://www.eua.be/Libraries/Publications_homepage_list/Responsible_Partnering_Guidelines_09.sflb.ashx).

How

To help with the implementation, a number of action steps have been outlined below. It is recommended that the implementation of these guidelines should be led by a combination of industry and research stakeholders. This aligns with the requirements of the guideline development and the roles of each stakeholder group in Australia's innovation system.

Implementation steps		Perceived benefits ■ Ease of implementation ■
1	*Define and develop a clear purpose, vision, and goals for the guidelines*	See draft vision and goals above.
2	*Establish a working party*	Participants could include: ▪ Company managers of both SMEs and large firms. ▪ Successful entrepreneurs. ▪ Commercialisation representatives from within research organisations. ▪ Actively engaged researchers. ▪ Finance personnel within research organisations that are responsible for the pricing of commercial activities.
3	*Determine scope of guidelines*	▪ Determine questions that collaborators want answers to. ▪ Determine the key stakeholders that should be involved in the process. ▪ Agree timelines for completion of the guidelines. ▪ Determine how success of the guidelines will be measured. ▪ Agree budget for the guidelines. ▪ Agree level of detail for the guidelines.
4	*Understand current processes*	▪ Bring together any existing guideline documents that cover the same issue and can be used as a base. ▪ Run one workshop with industry engagement representatives from research organisations (8-10 people) in NSW and one workshop with a selection of company owners/managers involved in research collaborations (8-10 people). The purpose of the workshops is to: – Outline various forms of interaction and the respective processes to engage e.g. access to facilities, contact research, and licensing. – Determine situations where each form of interaction is most appropriate. – Outline questions that representatives would like answers to (FAQ). – Outline high level expectations, such as pricing guidelines, timelines, and possible outcomes (e.g. patents). – Outline the key benefits and challenges of collaboration. – Outline key organisational differences, and key considerations when engaging (e.g. publications).
5	*Develop and test guidelines*	▪ Review findings and consolidate into a set of practical guidelines. ▪ Develop a framework to provide guidance on when various forms of collaboration makes sense. ▪ Create a standardised IP agreement for short-term engagements (see step 7 to 13). ▪ Test guidelines with workshop group attendees and make changes where required.
6	*Implement*	▪ Develop communications and marketing plan to roll-out guidelines across research organisations and companies in NSW. ▪ Create champions within research organisations to promote the use of the guidelines. ▪ Create mechanisms to capture feedback. ▪ Monitor and evaluate success of the guidelines. ▪ Publish on marketplace for easy access (see recommendation 3.5).

3.2

Standardised IP agreement

Implementation steps		Perceived benefits ■ Ease of implementation ■
7	*Meet University Vice Chancellors to seek buy-in*	▪ Gain input for the formation of a working committee. ▪ Communicate benefits, assign roles, agree non-disclosure agreement (NDA) for release of commercial information, timelines and funding.
8	*Form a working party*	Participants could include: ▪ Subject matter expert. ▪ Researchers who have been involved in IP transfer over the last six months. ▪ Heads of commercialisation within research organisations. ▪ Legal counsel. ▪ Venture capitalists that have had experience in technology transfer with research organisations. ▪ Cross section of industry representatives – by sector and size. ▪ IP law partners with experience developing agreements between research and industry.
9	*Collate precedent documents into a library*	Assemble and centralise examples of existing contracts from various reference points which may include: ▪ Research organisations (e.g. Easy access IP); ▪ Standard templates developed for a similar purpose in international markets (e.g. Lambert toolkit); and ▪ Precedent documents from law firms.
10	*Build a knowledge bank of terms and arrangements*	Scan, review and scrutinise existing document library to examine and compare terms in order to note points of uniformity and variation.
11	*Focus on building preferred terms*	Have the working party go through areas of divergence to arrive on preferred terms for standard agreements.
12	*Collate precedent documents and obtain feedback*	Collate findings into a standard agreement, including guidance on standard terms and possible variations, and circulate to key stakeholders to obtain feedback.
13	*Roll out and launch*	▪ Develop a roll-out plan, including marketing, communications and training. ▪ Publish on marketplace for easy access (see recommendation 3.5).

3.3

SME capability development workshops

VISION

To help motivated SMEs innovate and grow by addressing resource constraints that limits their capacity to collaborate with research organisations.

GOAL

Increase participation of SME organisations in collaborative innovation, by equipping them with the tools to build internal capabilities and engage effectively with research organisations.

What

It is recommended to run a series of workshops designed to help build capability in motivated SME organisations to better prepare them for innovation and collaboration with research organisations. Areas of interest as expressed by stakeholders interviewed includes workshops on developing management capability to drive innovation (including project management), developing viable business models and creating an internal knowledge base and research capacity to effectively capture and deploy knowledge from research organisations.

Why

The findings from this discussion paper indicate that there is a relatively low level of SME participation in industry-research collaborations because they are often resource constrained and tend to lack the internal capability to innovate. Without the right internal capabilities for innovation, SMEs experience difficulties understanding how they can benefit from engagement with researchers, thus creating barriers to effective industry-research collaborations.

The purpose of the workshops are to help SMEs to break down the barriers to participation by addressing resource constraints and lack of absorptive capacity. These workshops will help build the capacity of motivated SMEs to understand what the right problems are to solve, how research organisations can help to solve their problems, and how to identify viable markets for their products and services.

There are a number of current examples of SME capability building workshops that are currently in practice that have helped to increase participation of SME organisations in collaborative innovation, including The Exeter University building innovation management capability in SMEs workshops, FutureSME capability development programme and Singapore Governments SME capability workshops (as part of the SME centre program[22]).

Based on the success of the above parallel examples, it is anticipated that the SME capability workshops will lead to a number of benefits including:

- Helping build internal capabilities of SMEs to better prepare them for engagement with research-intensive universities.
- Improving match-making success, by helping SME managers to frame up the right problem to solve.
- Helping companies frame a problem into an interesting question to spark interest from researchers.
- Connecting SMEs with relevant government support programs.
- Expanding relationship networks through personal interactions with likeminded individuals.

How

To help with the implementation, a number of action steps have been outlined below. It is recommended that the implementation of these guidelines should be led by a combination of industry and research stakeholders. This aligns with the requirements of the guideline development and the roles of each stakeholder group in Australia's innovation system.

22 Refer to the following for more information:
Exeter University (http://www.aimresearch.org/index.php?page=building-innovation-management-capability-in-smes)
Future SME (http://www.futuresme.eu/docs/news-and-events-attachments/2011/05/27/Capability%20Dev%20Prog%20Pilot%20Update.pdf?Status=Master)
Singapore Government (https://www.aiaworldwide.com/news/sme-centres-offer-businesses-one-stop-access-singapore%E2%80%99s-government-assistance)

Implementation steps		Perceived benefits ■ Ease of implementation ■
1	*Define and develop a clear purpose, vision, and goals for the workshops*	See draft vision and goals above.
2	*Establish a working party*	Participants could include: ▪ Facilitator (industry or membership body). ▪ Thought leader / subject matter expert. ▪ Sponsor(s) – upstream seller / buyer of services from industry. ▪ Cross section of industry representatives – by sector and size. ▪ Research personnel that are aligned to the target workshop community.
3	*Determine the scope of the workshops*	▪ Agree the frequency and duration of workshops. ▪ Determine budget for the workshops. ▪ Determine resources required for the workshops, including speakers, facilitators, laptop to present, stationery and handouts. ▪ Determine how success of the workshops will be measured, such as participant feedback forms.
4	*Define the needs of the workshop participants*	▪ Detailed stakeholder consultation to determine the content requirements and expectations of workshop participants. ▪ Use available data sets to identify SMEs that are motivated to grow and have interesting problems worth solving. ▪ Seek input for topics from identified stakeholders.
5	*Choose a venue*	▪ Arrange a suitable venue to run workshops, which contains the required resources e.g. tables, projector and media outlets. ▪ Find a sponsor to reduce costs – could be shared and rotated between research organisations in NSW to expose participants to different thought leaders and respective approaches to knowledge exchange.
6	*Develop workshop content*	▪ Draft the agenda. ▪ Determine format and style of presentation. ▪ Prepare materials for workshop based on needs of participants, including presentation and handouts.
7	*Organise and promote workshops*	▪ Organise facilitator and subject matter expert. ▪ Organise the logistics, including catering and facilities. ▪ Establish a forward events calendar. ▪ Arrange for handouts and related material to be created for participants. ▪ Develop marketing plan to promote events to targeted stakeholders. ▪ Distribute agenda to workshop participants.
8	*Facilitate workshops*	▪ Registration desk for welcoming attendees. ▪ Subject matter expert and facilitator to run the event.
9	*Evaluate*	▪ Seek feedback from attendees to help with future planning. ▪ Publish workshop content on marketplace for easy access (see recommendation 3.5).

3.4

Work integrated learning forums

VISION

Produce more graduate researchers who are work ready and who have had 'hands on' industry experience.

GOAL

Embed work integrated learning activities into university curriculums to create opportunities for graduate researchers to apply theoretical knowledge into practice.

What

It is recommended to investigate opportunities to improve the practicality of education within universities through work integrated learning[23]. These opportunities will be explored through a series of forums that will engage with companies to provide input into university curriculums.

Why

The findings from this discussion paper indicate that organisational differences between companies and researchers, along with the small number of researchers working in business enterprises can lead to a number of translation problems. As a result, this can hold companies back from investing in more significant collaboration because they perceive that the research sector lacks an appreciation of the commercial imperatives.

The research sectors goal is to educate students and advance knowledge. Companies seek to develop products and services to meet the needs of customers and create value for shareholders. Because of these different missions, researchers and companies must take the time to understand one another and recognise that industry-research relationships are different from those between two companies.

The purpose of the work integrated learning forums are to increase exposure of students and researchers to real life company problems and culture. Research shows that employers would be willing to pay new workers 22% higher salaries if they had the skills they need (Mourshed et al, 2012). This means employers want graduates who are able to plan and organise their work, solve problems, work in teams, use technology effectively and understand how to be effective in the workplace.

There are a number of current examples of forums that have identified opportunities for the creation of work-integrated learning opportunities including the Innovative Research Universities' (IRU) annual work integrated learning forum[24] and the Informa work integrated learning forum. One such example of a successful work integrated learning program is UTS Shopfront. Business students engage with underprivileged community organisations with the support of consulting mentors to solve real life problems. Since 1996 more than 600 projects have been successfully completed with over 700 community partners, all UTS faculties, and more than 2,500 UTS staff and students.

Based on the success of the above parallel examples, it is anticipated that the outcomes of the work integrated learning forums will lead to a number of benefits including:

- Developing an awareness of workplace culture to reduce translation gaps.
- Enhanced employment prospects for research graduates.
- Practical application of theoretical knowledge to build commercial acumen.
- Establishing stronger links with industry to build trust and foster future collaborative projects.
- Reduced recruitment and training costs.
- Experience to make informed choices for a career pathway.

How

To help with the implementation, a number of action steps have been outlined below. It is recommended that the implementation of these guidelines should be led by a combination of industry, research and government stakeholders. This aligns with the requirements of the guideline development and the roles of each stakeholder group in Australia's innovation system.

23 Such as internships and graduate employment opportunities.

24 Refer to the following for more information: IRU (http://iru.edu.au/events/conferences/work-integrated-learning-forum.aspx)Inform (http://www.informa.com.au/conferences/education-conference/work-integrated-learning-forum).

Implementation steps		Perceived benefits ■ Ease of implementation ■
1	*Define and develop a clear purpose, vision, and goals for the guidelines*	See draft vision and goals above.
2	*Form steering committee*	Participants could include: ▪ University Professors – curriculum setters. ▪ Vice Chancellors of universities. ▪ Representatives from universities Australia. ▪ Representatives from the Department of Education. ▪ Representatives from the Department of Industry. ▪ Board accreditation members. ▪ Academic supervisors. ▪ Industry participants.
3	*Understanding the current context of work integrated learning in NSW*	Contextual understanding could include the following: ▪ Identify various forms of work integrated learning and their associated benefits. ▪ Identify the formal and informal strategies already in place within local universities to determine improvement opportunities. ▪ Identify successful work integrated learning programs currently in operation. ▪ Identify national developments around understanding and enhancing work integrated learning to inform the working group, such as the employability skills framework in VET. ▪ Identify applicable legal and regulatory guidelines, including student placement, course assessment and accreditation. ▪ Identify industry sectors that experience the greatest challenges in transitioning students from classroom to the workplace.
4	*Develop terms of reference for the forum*	Terms of reference could include the following: ▪ Explore the opportunities for industry participants to define and share existing problems or research opportunities and embed these into course content as research projects (subject to approval from accreditation board). ▪ Examine opportunities to embed or supplement the existing curriculum with industry requirements, which could be taught either by personal interaction in the workplace, simulation at the university, online, face-to-face or any combination of these. ▪ Investigate the opportunity to collaborate between faculties to build more commercial ready skill sets that enhance the market focus of research[24].
5	*Develop a work ready competency framework*	Design and develop an industry competency framework which segments desired competencies into groups, including: ▪ Knowledge and skill related competencies. ▪ Work-related competencies. ▪ People-related competencies. ▪ Organisational specific competencies. Publish the work ready competency framework on the marketplace for easy access (see recommendation 3.5).
6	*Enhance programs that include work experience*	Encapsulate the above initiatives into cornerstone work experience programs for researchers and industry participants.

24 An example is combining business students with technical researchers to build business cases, strategic plans or commercialisation roadmaps in relation to the application of intellectual property developed by researchers.

3.5

Creation of a marketplace for research expertise

VISION

To make it easy for researchers and companies to connect, exchange and engage.

GOAL

Reduce the difficulty and cost involved in identifying the right collaboration partner by developing a marketplace to bring willing buyers and sellers of research expertise together.

What

It is recommended to develop a marketplace to bring willing buyers and sellers of research closer together. The marketplace will become a central point for problem owners and problem solvers to commence the search process for collaboration partners. Stakeholders expressed a need for a combination of an online platform and an intermediary service to contextualise requests for expertise.

Further considerations included an email registration (online platform) to deliver regular updates, incentives to drive demand from industry (including open innovation competitions through a network of problem solvers), and a desire for engaging content (including links to relevant grants and case studies). To ensure the ongoing success of the marketplace, it is recommended to embed champions within research organisations that become advocates of the marketplace and provide updates on current research projects and areas of expertise.

Why

The findings from this discussion paper indicates that companies experience difficulties in identifying suitably qualified and motivated researchers to engage with. Geographic dispersion of research expertise can lead to substantial search costs, while time constraints and organisational differences can make it difficult to identify compatible partners. Smaller businesses have a further challenge, in that they are generally not aware of the expertise and services the research sector could provide.

The purpose of the marketplace is to address the match-making challenge. By creating a central portal (online platform), it enables a single entry point to facilitate introductions, gain access to template agreements, case studies, calendar of upcoming events (including relevant forums and workshops) and best practice guidelines for industry-research collaboration. The relationship brokering service provided by the intermediary will help to translate research expertise into a language that can be applied to business. This will make it easier for researchers and companies to connect, exchange and engage with each other.

There are a number of current examples of two-sided marketplaces that are currently in practice that have been successful in bringing together willing buyers and sellers, including the ASX, Facebook, Match.com, eBay and Betfair. Specific examples of marketplaces that help to connect industry with researchers includes UniGateway (see case study in Appendix F) and Coalfacer (see case study in Appendix G).

Based on the success of the above parallel examples, it is anticipated that the creation of a marketplace for research expertise will lead to a number of benefits including:

- Single entry point to reduce transaction costs involved in the search process (time and money).
- Reduces proximity barriers currently faced when businesses try to identify research capabilities residing within research organisations.
- Relationship broker that helps contextualise and frame up business problems to match the right problem owner with the right problem solver.
- Improve compatibility of collaboration partners by facilitating the connection of likeminded and motivated individuals.
- Connect more companies to government funding mechanisms, driving more demand-led innovation.
- Aggregated approach to bring relevant content and toolkits together in a single location to help facilitate more industry-research engagements.
- Focuses on both demand and supply connectivity, bringing together two-sided interaction.

How

To help with the implementation, a number of action steps have been outlined below. It is recommended that the implementation of the marketplace be led by industry, with consultation of research stakeholders. This could include partnering with existing providers of marketplaces for research such as Coalfacer and UniGateway. Further support could be required from government to address market failure if there is insufficient interest from industry stakeholders in developing the marketplace.

Implementation steps		Perceived benefits ■ Ease of implementation ■
1	*Define and develop a clear purpose, vision, and goals for the marketplace*	See draft vision and goals above.
2	*Establish a working party*	Participants could include: ▪ Subject matter expert in two-sided marketplaces. ▪ Research – Director / VC of Corporate Engagement. ▪ Industry – Director of Research / Commercial Manager. ▪ Actively engaged researchers. ▪ Successful entrepreneur / owner. ▪ Department of Industry representative. ▪ Facilitator from a membership body or professional services firm. ▪ Information Technology representative (CIO or equivalent). ▪ Website developer.
3	*Define the needs of the community which may include members, buyers (companies) and/ or sellers (researchers)*	Undertake detailed stakeholder consultation to determine the content and functionality requirements and expectations of users.
4	*Design the blue print for a marketplace solution*	Considerations could include: ▪ Mode of intermediation. ▪ Key criteria for relationship broker. ▪ Open vs. closed system. ▪ Minimum member profiling requirements. ▪ Search criteria. ▪ Privacy requirements. ▪ Basis for transaction and information exchange. ▪ Business model for service delivery, including content updates.
5	*Determine roles and responsibilities of relationship broker*	Considerations could include: ▪ Management of enquiries from users. ▪ Translation of research expertise into a language that can be applied to business. ▪ Establishment of relationships within research organisations and local companies. ▪ Facilitating introductions between motivated companies and researchers that have a shared interest. ▪ Advocating and promoting the marketplace to increase user base.
6	*Recruit relationship broker*	Considerations could include: ▪ Relevant experience across industry and research. ▪ Understanding of relevant government programs focused on innovation. ▪ Understanding of commercialisation process. ▪ Connections with existing research organisations. ▪ Strong relationship skills.
7	*Select or build technology platform*	Options could include: ▪ Partner with an existing provider. ▪ Utilise an off the shelf solution. ▪ Build a custom proprietary solution.
8	*User acceptance testing (UAT)*	Verify that the solution works for the user i.e. test that the user accepts the solution (software vendors often refer to it as beta testing)
9	*Attract buyers and sellers to provide liquidity and reach critical mass*	Considerations could include: ▪ Market the platform to target user group. ▪ Provide incentives to stimulate demand e.g. open innovation competitions. ▪ Aggregate relevant content e.g. Commercialisation Australia, Enterprise Connect and the ATO. ▪ Provide mechanism to facilitate content updates e.g. embedding champions within research organisations.

3.6

Government reform

VISION

A world class and innovative economy that underpins the sustainable living standards of all Australians.

GOAL

The government reform should be directed towards achieving an innovation system that is effective in promoting commercialisation outcomes to drive productivity improvements, economic growth and job creation in Australia.

What

Although the objective of the discussion paper was to identify practical recommendations that could be actioned within the next 6 to 12 months, the report has highlighted a number of barriers to effective collaboration that need to be addressed through government reform, including:

- Fragmentation and instability of government programs that support innovation.
- Incentives inside universities, which are not set up for commercial activity.
- Competitive neutrality provisions which set parameters around minimum pricing levels for research services (inside government funded organisations).
- Onerous requirements to access government funding (including paperwork, approval times, matched funding requirements, lack of information sharing between departments on innovation programs and declining STEM related course completion).

Why

Because of the implementation challenges involved in driving government reform at the Federal level, this recommendation falls outside the scope of the paper, which is the development of a number of practical pilot programs over the next 6 to 12 months. However, due to the importance of these issues in facilitating a productive innovation system in Australia, we have outlined a number of terms of reference below that could form the basis of a future review (including an outline of the process).

How

The Chambers will present the issues that require government reform to representatives of the Department of the Prime Minister and Cabinet for consideration.

Implementation steps		Perceived benefits ■ Ease of implementation ■
1	*Define and develop a clear purpose, vision and goals for the government reform*	See draft vision and goals above.
2	*Form steering committee*	Participants could include: ▪ Chief scientist. ▪ Researchers and subject matter experts. ▪ Representatives from Department of Industry. ▪ Representatives from Department of Education. ▪ Industry participants.
3	*Set the terms of reference for the review*	Policy initiatives to drive collaboration levels in line with the average of the top five OECD countries, which could include: ▪ Initiatives to incentivise and promote collaboration between research organisations and industry; can be initiated through policy changes (e.g. changes to ERA requirements), university funding models and innovation program support (e.g. funding from Australian Research Council). ▪ Review of government procurement policies to encourage and reward local, collaborative innovation; could include minimum local content provisions. ▪ Review of the neutrality provisions within the context of how much research organisations can charge for commercial services. ▪ Investigate opportunities to improve access to information on government funded innovation programs and to improve information sharing between government departments. ▪ Investigate opportunities to consolidate government innovation programs to reduce fragmentation, duplication and complexity, while providing improved stability. ▪ Investigate opportunities to encourage more motivated SMEs to collaborate with research organisations, including changes to government funding requirements (e.g. amount of paperwork, approval times, and level of matched funding). ▪ Initiatives to encourage more mobility between companies and research organisations to reduce the translation gap. ▪ Initiatives to address declining rates of STEM related course completion, including advocacy / promotion of available career opportunities, changing the perception of STEM to appeal to younger generation (e.g. practical application in development of Facebook and Google) and strategic investment in STEM education and infrastructure (e.g. technology and ICT infrastructure).
4	*Invite submissions from stakeholders*	Provide substantial opportunities for public participation and to gain information and views from those involved in the innovation ecosystem.
5	*Publish a discussion paper*	Set out the issues to be addressed and invite supplementary submissions.
6	*Stimulate public debate*	▪ Hold public consultations in all Australian capital cities. ▪ Make information about the review publicly available on Government home page.
7	*Report and implement*	A final report to be provided to the Federal Government with prioritised recommendations for action and implementation.[25]

25 An example of a current review of a government program includes the establishment of the $484.2 million Entrepreneurs' Infrastructure Programme, which will be delivered through the new single business service initiative. For more information, refer to: https://consult.industry.gov.au/entrepreneurs-infrastructure-programme/entrepreneurs-infrastructure-programme.

ACKNOWLEDGEMENTS

This paper was co-written by **Mark Welsh**, **Alister Berkeley** and **Manoj Santiago** – PwC on behalf of the NSW Business Chamber. The policy contact for this paper within the NSW Business Chamber is **Ash Salardini**.

We would like to thank all participating universities, government agencies and companies who generously gave up their time to contribute to this report:

AbbVie
ATP Innovations
AusBiotech
AusIndustry
Australian Department of Education
Australian Department of Industry
Australian National University
Australian Research Council
Australia's Chief Scientist
Baxter Healthcare
Blue Chilli
Boeing
Breseight
Business Higher Education Roundtable
Capstone Partners Australia
Cikarovski & Associates
Coalfacer
Cochlear
Coleman Greig Lawyers
Consulate General of the United States of America
CSIRO
Dale-Advisers
Deloitte
Department of the Prime Minister and Cabinet
Eidos Institute
EJC Corporate Services
Enterprise Connect
Garvan Institute of Medical Research
GE Healthcare
Global Orthopaedic Technology
Group of Eight Universities
Ingham Institute of Applied Medical Research
Macquarie University
Medical Technology Association of Australia
New South Innovations
Newcastle Institute for Energy and Resources
NICTA
Northrop Grumman
Norton Crumlin
NSW Business Chamber
NSW Chief Scientist
NSW Department of Premier & Cabinet
NSW Department of Trade & Investment
NSW Office of Health & Medical Research
NSW Trade & Investment
Pfizer
Phebra Pharmaceuticals
PwC
Quickstep
Research Australia
Resmed
Saber Astronautics
Simavita
Sirtex Medical
Standards Australia
Sydney Angels
Sydney Business Chamber
Thales
The University of Sydney
UniGateway
UniQuest
Universities Australia
University of Canberra
University of New England
University of Technology Sydney
University of Western Sydney
University of Wollongong
Westmead Millennium Institute

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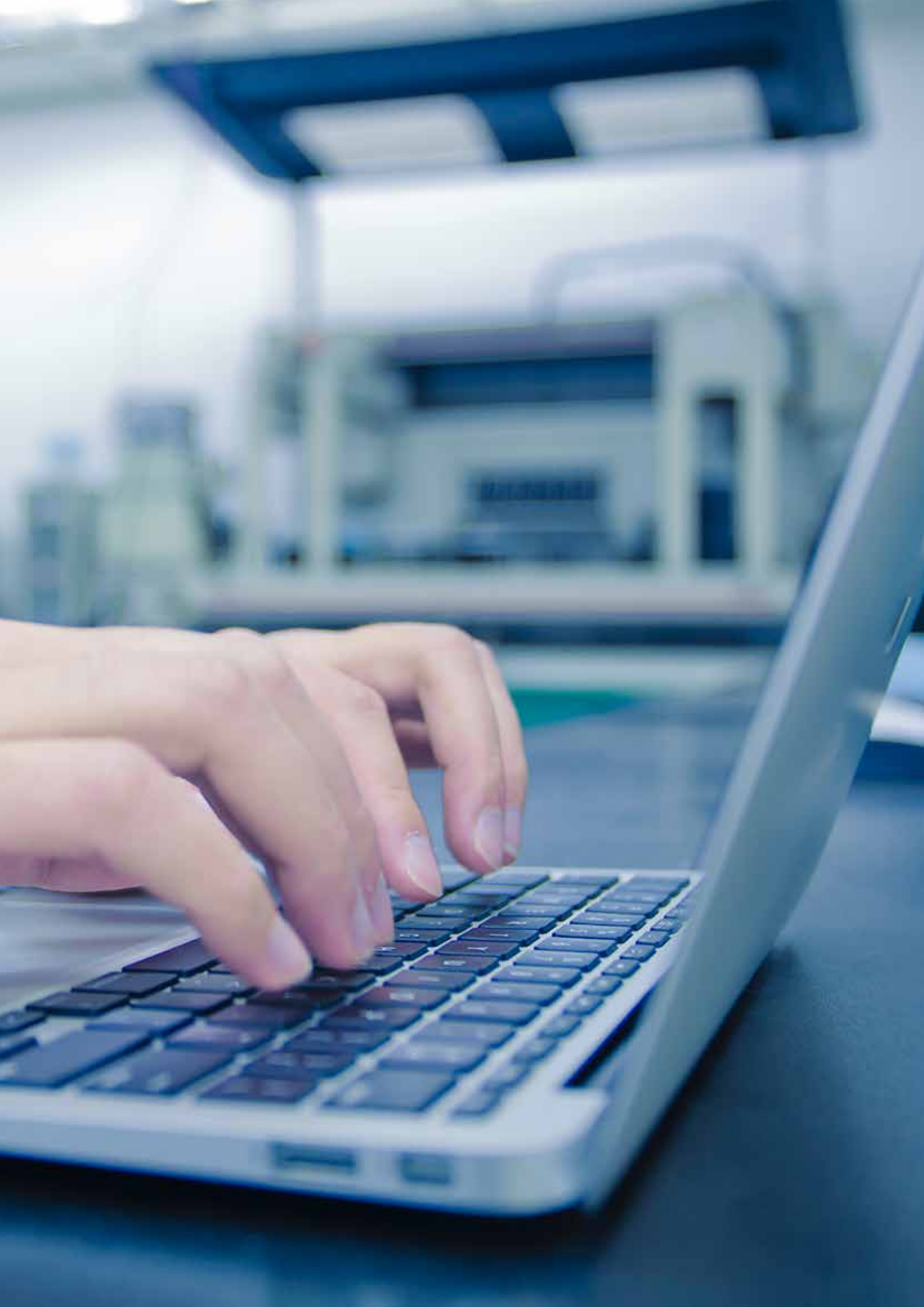

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Appendix A:

NSW Transport

EMBRACING OPEN INNOVATION TO DELIVER REAL TIME TRANSPORT INFORMATION TO THE PUBLIC OF NSW

Transport for NSW

Arrivo Sydney

TripView

pwc

PROBLEM

In a project to put the 'customer at the heart of everything we do', Transport for NSW wanted to deliver real time transport information on customers' smartphones. Based on the scope and requirements of Transport for NSW, the project was likely to cost $1 million+ and take 12+ months to deliver and implement.

SOLUTION

Transport for NSW approached professional services firm PwC to assist them in delivering real-time information of their services to customers. PwC's approach was to solve this business issue through open innovation – collaborating with the wider community to co-create products that they wanted. This enabled Transport for NSW to work hand-in-hand with the software developers that had been recognised as delivering products that were desirable for customers and feasible technologically.

PwC held a highly facilitated open innovation competition, invited targeted communities of software developers in NSW and abroad, and held an event and an assessment process to award prizes (in-kind marketing support) to assist the winning developers. The project was initially piloted with just bus information, but later extended to include trains.

RESULTS

- At the end of the project, Transport for NSW had seven unique solutions to the problem at a fraction of the cost.
- The smartphone apps contained real-time data spanning some 8,200 stops, more than 1,900 buses and almost 1,200 routes across the Sydney Bus Network.
- Within 16 weeks of products going live, Transport for NSW had 1 million customers access real-time information through their smartphones.
- The products spanned 4 different device operating systems (iOS, Android, Windows, Blackberry).

"The process received an overwhelmingly positive response from customers, and also the development community. The process set a new way in how Transport for NSW engaged with third party developers and collaborated to galvanise innovation, customer insight and real time data to develop Apps that ...customers want"

Appendix B:
Simavita

PROBLEM

Urinary incontinence is a serious condition that affects many Australians. In aged care facilities, it is estimated that over 70% of residents suffer from this condition, making incontinence, and the health problems associated with it, the single biggest cost in such facilities. But more importantly, urinary incontinence can have a profound impact on health, safety and quality of life.

Simavita (Aust) Pty Ltd, one of the world's leaders in continence management solutions, had developed a device to better manage this condition — the Smart Incontinence Management (SIM™). Using wireless technology, the small device is fitted to the diaper, and transmits information instantly to carers and the facility. SIM™, in short, takes away the guess work of managing incontinence, allowing aged care providers to better establish an evidence-based care plan for its residents. However, further product development had been completed and needed support to validate this.

SOLUTION

UTS were introduced to Simavita by the NSW Trade and Investment. UTS were needed to review Simavita's medical device in a controlled environment and provide data that could be used to validate the accuracy of the system. The TechVouchers scheme was identified as an ideal way for Simavita and UTS to collaborate on this initial small project, providing matched funding for the research activity.

Dr Bruce Moulton, a wireless technology expert with research interests in aged care technologies, was chosen as Chief Investigator. Under his guidance, 60 test subjects were recruited to take part in a study that simulated a variety of incontinence events.

RESULTS

- Using the data recorded from the study, Simavita were able to validate the accuracy of their algorithms, whilst providing insights into ways to improve their current wireless technology.
- The study helped Simavita deliver a proven solution to improve people's quality of life and the economic burden of aged health care.
- Since then, Simavita have contracted further research with UTS and Dr Moulton, to improve and refine their technology even further and are continuing to explore ongoing research collaborations.

A SMART WAY TO MANAGE INCONTINENCE

Simavita UTS

"Working with UTS has been a great experience because their insightful know-how in conducting field research saved us time in research protocol"

Appendix C:
Sirtex

TARGETED THERAPY FOR TREATING LIVER CANCER

PROBLEM

Liver cancer is one of the most common forms of cancer with over two million patients per year affected worldwide. As with all cancer treatments, the most significant problem to treatments are the incapacitating side effects caused by the systemic nature of radiation and chemotherapies. Therefore targeted therapies have long been the Holy Grail.

To address this problem, Sirtex had developed SIR-Spheres – a medical device used in selective internal radiation therapy (SIRT) for liver tumors. SIR-Spheres are very small radioactive beads about one third the size of a human hair width that are injected into tumors within the liver to deliver targeted internal radiation therapy. The product provides a dose of internal radiation up to 40 times higher than conventional radiotherapy, while sparing healthy tissue. However, Sirtex wanted to establish if heating tumours would increase the effectiveness of SIR-Spheres.

SOLUTION

Collaboration between Sirtex Medical Therapies and Professor Brian Hawkett from the University of Sydney commenced in 2004. Utilising another Australian developed platform technology (the CSIRO developed Reversible Addition-Fragmentation Chain Transfer or RAFT); Professor Hawkett's team pioneered a biocompatible microsphere system that allows the targeted delivery of hyperthermia treatment (THT), which is quite literally killing the cancerous cells through the use of heat.

RESULTS

This technology allows superior heating of microspheres, which leads to:

- Lower doses of material required;
- Increased treatment effectiveness;
- Improved patient safety and comfort; and
- Reduced side effects.

Sirtex has subsequently contracted further research with the University of Sydney and Professor Hawkett, including an investigation into biomedical applications of sterically stabilised magnetic nanoparticles.

Appendix D:
Boeing

DEVELOPING A SAFE, ECONOMICAL AND ENVIRONMENTALLY FRIENDLY COATING SYSTEM

PROBLEM

An aircraft's topcoat is an impervious polyurethane skin which protects the plane from extreme environmental conditions encountered at high speeds in flight – rain, hail, windblown dust and sand. As part of ongoing aircraft maintenance, the topcoat skin is re-coated to preserve its integrity. The topcoat must be mechanically abraded by sanding in order for these subsequent layers to adhere well – this is called reactivation.

The sanding process is:

- Time-consuming;
- Fatiguing and laborious for workers;
- Produces potentially harmful particles; and
- Has the potential to cause damage to the aircraft.

SOLUTION

Boeing partnered with the Commonwealth Scientific and Industrial Organisation (CSIRO) to develop a simple spray-on, leave-on chemical reactivation treatment that not only met the in-service adhesion performance requirements of aerospace coating systems but also the following strict design parameters:

- Cost effective, with improved worker safety and reduced environmental impact;
- Sufficiently robust to be applied on a large scale;
- No interference with the long-term durability of a diverse range of aircraft construction materials; and
- Rapid kinetics to allow direct application of fresh coatings within 30 minutes of reactivation.

As a result, CSIRO developed 'Paintbond' – a spray on and leave on re-coating technology, which specifically targets and reactivates the coating system, providing a surface to which fresh paint layers bond firmly. It is fast, consistent, safe, enables application of fresh paint layers without preparatory mechanical sanding, and can be applied on a large scale.

RESULTS

- CSIRO's expertise in surface and interface molecular design was critical to the development of Paintbond.
- The Paintbond technology has been successfully transferred to Boeing and is used across Boeing's entire commercial aircraft product line, with over 1000 aircraft recoated using Paintbond.
- Paintbond resulted in cost reductions, improved worker safety and a reduced environmental impact compared to previous solutions.
- The technology was instrumental in CSIRO's recognition as Boeing's supplier of the year in 2011.
- A new five year $25 million research program to cover innovations in space sciences, advanced materials, energy and direct manufacturing has subsequently been embarked on.

Appendix E:

GIANT Innovation Campus

FOSTERING COLLABORATIVE INNOVATION IN THE FRENCH ALPS

GIANT INNOVATION CAMPUS

"GIANT is here to churn out innovations, not Nobel Prizes!"

BACKGROUND

GIANT, Grenoble's dynamic campus dedicated to science, technology, and innovation, is a unique public-private endeavour that embodies state-of-the-art understanding of how knowledge is created and brought to bear on the needs of society and the lives of individuals.

The basic concept is simple: bring together some of the brightest minds in a diverse range of technical fields, provide the best tools and facilities for cross-disciplinary research and development, and create a framework for partnerships with innovation-driven corporations and creation of entrepreneurial start-ups.

In support of these activities, GIANT has cultivated an urban environment that provides scientists, engineers, students and entrepreneurs with vibrant, eco-friendly neighbourhoods and access to the natural beauty of the Grenoble region.

GIANT's organisational strategy is built around Centres of Excellence – three that focus on applied research in priority areas (information and communications technology, energy and health), and three that provide support for those efforts in the form of tight links with upstream basic research and access to expertise in the development of new business models. The principle underlying the centres of excellence is to group together on a single site, research activities, industrial interests, technology platforms and academic activity.

These clusters and their support structures are designed to foster operational synergies between researchers, technology facilities, academics and industrialists to provide solutions to some of society's major challenges. Miniatec, which is one of the clusters, brings together 2,400 researchers, 1,200 students and 600 business and technology experts on a 20 hectare state of the art campus. Students also have the opportunity to use state-of-the-art facilities and network with some of the world's leading authorities in key development areas, whether in fundamental or applied research.

GIANT TODAY

- 6,000 researchers.
- 5,000 industrial jobs.
- 5,000 students.
- 300 residents.
- 5,000 publications annually.
- 500 patents annually.
- Grenoble rated as the 5th most inventive city in the world by Forbes (2013).

Appendix F:
UniGateway

PROBLEM

There are many universities in Victoria, making it challenging for businesses to identify and connect with relevant research expertise. Feedback from local businesses indicated that there was no central point of contact to commence their search and the process was time consuming and costly. Identifying the right person to talk to was often trial and error, which was holding many businesses back from collaborating with universities. As a result, many of the discoveries made by researchers were not being applied in real world applications.

SOLUTION

UniGateway is a unique informal consortium of the major Victorian based universities, which was established in 2005 to make it easier for businesses to connect with university expertise. There are three core components of UniGateway: 1) a website portal (www.unigateway.com.au); 2) relationship brokering service; and 3) a series of networking events.

The website contains profiles of the eight consortium partners, (including an overview of research expertise and key contact information), details of government funding mechanisms and a calendar of upcoming events. These consortium partners pay a subscription fee to cover UniGateway operating costs.

Businesses can make enquiries through the website's contact form to identify research expertise. This expertise may be related to any of the following: contract research, licensing of intellectual property, consulting services, accessing various grant funding and seeking graduates. Alternatively, businesses may go directly to UniGateway's Executive Officer or one of the university representatives (identified on the website).

Any enquiries made to UniGateway are attended to by an offline relationship broker, who helps contextualise the businesses problem and connect them with motivated and experienced researchers. Initial responses are provided within 48 hours and referrals are circulated to all universities to identify suitably qualified researchers. An initial meeting is then organised to identify who is the best fit for the business. This sometimes requires collaboration between two or more universities.

UniGateway also hosts a number of networking events in partnership with sponsors, including a business breakfast series that covers topics identified by attendees as important to their business. Many of the events include presentations by researchers within the Victorian universities, to expose businesses to the expertise available, as well as relevant business case studies. Through its partnership with the Victorian State Government, UniGateway helps connect businesses with funding mechanisms, such as the Innovation Voucher Program.

It was not an easy road initially, and a number of challenges were overcome to get UniGateway up and running. One of the key challenges in the early stages was getting all universities to work together towards the same goal and having willing participants at each university to champion the connectivity drive. Furthermore, UniGateway had to demonstrate that it could provide a valuable return on investment (cash or in-kind) for all involved. The role of the relationship broker or 'gate-keeper' (currently the Executive Officer), has been of paramount importance in developing and nurturing relationships for effective collaborations.

CONNECTING BUSINESS WITH VICTORIAN UNIVERSITIES EXPERTISE

unigateway.com.au

RESULTS

- Has facilitated an increase in business-university connectivity, as well as an increase in interactions between Victorian universities.
- Introductions made through UniGateway have resulted in positive outcomes, as evidenced by user feedback.
- Has helped connect more Victorian businesses to government funding mechanisms, driving more demand-led innovation.
- Registrations at UniGateway events have consistently exceeded 100 people.

A small sample of feedback received provides an idea of the perceived value of UniGateway:

"It is so great to be able to talk to all the universities at the one time and have someone do the leg-work for me in finding who I should be talking to within each"
"Thanks very much for providing this invaluable service"
"...our interest in co-operating via UniGateway is genuine"
"Thank you for your kind offer of assistance with my grant application"

Appendix G:
Coalfacer

CREATING A TWO-SIDED MARKETPLACE FOR RESEARCH EXPERTISE

www.coalfacer.com

PROBLEM

While, industry is aware that universities have significant knowledge that can propel business growth, they find it difficult to connect with researchers. University and government responses to this issue have been typically driven on the research supply side. However, for an active market to thrive there needs to be willing buyers and sellers.

SOLUTION

Coalfacer, a technology start-up is creating a solution to the match-making problem by developing a double-sided online marketplace to connect industry with researchers. This will enable both sides to ask for and offer research services, focusing on both supply and demand.

Once the marketplace is developed, it is expected that researchers, companies and students can create proposals for expertise, funding or hands-on learning experiences. Companies will be invited to present challenges that could form part of a long-term research project. Equally, students can express their interest in obtaining an internship to develop hands-on learning experiences, and researchers can seek partners to help commercialise their discoveries.

In addition, it is expected the marketplace will include a criteria searchable platform to identify relevant research discoveries developed in Universities (IP Gallery), case studies of successful collaborations, and content from industry specialists and toolkits to help put a research project together (incl. template agreements and engagement guides).

The start-up has interviewed and run workshops with universities and companies across Australia to understand the needs for a marketplace. Borrowing techniques and approaches from a prior career in law, investment banking and structured finance, and having tested the process with leading universities in the UK, Coalfacer's owner believes they can offer an independent, simple process to foster greater engagement between research and industry.

The benefits Coalfacer expect to offer, once the marketplace goes live includes:

- Connecting researchers with industry partners who share their research interests.
- Offers a means to realise the value of otherwise unutilised technologies developed in universities.
- Making research engagement more accessible by reducing the proximity barriers.
- Academic projects are enabled with a focus on real world challenges and helps researchers build relationships with potential employers.

NSW Business Chamber

Tracing our heritage back to 1825, NSW Business Chamber's mission is to create a better Australia by helping businesses maximise their potential. The Chamber is a passionate advocate for business in the public arena: whether standing up to government and decision makers when business interests are neglected or working together to create positive change.

On a one-to-one basis, the Chamber helps all businesses from small enterprises to large corporations. Our commercial services division, Australian Business, delivers a range of business services to both member and non-member clients throughout Australia, with the operating surplus going back to supporting Chamber initiatives. In all, we believe it's important for Australia's business community to succeed, because prosperity creates new jobs, social wealth, and better communities in which to live.

- Local, regional, state and national coverage
- Public policy and advocacy.
- Reducing complexity to manage risk
- Empowering business through connections, knowledge and expertise.

Let the NSW Business Chamber team be an extension of your business so you can concentrate on what you do best – growing your business.
For more information: nswbusinesschamber.com.au

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July 2014