Australian Government
Department of Education, Skills and Employment

University Research Commercialisation

Consultation paper

We are seeking views on the development of a model for university research commercialisation (URC) and possible mechanisms to incentivise and increase partnerships between businesses and universities. The issues, rationale and key design elements of a new scheme are outlined below with some discussion questions which could be used as a prompt to guide your submission (summary of questions is at Attachment A). Please email your submission (of no more than 1,500 words) to the Department of Education, Skills and Employment at urcs@dese.gov.au.

Please advise in your email whether you consent to your submission to be made publicly available. Submissions which do not state that they can be made publicly available will not be published to the department's website.

Submissions on the URC consultation paper will close at 11.59pm AEST Friday, 9 April 2021

Submissions, as well as input from numerous stakeholders will be fed into a scoping study that outlines options for a new model. The scoping study will be presented to Government later in the year for consideration and decision on next steps of implementation.

> "We want to provide a platform and a pathway for our talented researchers to partner with you, with businesses all around the country and to apply their intellectual firepower as research entrepreneurs."
>
> - The Hon Scott Morrison MP, Prime Minister, Virtual Address to the Business Council of Australia AGM, 19 November 2020

Purpose and background

Importance of research commercialisation

The translation and commercialisation of research (see Figure 1) produces great social and economic benefits.

Figure 1: Innovation pipeline

Where knowledge is passed along the translational pathway that may or may not lead to commercial return.

The process through which research is transformed into marketable products, capital gains, income from licenses and/or revenue from the sale of a product.

'Commercialisation' in this context is supporting the translation and adoption of research that leads to commercial benefit for the Australian community, business and the university research sector.

The commercialisation of a product can yield profit, inspire new businesses and create jobs. In 2019, Australian research organisations generated over $176 million in commercialisation revenue, and 42 new spin-out companies and start-ups.[1] Improving commercialisation of research will increase the scale of these economic returns.

Spin-out companies and start-ups from research organisations can grow into large, profitable companies, as well as feed directly into existing businesses. While the adoption of new research is of commercial benefit to businesses, the application of new technologies and innovations through research helps to push Australian businesses toward the global productivity frontier.[2] Businesses who invest in research are more productive, with the turnover growth for high R&D intensity firms between 5.9 to 7.3 times higher than low R&D intensity firms.[3]

Now is the opportune time to drive improvements in commercialisation of research. Australia's innovation is critically important to the long-term success of our nation, but particularly in the short to medium term COVID-19 recovery. Focusing effort on commercialisation will boost the economy and optimise community benefit from public investment in research.

[1] Knowledge Commercialisation Australasia, *Survey of Commercialisation Outcomes from Public Research (SCOPR),* 2020.
[2] OECD, *Frontier Firms, Technology Diffusion and Public Policy: Micro Evidence from OECD Countries*, 2015.
[3] Department of Industry, Science, Energy and Resources, *Australian Innovation System Report,* 2017.

Australian performance in research commercialisation

With Australian scientists producing ground-breaking research every day, there are ample opportunities for Australia to capture commercial benefits. In the past year alone, Australian scientists have led breakthroughs that could lead to an early diagnostic test for Alzheimer's disease, improved reliability of quantum computers, and greater detection of improved threats such as drone technology. Almost 90 per cent of Australian research is rated at or above world standard, and research strength is demonstrated in numerous areas, including medicine and health sciences, biological sciences, engineering, agriculture and archaeology.[4] Most of this research excellence is driven by universities.

Australia has a higher proportion of research undertaken in higher education institutions than key comparable nations.[5] Of the $33 billion that Australia invests per year in R&D, universities undertake around one-third of this activity.[6] Australian universities are outstanding in knowledge creation, ranking 9th out of 31 OECD countries for our presence in the top 200 list of world universities.[7]

Excellence in research, however, does not necessarily lead to excellence in research commercialisation, either with existing businesses or through the creation of new businesses.[8] The 2020 WIPO Global Innovation Index ranks Australia as the 23rd most innovative country overall.[9] Our input is strong, but we are 40th when it comes to knowledge and technology outputs. Australia performs well in knowledge creation but poor in translating this knowledge into new products or other innovations.

Industry-university collaboration is a key mechanism for the translation and commercialisation of research, as knowledge is transferred between sectors resulting in innovation. Metrics on the extent of collaboration indicate that Australia needs to improve its performance in industry-university collaboration if we want better commercial outcomes. Only 1.6 per cent of innovating business in Australia collaborate with our world-class university research,[10] just 2 per cent of articles were published with academic and corporate co-authors in 2017 (ranked 25th out of 35 OECD countries), and 3.9 business enterprise researchers were (full-time equivalent) employed per thousand in industry in 2017 (23rd out of 34 OECD countries).[11]

Whilst the Australian Government has incrementally increased collaboration and commercialisation through initiatives such as the Medial Research Future Fund (MRFF) and innovation programs through CSIRO, focusing on university research will be a new approach to solving this problem. With over 80,000 people devoted to R&D[12] working across 42 research-active universities producing

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[4] Universities Australia, *Clever Collaborations*: *The Strong Business Case for Partnering with Universities,* 2020.
[5] Innovation and Science Australia, *Australia 2030: prosperity through innovation,* 2017.
[6] Australian Bureau of Statistics, *Research and Experimental Development, Higher Education Organisations*, 2020.
[7] OECD, *Main Science and Technology Indicators*, Vol. 2019/2.
[8] Innovation, Science Australia, *Performance Review of the Australian Innovation, Science and Research System*, 2016.
[9] WIPO, *Global Innovation Index: Australia*, 2020.
[10] Department of Industry, Science, Energy and Resources, *Australian Innovation System Monitor*, 2020.
[11] OECD, *Main Science and Technology Indicators*, Vol. 2019/2.
[12] In person years of effort (PYE), equivalent to a full-time employee whose times is wholly dedicated to R&D. Australian Bureau of Statistics, Research and Experimental Development, Higher Education Organisations, Australia, 2018.

outstanding research, universities present the greatest opportunity to increase the commercialisation of our research endeavour.

Barriers to university research commercialisation

The commercialisation outcomes for university research are driven by a balance of economic and social incentives which provide signals to the university research sector, the business sector and the Australian community. The current education, research and innovation settings within the system are targeted more toward pure research than commercialisation and do not always foster a culture of industry engagement and collaboration. To encourage and accelerate university commercialisation outcomes the existing paradigm will need to shift, whilst also maintaining our investment in research excellence and basic research.

Universities

While universities increasingly invest in research that has social and economic impact,[13] they have weak incentives to commercialise research which has commercial potential. Revenue from international students is influenced by global rankings, which in turn are linked with publication output. Universities have strong incentives to increase their publication impact, but not their commercialisation outcomes. Universities also lack capability to commercialise research, with most researchers lacking experience working with industry. [14] An innovation culture has not been fostered within Australian universities, with performance management and rewards focused on quality of academic output and citations.

Business

Business investment in R&D is low in Australia compared to international peers.[15] Most businesses prefer to invest in research in-house than collaborate with universities. The risk appetite for R&D investment is low, with businesses reluctant to invest in research that has potential for failure. The Australian market is also constituted by a high proportion of small to medium enterprises (SMEs) who have less capacity than larger businesses to take the time and financial risks associated with engaging with research. Businesses report difficulties in engaging with universities such as cultural and skillset differences, barriers with intellectual property and regulation.[16]

Government

Grant application processes are more geared towards academic rather than commercialisation objectives. Government university research funding is allocated largely to projects over a long period of time with no evaluation or assessment for commercial impact. Timeframes, process and effort required to obtain research grants can deter businesses from engaging and collaborating with universities and academics.

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[13] Thomas Barlow, *The Future is Black and White,* 2020.

[14] Innovation and Science Australia, *Performance review of the Australian innovation, science and research system*, 2016.

[15] Innovation and Science Australia, *Stimulating business investment in innovation,* 2020.

[16] Innovation and Science Australia, *Performance review of the Australian innovation, science and research system*, 2016.

Key design elements of a new scheme

International governments have been increasing their focus on funding programs that increase their national research impact. International experience demonstrates that commercialisation works well when there is strong collaboration between industry and academia, alignment of funding directed towards clear objectives or challenges, and sufficient quantum or scale of investment, by both industry and government.

A new model to improve the commercialisation of university research needs to consider these issues, as elaborated in the below sections:

1. Mission-driven research
2. Stage-gated design
3. Incentives for participation
4. Industry-university collaboration
5. Governance

1. Mission-driven research

Prioritisation of research funding can raise the efficacy of programs as effort is directed to areas of national importance. Internationally, there is an increasing focus on challenge or mission-based innovation demonstrated through examples such as the German Hightech-Strategie, the Japanese Moonshot Research and Development Programme, and the UK's Grand Challenges. Mission-driven research occurs when an organisation sets a goal to solve a critical, complex challenge, and researchers in the public and private sectors strive to achieve it. Mission-driven research has three distinguishing features:

- It is based around a Challenge, usually set by a government agency and/or group of experts
- It specifically seeks to create markers for new products and services, firms and/or industries
- It seeks to link demand and supply side policy interventions.

Example - UK Grand Challenges

The UK has developed four Grand Challenges as part of their industrial strategy, with more specific, ambitious missions to tackle the Grand Challenges.

- Artificial Intelligence and Data Mission: Use data, Artificial Intelligence and innovation to transform the prevention, early diagnosis and treatment of chronic diseases by 2030.
- Ageing society Mission: Ensure that people can enjoy at least 5 extra healthy, independent years of life by 2035, while narrowing the gap between the experience of the richest and poorest.
- Clean growth Mission: At least halve the energy use of new buildings by 2030; establish the world's first net-zero carbon industrial cluster by 2040 and 4 low-carbon clusters by 2030.
- Future of mobility Mission: Establish the world's first net-zero carbon industrial cluster by 2040 and 4 low-carbon clusters by 2030.

Example – Japanese Moonshot Research and Development Programme Missions

The Moonshot programme will promote high-risk, high-impact R&D through a stage-gate investment process to accelerate Japan's research commercialisation. The ¥117 billion (equivalent to AUD$1.5 billion) aims to achieve ambitious Moonshot goals that solve issues facing future society. These are:

- Realisation of a society in which human beings can be free from limitations of body, brain, space, and time by 2050.
- Realisation of ultra-early disease prediction and intervention by 2050.
- Realisation of AI robots that autonomously learn, adapt to their environment, evolve in intelligence and act alongside human beings, by 2050.
- Realisation of sustainable resource circulation to recover the global environment by 2050.
- Creation of the industry that enables sustainable global food supply by exploiting unused biological resources by 2050.
- Realisation of a fault-tolerant universal quantum computer that will revolutionize economy, industry, and security by 2050.
- Realisation of sustainable care systems to overcome major diseases by 2040, for enjoying one's life with relief and release from health concerns until 100 years old.

The scoping study will identify areas of national priority to focus commercialisation effort. Given our aim is to commercialise research and achieve greater connection between university research and business, selected areas of national priority should align with areas of commercialisation opportunity and business need. The recent selection of priorities for the Low Emissions Technology Statement highlights one way to inform selection of Missions.

Example - Low Emissions Technology Statement

Australia's Technology Investment Roadmap is an enduring strategy to accelerate the development and commercialisation of new and emerging low emissions technologies. The selection process consisted of Government appointed an expert advisory panel which consulted with stakeholders and consolidated that feedback with expert advice in its advice to Government. Many technologies were presented to the panel but only five were selected as priorities, based on the following filters:

- Australia's comparative advantages
- Scale of economic benefit
- Technology readiness
- Abatement potential.

Within each technology, a 10-15 year stretch goal was identified. The statement is proposed to be updated each year.

The number of Missions to be supported, the size of the Missions, whether they should be supported by smaller targeted Challenges, the process of selection, and other design and governance elements should be considered in the scoping study.

Discussion questions

a) Are Missions the appropriate priority-setting mechanism? Should they be accompanied by smaller, targeted Challenges?

b) What criteria should be used to select Missions?

c) Is Australian research sufficiently linked to demand? Where are the opportunities to link supply to demand?

d) How can university researchers identify this demand?

2. Stage-gated Scheme design

The risks involved in the development and commercialisation of very early-stage scientific research are often too high for businesses to justify funding the necessary development. This gap, colloquially referred to as 'The Valley of Death', has been identified as a major barrier to commercialisation in Australia.[17] This problem is not unique to Australia, with many Governments addressing this gap through providing funding for high-risk research.

Example - Canada's Industrial Research Assistance Program (National Research Council)

Canada's IRAP connects Canadian small and medium-sized businesses to financial assistance, advisory services and R&D experts to develop and commercialise technologies for market. The Accelerated Review Process (ARP) is designed to enhance market competitiveness of smaller firms through exploratory R&D projects tackling internal technical challenges. Research grants of up to $CAD50k can be used for prototype engineering, feasibility studies for new services/products, or development of technologies to improve internal processes. This is supported by funding for mid-sized technology innovation projects of up to $CAD10million to facilitate applied research and experimental development.

Example – United States' SBIR program

In the USA, the Small Business Innovation Research program solves a common gap in commercialisation by helping SMEs identify business needs and supporting them to develop solutions through research collaborations. The program operates through a competitive, award-based program which includes three phases. The objective of Phase I is to establish the technical merit, feasibility and commercial potential of the proposed R&D, and Phase II may further invest in projects based on results achieved to date and the project's ongoing scientific and technical merit, and commercial potential. Funding of up to US $250k and $750k can be received for Phase I and II, respectively. The objective of Phase III seeks to pursue commercialisation objectives, and no funding is provided. SBIR funds US$2.6 billion of projects per year, with funding sourced from federal government agency investment. Over the first 30 years of the program, SBIR grants engendered 70,000 issued patents and supported the launch of almost 700 public companies, with those companies attracting approximately $41 billion in subsequent venture capital investment.

While it is not expected that taxpayers should bear all risks of commercialising research endeavours, it is clear that Government-administered programs have an important role to de-risk research projects in the national interest. Specifically, by investing in research at Technology Readiness Level (TRL) 4-7,[18] critical research can be accelerated to a stage where business and investors are more likely to be able to assess the potential for commercial opportunities and utilisation in their own settings. A Scheme to commercialise university research should fill a gap in the current research commercialisation landscape by funding translational research; progressing ideas from early-stage research into a product that shows proof of concept and viability for industry partnership and investment.

A stage-gated process like that used in the United States and Japan may be an appropriate model in the Australian context. To incentivise greater risk-taking and innovation, initial short-term funding (Stage 1) would be required for projects to demonstrate feasibility or proof of concept. Longer term funding would then be required for projects that have shown proof-of-concept and need to be

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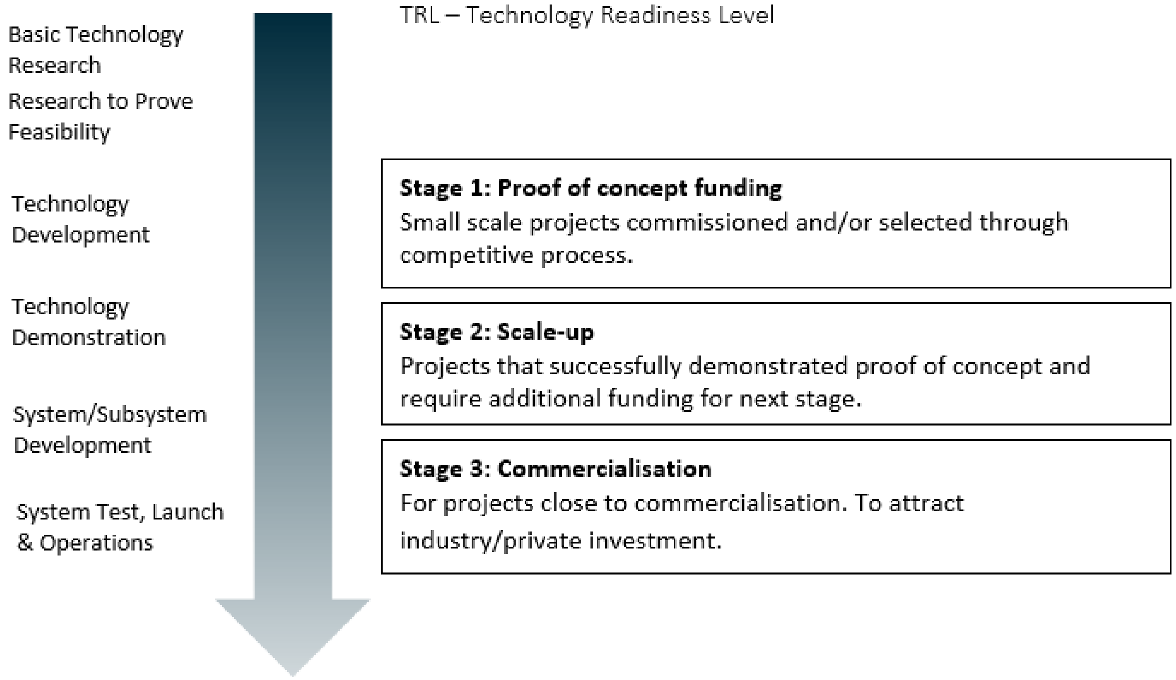
[17] Innovation and Science Australia, *Australia 2030: prosperity through innovation*, 2017.

[18] NASA, *Technology Readiness Level Definitions.*

scaled-up or further developed to sufficiently de-risk later investment (Stage 2). This "fast fail" funding mechanism would prioritise larger scale funding for the projects showing the greatest promise for commercialisation, supported through the Scheme's governance arrangements. For projects to be successfully commercialised, substantial funding is often required. Funding mechanisms such as venture capital investment or contingent loans may be considered for Stage 3 of large-scale commercialisation funding. This is the stage that co-investment by businesses and private investors would be sought.



Discussion questions

a) Is a stage-gated model suited for the purpose of the Scheme?

b) What is the appetite from industry and private investors to participate in such a Scheme?

c) How should any stage-gating process be defined to ensure any additional incentive is maximised?

d) How should projects be selected?

e) How should the success of projects be measured?

3. Incentives for Participation

The effectiveness of the Scheme will be influenced by broader incentives for businesses and universities such as those discussed in the 'Barriers to university research commercialisation' section, which should be considered in its design. Incentives and frameworks for participation can drive participation and behaviour that aligns with the Scheme's objectives.

Example – Canada's Strategic Innovation Fund

A Strategic Innovation Fund provides funding for large-scale, transformative and collaborative projects. It provides a $1.26 billion investment over five years, with co-funding sought from applicants. The Fund offers financial contributions valued at up to 50 per cent of project costs. Applicants include Canadian businesses and non-profit organisations. Since the program's inception in 2017, 68,000 direct jobs have been created and maintained.

Example – NZ Pre-Seed Accelerator Fund

The Pres-Seed Accelerator Fund allows new ideas to be developed and proven (de-risked) to a stage where businesses and investors are more likely to be able to assess the potential for commercial opportunities. At least 50 per cent co-funding is required. This may come from research organisations or private sector contributions. A 10 year review of the Pre-Seed Accelerator Fund found that the government directly contributed about one third of investment, approximately 20 per cent was sourced from external investors (mostly private), and half was sourced from research organisations.[19] Co-funding requirements for research organisations means they are incentivised to identify the best ideas to fund and the most efficient and effective pathway to commercial outcomes.

The current university system is incentivised to deliver and reward research excellence more than research commercialisation. To shift this emphasis, should existing incentives for commercialisation within a Scheme outweigh publication incentives? Should universities have "skin in the game" to provide an incentive for universities to identify the best ideas to fund and the most efficient and effective pathway to commercial outcomes?

While business and private investors might be willing to participate in the Scheme due to the de-risking of investment opportunities, they would also be expected to co-fund projects leading to commercialisation. Encouraging business participation in the Scheme may present a challenge if businesses do not have a clear line of sight to how such investment would raise their productivity.

Discussion questions

a. What broader incentives influencing the business and university sectors may influence their participation in a Scheme?
b. What would motivate businesses, universities or private investors to invest in this Scheme?
c. Aside from co-funding, should universities or businesses have any additional requirements for participation?

4. Industry-university collaboration

A Scheme may drive broader culture change across the business and university sectors by enabling or incentivising industry-university collaboration. International models have enabled collaboration through co-location of facilities or incentivise collaboration through co-funding requirements.

Example – UK Catapult Network

The UK's Catapult Network bridges the gap between research and industry with physical centres that boast cutting-edge R&D infrastructure – including laboratories, testbeds and factories. With 40 locations across the UK, in major cities and regions, Catapult hubs have led to innovation across domains such as medicines discovery, high value manufacturing and satellite applications. Since 2013, Catapult has supported more than

[19] Ridley Insight Ltd, *Pre-Seed Accelerator Fund Outcomes 10 Year Review,* 2014.

8,000 SMEs to collaborate and innovate across industry and with researchers and generated more than AUD$1bn in R&D investment.

Barriers to industry-university collaboration include a lack of financial, time or workforce resources needed to collaborate, regulatory and intellectual property barriers, information asymmetry where businesses and universities are unaware of what they can offer each other, a lack of workforce skills to engage with sectors, and others. [20]

As collaboration between sectors will be needed for the Scheme to be successful, consideration into how the Scheme will enable or support collaboration is needed. Broadly the Scheme will help incentivise collaboration through funding mechanisms, however other enabling factors may be needed. For instance, universities might consider rewarding researchers who have achieved success in industry-based commercialisation for academic promotions, encouraging greater mobility between sectors, as well as greater engagement. Part of the Scheme may support PhD students to undertake industry research to drive industry-university collaboration. The Scheme may consider how it may act as a broker between industry and university, reducing information asymmetry.

> "Our government has invested more than $10 billion in research and the people who power it. With that historic investment, we recognized that remaking Canada's science and research culture is a huge and complex undertaking. The National Research Council's commitment to creating connections between universities, industry, and researchers is helping us to make this shift, while at the same time, it's creating the skills and training environments for the jobs of the future."
>
> - The Honourable Kirsty Duncan, Minister of Science and Sport

Discussion questions

a) How may the Scheme incentivise or support better industry-university collaboration?

b) Would an Industry PhD program help improve collaboration outcomes?

c) Are there skills gaps in academia or business that inhibit collaboration or commercialisation?

d) How can we increase collaboration between university researchers and industry, particularly amongst SMEs?

5. Governance arrangements

Governance arrangements must be carefully designed to support the key design elements of the Scheme, and so will very much be informed by the outcome of the above design elements. Who selects projects for funding, who selects Challenges, and the level of co-funding will all feed into a final governance model.

[20] Innovation and Science Australia, *Performance review of the Australian innovation, science and research system*, 2016.

Discussion questions

a) What stakeholders should be involved, and where, in the governance arrangement?

b) What type of Governance arrangement is best suited for the Scheme?

c) How should projects be selected and managed?

d) How can the Governance arrangement minimise administrative burden whilst also minimising risk?

Attachment A: Summary of discussion questions

1. Mission-driven research

a) Are Missions the appropriate priority-setting mechanism? Should they be accompanied by smaller, targeted Challenges?
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