Australian Innovation Systems Overview 2023

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The Growth Drivers

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1 | Background

1.1 | Introduction & Overview of the Australian Innovation Ecosystem

Innovation stands as a paramount force driving human progress, productivity, and economic growth in the modern world. By constantly pushing the boundaries of what is possible, innovative technologies have transformed industries, revolutionized daily lives, and opened new horizons for humanity. Whether it be the development of vaccines for the elimination of diseases such as smallpox and polio, the development of internal combustion engines and airplanes to increase global mobility or the development of the internet to connect people and exponentially increase information sharing, all these benefits are a result of innovation. Innovation's role in shaping societies and propelling advancement cannot be overstated, hence governments around the world are constantly launching initiatives and incentives to encourage and support more of it.

Australia has long recognized the importance of fostering an innovative ecosystem to drive economic growth and remain globally competitive[1]. Over the past several decades, the country has implemented key reforms and initiatives to strengthen its innovation system. One critical aspect of this system has been the focus on research commercialisation, enabling the transformation of groundbreaking research into tangible products, services, and industries. This report delves into the evolution of Australia's innovation system and highlights key reforms, initiatives, and activities that have propelled the country to its current state.

One of the best understood aspects of any nation's innovation system is the role of research and development (R&D). The structure and role of R&D in Australia, both public and private, is a fundamental pillar of the national innovation system. Australia's innovation journey can be traced back to the oil shock of the early 1970s when the country recognized the need to shift from a resource-driven economy to a knowledge-based one, with investment in R&D and knowledge creation a core focus. This realization prompted significant investments in R&D and led to the establishment of various institutions and programs to support innovation. However, it wasn't until the 1980s that Australia began to actively promote research commercialisation and the transfer of technology from academia to industry[2].

Australia's innovation system has undergone significant transformations over the past several decades, driven by the nation's desire to foster economic growth, technological advancements, and commercialisation of research outcomes. A recent Australian innovation and science research system report has concluded six key enablers that facilitate innovation activities, being; policy, money, infrastructure, skills, network and culture[3]. Furthermore, key actors across the

[1] https://www.industry.gov.au/sites/default/files/2018-10/performance-review-of-the-australian-innovation-science-and-research-system-isa.pdf
[2] https://www.oecd.org/science/inno/2373881.pdf
[3] https://www.industry.gov.au/sites/default/files/2018-10/performance-review-of-the-australian-innovation-science-and-research-system-isa.pdf

ecosystem from educators, researchers, governments, entrepreneurs, not for profits, business and investors are identified as pivotal in knowledge creation, transfer, and application to achieve impact (See Figure 1). There is no such thing as a silver bullet for research commercialisation, it is the combination of these inter-related matters that enable innovation within an ecosystem.

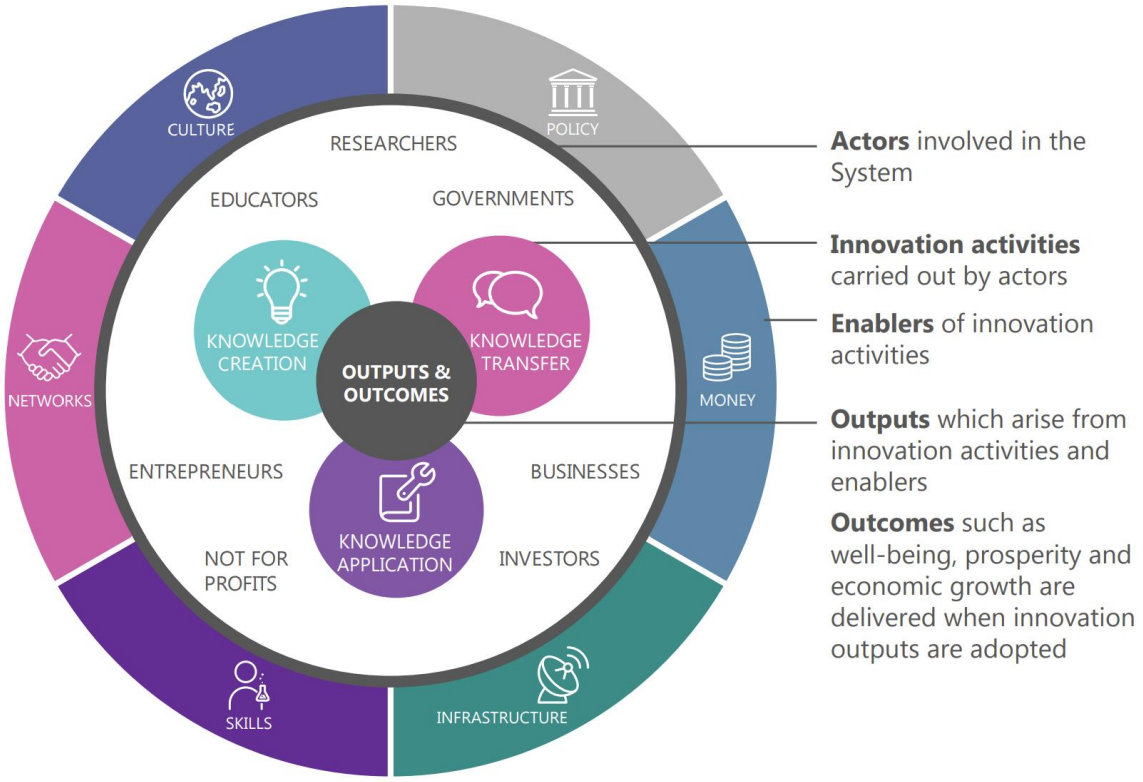

Figure 1: Key enablers of innovation activities within the Australian ecosystem[4]

1.2 | Australian Science Commercialisation Policy & Governance

In general, Australia performs highly across typical indicators of federal regulatory policy and governance[5]. The Australian business environment ranks very highly for regulatory quality, ease of doing business and has one of the world's most efficient stock markets and strongest financial, banking and competition regulations globally. Australian regulatory policies and governance frameworks are not seen as a major barrier to innovation by Australian businesses and deemed generally supportive. This manifests in many forms, one very clear example in research commercialisation are the 'light touch' policies adopted for publicly funded research commercialisation outcomes.

[4] https://www.industry.gov.au/sites/default/files/2018-10/performance-review-of-the-australian-innovation-science-and-research-system-isa.pdf
[5] https://www.industry.gov.au/sites/default/files/2018-10/performance-review-of-the-australian-innovation-science-and-research-system-isa.pdf

Specifically, major science research grant programs such as the Australian Research Council (ARC)[6] and National Health and Medical Research Council (NHMRC)[7] bestow upon the publicly funded research organisations (PFROs), full ownership and commercialisation rights of intellectual property created through science grants funded by these federal programmes. This provides PFRO's commercialisation offices full autonomy with respect to the;

- Identification of any new intellectual property (IP)
- Process and strategy with respect to formal / informal protection of IP
- Commercialisation strategy of new IP
- Financial terms of transaction utilising IP (i.e. licence, acquisition, start-up company)

A very distinct advantage of this decentralised approach is the speed at which commercialisation activities can take place by mitigating red-tape and time-consuming decision-making processes. Smaller and more nimble commercialisation offices can file formal IP protection and attract investment in new opportunities in the space of weeks to months. In comparison, many federally funded grant programs can take 6+ months from application to decision to legal agreements to commencement of research activities. The timely execution of commercial deals between academia and industry is pivotal, to ensure key opportunities for licencing or investment are not lost and facilitates the rapid dissemination of new knowledge into the marketplace.

Decentralised commercialisation administered by the PFRO, also permits more flexibility around key commercialisation deal terms. Centralised administration, managed by the Federal Government, would be far more challenging given the broad range of research interests (i.e. medical devices, therapeutics, artificial intelligence etc) and different stages of technology readiness level[8]. This also allows PFROs to establish specialist commercialisation offices and expertise in areas that a university may have research excellence, to maximise commercialisation effectiveness, impact and financial return for the university. For example, one of the most successful commercialisation offices globally is UniQuest from the University of Queensland[9]. They have established specialist life science, food and agriculture, physical science, and humanities & social science commercialisation teams that have the autonomy to design and implement commercialisation plans bespoke to the opportunities they are managing [10].

Determination of the value of new IP crated through R&D is often a fiercely debated topic at the negotiating table. However, hundreds of deals across the Australian university sector have shown there is no one-size-fits-all solution. The value of IP may be dependent on a wide range of factors, including market comparables of similar deals, breadth of IP portfolio, size of market opportunity, competitive investment interest, technical and commercial readiness, quality of the team etc. Having a decentralised approach to commercialisation allows the PFRO to determine the most suitable value for any given transaction.

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[6] https://www.arc.gov.au/
[7] https://www.nhmrc.gov.au/
[8] https://www.twi-global.com/technical-knowledge/faqs/technology-readiness-levels
[9] https://uniquest.com.au/uniquest-commercialises-university-research-to-create-change/
[10] https://uniquest.com.au/commercialisation-2/

The decentralised approach shifts the resource and financial burden of commercialisation activities away from the federal government and onto the PFRO. Whilst most, but not all, commercialisation offices are a loss-making division within the university, they create tremendous impact through the translation of research outcomes that is used in marketing to attract researchers and students and to invest in follow-on R&D. International student education in Australia is one of the country's largest exports, earning $40.3 billion and supporting around 250,000 jobs in 2019[11]. In the case of a successful financial outcome form commercialisation activities, it also allows the universities and inventors to share in the proceeds and incentivisation to both stakeholder groups.

1.3 | Financial Returns from Research Commercialisation & contribution to broader innovation ecosystem

Despite Australia having a relatively well established and mature research commercialisation ecosystem, Australian National University policy expert Andrew Norton has said it is never likely to be a major source of revenue for either universities or the broad economy. While university accounts were "opaque" about commercialisation, revenue from royalties and licences had totalled just A$136 million in 2019[12]. This is against a backdrop of $12.2B in expenditure on research and development, employing over 80,000 people devoted to R&D at Australian Universities[13,14].

Some key figures from a recent report in the US[15], indicates that some $75.3 billion / year is spent by academia on research. In 2016 this expenditure accounted for just 2% of the total patents granted, suggesting patenting by academic inventors as being relatively limited. In addition, US universities spun out on average 550 startups per year, which accounted for just 0.1% of the ~400,000 annual startups reported by the Bureau of labour statistics. From a purely financial return perspective, Stanford University, one of the world's best universities for innovation, earned just $41M in royalties from licencing when the institution has an annual operating budget of $11.6 Billion. Financial returns attributed to commercialisation are highly skewed to a small number of success stories with 8% of research institutions accounting of 72% of all financial returns.

Clearly, direct financial return to universities from commercialisation is often challenging and inconsistent. However, industry–university collaboration in Australia is a key mechanism for the translation and commercialisation of research. Cross-sector collaboration has been modelled as resulting in $10.6 billion in revenue for businesses, representing a return on investment of $4.50 for every dollar invested in collaborative research with a university. Such a return on

[11] https://www.education.gov.au/university-research-commercialisation-package/resources/research-commercialisation-action-plan
[12] https://www.timeshighereducation.com/news/canberra-tells-sector-refocus-blockbusters
[13] https://www.education.gov.au/university-research-commercialisation-package/resources/research-commercialisation-action-plan
[14] https://www.universitiesaustralia.edu.au/media-item/unis-lift-national-research-effort/
[15] https://hechingerreport.org/think-universities-are-making-lots-of-money-from-inventions-think-again/

investment has added $26.5 billion to the Australian economy in 2020 and supports 38,500 full-time jobs[16].

[16] Universities Australia, *Clever collaborations: the strong business case for partnering with universities*, Universities Australia, 2020, accessed 2021

2 | Promoting R&D and Investment through Incentives or Regulations?

Australia has implemented a range of incentives to foster R&D, encourage innovation, and attract investment. The speed and uncertainty bought about by innovation often challenges the traditional models of regulation. Regulate too quickly and risk stifling innovation, regulate too slowly and bad actors may take advantage of an environment and lead to undesirable consequences. Robust regulation requires time, and humility in the face of uncertainty and aspires to manage the competing interest of all stakeholders across the ecosystem. The Australian government does not have strict whole-of-ecosystem regulations around innovation, but rather a brad range incentives, programs and grants which have their own specialised rules to best suit the sector, stage or part of the innovation ecosystem they support.

Of the many innovation initiatives developed by the Australian government, five key initiatives will be explored further in this report as outlined below. These initiatives are an example of the more impactful incentives / grants / programs that address critical gaps in R&D, commercialisation, investment and university - industry collaboration in Australia.

- The R&D tax incentive,
- Federal commercialisation grants,
- Federal R&D grants,
- Venture capital and investment tax offsets.
- Cooperative research centres.

An overview of each incentive outlining their structure, how they work, reporting requirements and key performance metrics is provided below.

By way of background on Australian R&D investment, government policy during the 1980s focussed on stimulating business R&D and proved very successful with a tripling to 0.74% of GDP by 1994-95. Policies such as the Industrial R&D Tax concession, a competitive grant scheme for Industrial R(D and the R&D Start Program for larger industrial research ventures all aided in catalysing business R&D expenditure. However, this figure still benchmarked low by international standards (i.e. OECD average of 1.20%). At the same time, the government expanded its investment in public R&D from 0.75% of GDP in 1981-82 to 0.88% of GDP in 1992-93, which was above the OECD average of 0.71%[17]. By 2014, the national investment in R&D was 2.1% of GDP, in absolution terms the Australia Government is invested around $12 billion in R&D, whilst other participants in the innovation research system (primarily business community) invested twice as much for a total Australia investment of $36 billion on R&D[18] (see Figure 2).

[17] https://www.oecd.org/science/inno/2373881.pdf
[18] https://www.education.gov.au/university-research-commercialisation-package/resources/research-commercialisation-action-plan

Figure 2: Sources, Uses and Activities of R&D Funds[19]

2.1 | R&D Tax Incentive

Background

The R&D Tax Incentive is a program administered by the Australian Taxation Office (ATO) and designed to encourage businesses to conduct R&D activities[20]. It provides a tax offset for eligible expenses related to R&D activities, currently at 43.5%.

Structure & How it Works

To qualify for the R&D Tax Incentive, businesses must meet specific criteria, including conducting eligible R&D activities that involve experimentation and technical uncertainty. The program offers two components: a refundable tax offset for entities with an aggregated turnover of less than $20 million and a non-refundable tax offset for entities above this threshold. The refundable offset allows businesses to receive cash refunds if their offset exceeds their income tax liability.

Reporting Requirements & Key Performance Metrics

Businesses must register their R&D activities with AusIndustry, which administers the program on behalf of the government. They are required to provide detailed project descriptions, expenditure breakdowns, and evidence of the experimentation and innovation undertaken. Key performance metrics for the R&D Tax Incentive include the number of eligible projects, total expenditure claimed, and the commercialisation outcomes resulting from R&D activities.

[19] http://www.industry.gov.au/innovation/reportsandstudies/ Pages/SRIBudget.aspx
[20] https://business.gov.au/grants-and-programs/research-and-development-tax-incentive

Impact

The R&D tax incentive is the governments key mechanism to stimulate industry investment in R&D in Australia. In 2022-2023 it is estimated that the Australian government will invest $3.2 billion to companies under the R&D Tax Inventive initiative[21]. Australia's Biotech industry is reported to receive approximately half of the R&D Tax incentive, at just over $1.6 billion. This figure having increased more than 5 x in the last 10 years. Furthermore, for each dollar of forgone tax revenue, the R&D Tax Incentive has generated an average return of $2.18 for the economy. Similar to the GDP and employment impacts, the return to the economy increases substantially over time, from an estimated $1.32 in 2013 to $3.14 in 2021 [22].

2.2 | Federal Commercialisation Grants

Background

The Australian government provides federal grants to support innovative businesses and promote commercialisation. Two significant grants are the Accelerating Commercialisation (AC)[23] and Australian Economic Accelerator (AEA)[24].

Structure & How They Work

The AC grant assists businesses in bringing novel products, processes, and services to market by providing matched funding and expert guidance. It follows a competitive application process and offers financial support for commercialisation activities such as marketing, intellectual property protection, and business development.

The AEA is a $1.6 billion program to accelerator the translation and commercialisation of university research, through a stage-gated funding program. Funding is made available to universities to support projects aligned with national research priorities which high commercial potential and applicants will partner with industry.

These funding schemes provide a wide range or support to various commercialisation initiatives at different stages of development and different market sectors. The non-dilutive nature of most of these funding schemes is very favourable for early-stage start-up companies and allows de-risking from a technical and commercial perspective without unnecessary shareholder capital dilution. Unfortunately, the majority of these schemes are highly sought-after and competitive, so offer a low probability of success for potential applicants.

Reporting Requirements & Key Performance Metrics

Recipients of AC and AEA grants are required to submit progress reports detailing the utilization of funds, milestones achieved, and commercialisation outcomes.

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[21] https://www.industry.gov.au/publications/science-research-and-innovation-sri-budget-tables-2022-23

[22] https://www.ausbiotech.org/news/new-report-quantifies-the-impact-of-rd-tax-incentive-rdti-in-australias-life-sciences-sector

[23] https://business.gov.au/grants-and-programs/accelerating-commercialisation

[24] https://www.education.gov.au/university-research-commercialisation-package/australias-economic-accelerator

The AC program assesses success based on metrics such as increased sales revenue, job creation, and intellectual property generated.

Impact

Across the range of programs offered by the AC program, analysis has revealed that on average a $200,000+ increase in company turnover is observed for companies participating in an AC program. Company failure is also substantially less for those who have participated in AC with less than 2% failing, whilst on average about 25% of companies fail within 3 years[25]. The AC program also had lead to an increase in companies exporting their product / services, and increase in formal IP registration activities, an increase in capital ad R&D expenditure. The AEA Program is still in its infancy and does not have material case studies and statistics surrounding it's impact on commercialisation outcomes.

2.3 | Federal R&D Grants

Background

The Australian Research Council (ARC)[26] and other agencies offer various grants to facilitate collaborative research and development. These grants aim to foster innovation, advance knowledge, and address societal challenges.

Structure & How They Work

The ARC provides grants such as the Linkage Projects and Discovery Projects, which support both fundamental 'blue sky' R&D as well as collaborations R&D between industry and academia. In 2023-2024 this program will deliver around $895 million to the most dynamic researchers in Australia[27]. The National Health and Medical Research Council (NHMRC)[28] supports health and medical research endeavours through centres of excellence and the medical research future fund, investing over $800 million / year[29].

Reporting Requirements and Key Performance Metrics

Grantees must submit progress reports detailing project milestones, outcomes, and expenditure. Reporting requirements may vary depending on the grant scheme. Key performance metrics include research publications, commercialisation outcomes, industry collaborations, and societal impact.

Impact

The ARC recently released the *Impact assessment of ARC-funded research* report[30], finding that for every $1 of research funded through the National Competitive

[25] https://www.industry.gov.au/sites/default/files/2019-06/impact-of-commercialisation-australia-on-business-performance.pdf
[26] https://www.arc.gov.au/
[27] https://www.arc.gov.au/sites/default/files/2023-06/National%20Competitive%20Grants%20Program.pdf
[28] https://www.nhmrc.gov.au/
[29] https://www.pc.gov.au/__data/assets/pdf_file/0019/238033/sub027-mental-health-attachment.pdf
[30] https://www.arc.gov.au/news-publications/media/feature-articles/research-excellence-delivering-exceptional-outcomes-

Grants Program (NCGP), $3.32 is generated for the Australian economy. Furthermore the report estimates that ARC funded research in the past 20 years has increased economic output for Australia by $184.3 billion and created 6,570 jobs per year across Australia. The NHMRC has also been highly proficient at stimulating the Australian economy creating over 23,000 jobs in a 15 year period, and increasing GDP by over $2.6B[31]. Some of the most impactful funding however, has supported investigator initiated clinical trials where every $1 invested by the NHMRC, yielded a return of $51.10.

2.4 | Venture Capital and Investment Tax Offsets

Background

Following the dotcom crash in 2002, the commonwealth government launch programs designed to increase venture capital investment in Australia by providing beneficial tax treatment to eligible local and foreign investors. The Early Stage Venture Capital Limited Partnership (ESVCLP) and Early Stage Innovation Company (ESIC) tax offsets are crucial mechanisms to attract investment in startups and innovative companies.

Structure & How They Work

The ESVCLP is a partnership between investors and venture capital fund managers, providing tax benefits for investments in eligible early-stage businesses. It encourages long-term investment and provides tax-free gains on exits. Benefits include;

- Flow through tax treatment for a venture capital limited partnership
- Exemptions from income tax on capital and profits realised from investments
- Fund managers taxed on their carried interest on capital account, rather than as income

The investment benefits offered by the ESVCLP program has proven instrumental in the creation of the current Australian Venture Ecosystem. Many of the larger and more successful funds in existence today have taken advantage of the ESVCLP program. For example, the CSIRO Innovation Fund (Main Sequence Ventures) was established as an ESVCLP to invest in early-stage opportunities from the research sector to increase translation into Australian Industry. In the first 4 years of operation Main Sequence Ventures conducted two successful capital raises to attract $400M from the market, the first 27 of the companies backed have created over 850 deep-technology jobs[32].

australia#:~:text=The%20Australian%20Research%20Council%20(ARC,generated%20for%20the%20Australian%20economy.

[31] https://www.pc.gov.au/__data/assets/pdf_file/0019/238033/sub027-mental-health-attachment.pdf

[32] https://www.education.gov.au/university-research-commercialisation-package/resources/research-commercialisation-action-plan

ESIC tax offsets incentivize investments in qualifying early-stage innovation companies by providing tax benefits to investors[33]. These incentives include a capped 20% non-refundable carry forward tax offset and modified capital gains tax treatment.

Reporting Requirements & Key Performance Metrics

ESVCLP managers and ESIC companies must comply with reporting obligations set by the Australian Securities and Investments Commission (ASIC) and the ATO. These requirements include financial statements, investor eligibility documentation, and compliance with investment criteria. Key performance metrics include the amount of investment raised, the number of startups supported, and the subsequent growth and success of invested companies

Impact

Since the inception of the VC tax concession programs over $20 billion has been committed to program partnerships. Over the life of the program investments in over 1775 businesses have been made, 94% of which have been Australian-based businesses. Over a 15 year period from 2005 to 2020 the capital invested by Australian VC's increased 7x from $200M to over $1.5B, tracking global investment trends[34].

2.5 | Cooperative Research Centres (CRCs):

Background

One significant reform introduced in the 1990s was the Cooperative Research Centres (CRCs) program[35]. This initiative aimed to foster collaboration between industry, universities, and other research institutions.

Structure & How They Work

CRCs were established in a range of priority sectors, bringing together researchers and industry partners to work on applied research projects with a focus on commercial outcomes. The CRCs program has played a crucial role in bridging the gap between academia and industry, enabling the commercialisation of research findings. The program has many success stories over the years spanning from portable brain scanners, plastic waste recycling, to improved outcomes for breast cancer surgery[36].

The original CRC model required lengthy application process across many partner institutions to yield a research centre focussed on a key theme / national priority that was established any funded for many years. A challenge for these centres is that they were large, complex and time consuming to establish, they lacked the ability to move quickly with emerging industry opportunities and trends. To enable a more nimble approach, a CRC-Project grant program was launched focused on

[33] https://www.ato.gov.au/Business/Tax-incentives-for-innovation/In-detail/Tax-incentives-for-early-stage-investors/
[34] https://treasury.gov.au/sites/default/files/2022-10/p2022-328982.pdf
[35] https://cooperativeresearch.org.au/about-the-crc-association/
[36] https://business.gov.au/grants-and-programs/cooperative-research-centres-projects-crcp-grants/customer-stories

short term (up to 3 years) industry led research collaboration[37]. A very popular program offering matched funding of between $100,000 - $3,000,000 and the ability to move quickly and efficiently to develop new IP and commercialise the outcomes.

Impact

The CRC program has continued to work well to deliver on its objectives following a recent economic impact evaluation[38]. The report found;

- CRCs will generate an estimated $32.5 billion of economic impacts by 2025
- Australia's GDP is estimated to increase by $5.61 for every dollar of government funding for CRCs since 2005
- completed CRC Projects are estimated to return $7.73 in economic benefit for every dollar of government funding since 2016.

[37] https://business.gov.au/grants-and-programs/cooperative-research-centres-projects-crcp-grants#2

[38]

3 | Comparative analysis to key innovation ecosystems:

Research and innovation ecosystems play a pivotal role in driving economic growth, fostering scientific advancements, and enhancing global competitiveness. A brief comparative analysis of the current research innovation ecosystems in Australia, the United States, the United Kingdom, and Israel is provided below. It examines key statistics, initiatives, and factors that contribute to their success, highlighting both their similarities and unique characteristics.

3.1 | Australia:

Australia has made significant strides in developing a robust research innovation ecosystem. Key statistics indicate the country's commitment to research and innovation:

- Research Excellence: The Australian government invests heavily in research and innovation, with substantial funding allocated to various initiatives, with annual investment of ~$12 billion. Australia has a robust research infrastructure, evident from its world-class universities and research institutions. It consistently ranks among the top countries in terms of research output and impact.
- Industry Collaboration: Collaboration between industry, academia, and government to drive research with commercial applications is a key focus with a range of programs and grants currently on offer (i.e. CRC, ARC-Discovery, AC). These initiatives have facilitated innovation in knowledge-intensive sectors such as advanced manufacturing, health, and agriculture. However, and despite these efforts, Australia continues to rank low against OECD members on this metric. One reason given is that many of Australia's large corporations are involved in mining, oil and gas, which historically have not invested heavily into R&D that requires partnerships with the university sector. Additionally, the global technology companies that do have a footprint in Australia, such as Microsoft and Google, are largely focused on sales, with the R&D activities happening in other geographies globally. Nonetheless, as industries such as quantum, advanced manufacturing, and next generation food and agriculture have grown, rates of collaboration between industry and universities is gradually improving. This points to the importance of looking at these incentives and policies in combination rather than individually.
- Start-up Ecosystem: Australia has witnessed the growth of a vibrant start-up ecosystem, supported by initiatives like the Entrepreneurs' Program and the National Innovation and Science Agenda (NISA). Sydney and Melbourne have emerged as key start-up hubs, fostering entrepreneurship and innovation. Whilst in their infancy, several early success stories have emerged (i.e. Airwallex, Canva, Go1).

- Cultural / Social Norms: Australia exhibits an increasing acceptance and recognition of the importance of research commercialisation and start-up companies. While traditionally more focused on academic research, there is a growing emphasis on translating research outcomes into tangible societal and economic benefits. Universities and research institutions actively support entrepreneurship and encourage researchers to explore commercialisation opportunities.

3.2 | United States:

The United States has long been at the forefront of global innovation. Key features of its ecosystem include:

- Research Excellence: The US government invests heavily in research and innovation through agencies like the National Institutes of Health (NIH) and the National Science Foundation (NSF). Private sector investments from venture capitalists and corporations also play a crucial role.
- Entrepreneurship Culture: Silicon Valley, located in California, has become synonymous with innovation and entrepreneurship. It boasts a rich network of investors, mentors, and a culture that encourages risk-taking. Silicon Valley, like regions in Boulder, Boston, Austin and elsewhere, have become self-perpetuating systems, with successfully entrepreneurs becoming active mentors and investors support future generations of entrepreneurs. This culture of 'giving back' has been tremendously successful and has been a big contributor to the success of the US entrepreneur ecosystem.
- Cultural / Social Norms: The United States has a well-established culture of research commercialisation and start-up companies. It embraces risk-taking, celebrates entrepreneurial success, and views failure as a stepping stone to future accomplishments. Silicon Valley, located in California, has become a global symbol of innovation and entrepreneurship. The presence of renowned universities, venture capitalists, and industry leaders creates an ecosystem that encourages the translation of research into commercial ventures.
- Commercialisation Policy of universities: Many universities in the USA approach commercialisation with a bias toward efficient translation of IP into market as opposed to being focused on maximising the return for the university. Their mentality is that they can enjoy a high ROI (financially, philanthropically, and investment in R&D labs) by commercialising many products and services rather than just a few39.
- The SBIR/STTR programs: A key pillar in the US government's approach to stimulating innovation are the SBIR and STTR (Small Business Innovation Research and Small Business Technology Transfer) programs40. These programs are highly competitive programs that encourage domestic small businesses to engage in Federal Research/Research and Development (R/R&D) with the potential for commercialization. SBIR projects typically do

[39] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4104711/
[40] https://www.sbir.gov/

not exceed $150k and involve 50:50 co-investment. The Department of Defence, the largest contributor in the SBIR program, invests over $1B annually through the program.

3.3 | United Kingdom:

The United Kingdom has a strong research and innovation ecosystem, supported by the following factors:

- Research Excellence: The UK is home to renowned universities and research institutions, such as Oxford and Cambridge. It has a rich history of scientific discoveries and Nobel laureates. These universities have provided fertile grounds for innovation to thrive. The Cambridge Science Park is one such example. With close connections to the R&D labs within Cambridge Universities, the Science Park has become a global hotspot for the development of laboratory and medical equipment / devices. The tight feedback loop between the companies in the Science Park and the researchers within the university has helped develop world leading medical devices.
- Government Initiatives: The UK government has launched various initiatives, including the Industrial Strategy Challenge Fund and the UK Research and Innovation (UKRI), to drive research and innovation in key sectors. The Catapult Centres are another key initiative. These centres are focal points in the innovation system for industry-research collaboration, and they are in sectors that are important to the productivity of the UK. These Centres are seen globally as best practice government funded initiatives, helping grow investment into R&D and the development of products, services, and knowledge to help the UK economy grow and maintain global competitiveness.
- Cultural / Social norms: The United Kingdom acknowledges the economic potential of research commercialisation and has made significant strides in cultivating a supportive ecosystem. British universities are renowned for their contributions to scientific research. The UK government has launched initiatives like the Industrial Strategy Challenge Fund and the UK Research and Innovation (UKRI) to promote research translation and collaboration between academia and industry. Socially, there is growing recognition of the value of entrepreneurship and start-up companies, with increased support and mentorship networks available to aspiring entrepreneurs.

3.4 | Israel:

Israel has emerged as a global innovation powerhouse, known for its vibrant start-up ecosystem and technological advancements:

- Start-up Nation: Israel has one of the highest densities of start-ups globally. It benefits from a culture that encourages entrepreneurship, a strong venture capital ecosystem, and the presence of renowned tech accelerators like Y Combinator.

- Military Influence: Israel's military conscription system has contributed to its innovation ecosystem. Many technological advancements and start-ups have roots in military research and development. Additionally, the military conscription has cultivated a highly networked society, enabling entrepreneurs, investors, mentors, and other stakeholders to find each other and help turn ideas into impact. This connectivity is widely recognised as one of Israel's key entrepreneurial competitive advantages globally.
- Cultural / Social Norms: Israel's culture strongly embraces entrepreneurship, innovation, and risk-taking. It is often referred to as the "Start-up Nation." The country's social norms actively encourage military service, which has become a significant driver of technological advancements and start-up creation. The Israeli government has implemented policies to facilitate research commercialisation, offering support through funding schemes, incubators, and accelerators. Society places high value on entrepreneurship, resulting in a robust start-up ecosystem and a willingness to take calculated risks.

Australia's research innovation ecosystem demonstrates significant progress, with notable funding, research excellence, industry collaboration, and a growing start-up ecosystem. While it may not match the scale and depth of the research innovation ecosystems in the United States, the United Kingdom, and Israel, Australia's commitment to innovation and its collaborative approach provides a solid foundation for future growth and global competitiveness. The comparative analysis highlights the importance of continued investment, strategic partnerships, and a supportive regulatory environment to foster research and innovation excellence on a global scale.

3.5 | Commercialisation mindset & the 'dark-side'.

It is worth noting, within Australia and potentially other innovation ecosystems around the world a stigma exists for researchers associated with commercialisation and engaging with industry regularly. For researchers, not conducting blue-skey research are sometimes referred to as being part of the 'dark-side'. It is a theme that is regularly permeates within different universities in Australia at the intersection of Science and Commercialisation [41,42]. Historically, academics have been measured on their performance and subsequent suitability for promotion based on research grants and publications. As a result, those undertaking commercialisation activities were not contributing to performance metrics and were often not recognised for their efforts[43]. There has fortunately been a shift, albeit slow, over the past two decade to better acknowledge researchers for their commercialisation and industry engagement efforts in

[41] https://www.biocurate.com/insight/the-academic-insider-stories-from-flirting-with-the-dark-side/
[42] https://sciencemeetsbusiness.com.au/commercialisation-dark-side/
[43] https://researchaustralia.org/wp-content/uploads/2014/11/Boosting-the-Commercial-Returns-from-Research.pdf

university performance reviews[44]. This recognition is helping have more researchers engaged in the challenge of translating research discoveries to the real world.

[44] https://www.sydney.edu.au/content/dam/corporate/documents/about-us/governance-and-structure/university-policies/2021/20210225-university-research-commercialisation-consultation-paper.pdf

4 | University Commercialisation Model in Australia

Commercialisation of research and intellectual property (IP) plays a crucial role in driving innovation and economic growth. This summary provides an overview of the 'typical' university model, focusing on IP ownership, valuations, financial returns, and equity sharing for inventors. The key features of the university commercialisation model include:

IP Ownership

Universities generally assert ownership rights over IP generated by their researchers. However, ownership and management arrangements for commercialisation may vary depending on agreements between researchers, the university, and external partners.

Valuation

Valuing IP is a complex process and varies based on factors such as novelty, market potential, and competitive landscape as outlined earlier in this report. Universities have specialised commercialisation divisions experienced in transacting with new IP to help guide the appropriated commercial value. Often value is determined by market conditions – that is, the ultimate value is what an investor is willing to pay for the IP.

Financial Returns

Universities aim to generate financial returns from commercialized IP. Revenue streams can include licensing fees, royalties, equity holdings, and spin-off companies. These returns are often re-invested in research, innovation, and supporting future commercialisation activities.

Equity Split/Sharing

Universities typically negotiate equity sharing arrangements with inventors when establishing start-up companies based on university-owned IP. Equity stakes for inventors may vary based on factors such as their contribution, role, and the university's policies. Many universities in Australia adopt a 33% / 33% / 33% split of commercialisation revenue to the investors / school or faculty / and university. This model is sometime at odds with the conventional venture capital model with prefers founders to hold a substantial percentage of the company on incorporation, which is then heavily diluted in later funding rounds – but provides enough upside for the team to remain committed and grow the company, rather than exploring of ideas / work. There are moves within some Australian universities to lower this, and recent examples have seen a university as taking a little as 5% equity in a spin-out company.

5 | Key Challenges to Commercialisation in Australia

Research commercialization in Australia faces several significant challenges that hinder the seamless transition of innovative ideas from the lab to the market. These challenges include:

Limited Funding and Investment

Insufficient funding and risk-averse investment behaviour can stifle research commercialisation efforts, particularly in deep-technology ventures that may have high capital expenditure requirements. The high costs associated with translating research into viable products or services often deter potential investors, resulting in limited financial support for startups and innovative ventures. This has been particularly challenging for those wanting to commercialise new therapeutics, which can often take 15+ years and over $1B US to turn an idea into a marketable product.

Bureaucratic Hurdles

Global best practice suggests, complex bureaucratic processes and regulations can slow down the commercialization process. Australia has performed quite well in terms of removing bureaucracy from the innovation process (i.e. through de-regulation and decentralisation) but continues to evolve and practice proactive efforts in maintaining ease of innovation. Obtaining patents, navigating legal frameworks, and meeting compliance requirements can be time-consuming and resource-intensive, discouraging researchers and entrepreneurs from pursuing commercialization. These hurdles represent a significant time delay and are often challenging to overcome and are a key inhibitor to successful commercialisation and investment. An experienced and well-rounded commercialisation team can assist in the efficient navigation of these hurdles.

Academic-Industry Collaboration Barriers

While collaboration between academia and industry is crucial for research commercialization, barriers such as differing priorities, cultures, and intellectual property concerns can impede effective partnerships. Bridging this gap requires effective communication and mutual understanding between researchers and industry stakeholders.

Lack of Entrepreneurial Skills

Researchers may possess excellent technical expertise but lack the necessary entrepreneurial skills to navigate the business landscape successfully. Commercialization demands a different skill set, including marketing, business development, and financial management, which may not be emphasized in traditional research training. Several grant schemes in Australia actively work to bridge this gap through match-making with experienced commercialisation professionals.

Additionally, many Australian research organisation's commercialisation officers do not have significant experience, which can lead to poor deal structuring which in

turn can make commercialisation difficult. As seen in countries like the US, having a community of experienced entrepreneurs, investors, mentors, and commercialisation experts is essential to having an innovation system that can translate the value of research into products and services.

Market Readiness and Validation

Some research innovations may not be fully developed or validated for commercial viability. Moving technologies from the lab to real-world applications requires sufficient market research and validation to ensure there is a genuine demand for the product or service. This is typically referred to as the 'valley of death' where research funding concludes, and commercial funding begins. There are several funding avenues to explore (i.e. Angel investment, university proof-of-concept funding, pre-seed venture capital funding) to assist commercialisation during early phases of development.

Risk-Averse Culture

Risk aversion in both the public and private sectors can hamper the willingness to support innovative projects. Fear of failure and a preference for safer, incremental investments may discourage the pursuit of ambitious, disruptive technologies. The establishment and maturing of the start-up ecosystem, as well as reference success stories, is slowly helping to shift the risk averse culture in Australia.

Limited Access to Intellectual Property (IP) Protection

Inadequate protection of intellectual property can deter researchers from disclosing their findings or engaging in commercialization efforts. Without secure IP protection, there is a risk of ideas being copied or stolen, making it challenging to attract investors. Many universities are constrained by IP protection budgets and as such can not conceivably protect everything.

Geographical Isolation

Australia's geographical distance from major international markets can pose challenges for startups seeking global reach and partnerships. Accessing international customers, investors, and distribution networks can be more complex and expensive.

Long Commercialization Timelines

The commercialization process for 'deep tech' opportunities can be lengthy, and successful outcomes may not be realized for many years. This prolonged timeline can be discouraging for investors seeking quicker returns on their investments.

Addressing these challenges requires a multi-faceted approach involving increased funding support, streamlined regulatory processes, enhanced entrepreneurial education, and a shift towards a more risk-tolerant culture. By overcoming these hurdles, Australia can unlock the full potential of its research and innovation capabilities, driving economic growth and societal advancement.

6 | Case Studies

Company Name: Nourish Ingredients Pty Ltd
Year incorporated: 2019
Headquarters: Canberra, Australia
Funding raised: ~$59,000,000[45,46]
Number of Employees: ~60
Website: https://nourishing.io/
Stage: Series A Growth

Interviewee: Dr. Ben Leita
(Nourish Ingredients COO, Co-Founder and Director)

Company Overview: Nourish Ingredients is a deep-tech company using science and precision fermentation to create fats for the next generation of plant-based food and alternative proteins, so they cook, smell, and taste just like the real thing, animal-free.

Technology Commercialisation Journey: Nourish is the co-founding team's 3rd Startup idea after previously taking two other technologies through accelerator programs (CSIRO ON) in Australia and concluding they were unlikely succeed. Many of the learnings from these startups led us to refine our vision and approach for Nourish ingredients and allowed the team to close a $14.3M Seed round. R&D work was contracted with the CSIRO and the team grown to approximately 30 people. During this time the company established its own R&D facilities and off the back of promising early trial results and IP portfolio closed a $45M Series A round. Nourish has also received a CRC-P grant ($2M), Kickstart Grants from CSIRO and accessed the R&D Tax incentive. The team is currently ~60 people, spread over several sites in Canberra and Sydney.

Interactions with Universities: Nourish has had many collaborative interactions with universities here in Australia (Macquarie, ANU, QUT, UQ, Uni Adelaide) and internationally (Uni of California, Imperial College etc). Nourish's largest engagement is with CSIRO and rented laboratory space soon after its incorporation. Across all of these interactions, access to IP and desire for Joint IP positions has been challenging, particularly with joint researcher and post-doctoral hires, and differences in standard positions between Australia, US and UK. Speed of transactions was also a frustrating element of dealing with most universities. Despite these challenges, the research organisations have provided access to expertise and equipment on demand (in comparison to establishing new facilities and teams), which is critical to rapid product development.

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[45] https://www.forbes.com/sites/chloesorvino/2021/03/25/billionaire-li-ka-shings-horizons-ventures-backs-vegan-ingredient-startup/?sh=5992971462fe
[46] https://www.afr.com/companies/agriculture/hk-billionaire-backs-aussie-fake-animal-fat-start-up-in-45m-round-20221019-p5br1j

AURTRA

TRANSFORMING POWER ASSET MANAGEMENT

Interviewee: Terry Woodcroft
(Aurtra CEO, Co-Founder and Director)

Company Name: Aurtra Pty Ltd
Year Incorporated: 2017
Location: Brisbane, Australia
Funding Raised: $4,000,000[47]
Number of Employees: 13
Website: https://www.aurtra.net/
Stage: Acquired by Schneider Electric in 2022[48]

Company Overview: Aurtra delivers highly cost-effective asset management solutions for power distribution networks through online condition monitoring and state of the art analysis. With a fleet-wide view of individual transformer health, Aurtra delivers asset managers and engineers the insight to extend transformer life with confidence and significantly reduce capital costs.

Technology Commercialisation Journey: Aurtra was born following the licencing of University of Queensland IP to an experienced founding team. The company received grant support through both state (Queensland Ignite Ideas Fund) and federal government (Accelerating commercialisation), as well as the R&D Tax Incentive through initial bootstrap & growth phases. A Seed round from a VC firm supported by high net worths helped to supported further product development and early sales whilst the company grew to ~13 people. Partnerships with the right service provides (lawyers and accountants) were also critical to informing business strategies and positioning for acquisition. The company was acquired by Schneider Electric within 4 years and provided a successful return to both investors and founders.

University Interactions: Initial IP licence and facilities to support ongoing product development and testing (via a research contract) were paramount to the company's success. The university researchers collaborating with Aurtra stayed engaged as university employees and did not 'spin-out' with the company. Equity incentivisation through standard university IP licencing models were challenging, particularly to ensure enough skin-in-the-game for the founding team to weather the tough times experienced during the commercialisation journey.

[47] https://www.startupdaily.net/topic/asx/schneider-electric-snaps-brisbane-startup-aurtra-in-multi-million-dollar-deal/
[48] https://www.se.com/au/en/about-us/newsroom/news/press-releases/schneider-electric-acquires-aurtra-to-advance-service-innovation-in-the-electrical-distribution-value-chain-6244da697b14416b010c4f70

Company Name: Microba Pty Ltd
Year incorporated: 2017
Headquarters: Brisbane, Australia
Funding raised: ~$32,000,000[49]
Number of Employees: 65
Website: https://microba.com/
Stage: ASX Listed, Current Market Capitalisation: $93,000,000

Interviewee: Dr Kylie Ellis
(Microba Head of Research Services)

Company Overview: Microba Life Sciences is a precision microbiome company driven to advance health. With world-leading technology for measuring the human gut microbiome, Microba is driving the discovery and development of novel therapeutics for major chronic diseases and delivering gut microbiome testing services globally to researchers, clinicians, and consumers.

Technology Commercialisation Journey: Microba originated from the University of QLD from the work of two globally renown scientists; Dr Gene Tyson and Dr Phil Hugenholtz. The intellectual property underpinning Microba was assigned in 2017 to develop solutions across direct to consumer, healthcare, research services and therapeutic streams. First product launched direct to consumers in 2018 in Australia and soon followed by scaling of research services globally. Microba has raised 3 funding rounds over the years from a mix of profession venture capital & high net worth investors and related industry corporate venture arms. Microba has also been a beneficiary of the Medical Research Future Fund and the R&D tax incentive. The company listed on the Australian stock exchange in April 20233 and currently distributes to 30 countries around the world.

Interactions with Universities: Microba conducts collaborative work with a number of universities and medical instates around Australia, including; QUT, Uni of Newcastle and the Garvan Institute. Access to complimentary skill sets and expertise have been invaluable. However, many there have a time been challenges around access and value of new IP created and lengthy timelines to contract with University groups. Microba also provides research services / testing facility for many universities and researchers around the world. A general observation that many international universities are more open to researchers engaging with corporates in dynamic ways, which is often a limiting factor in Australia.

[49] https://www.crunchbase.com/organization/microba

Company Name: Cipher Sports Technology Group

Year incorporated: 2015 and 2022

Headquarters: Melbourne, Australia

Funding raised: ~$6,000,000

Number of Employees: 28

Website: https://www.ciphersports.io/

Stage: Series A Growth

Interviewee: Dr Darryl Woodford & Katie Prowd
(Co-Founders, CTO, CMO & Directors)

Company Overview: Cipher arms users with the ultimate combination of tools, content and communities, and makes sports more bettable. The company aspires to be the centrepiece of a sports fan's betting experience. Cipher is powered by advanced analytics that drive machine learning models developed by a team of data scientists, who specialize in sports betting and daily fantasy.

Technology Commercialisation Journey: Company formed in 2015 and licenced social media analytics intellectual property from QUT. This allowed the team to raise a small angel round from local angel investors, received Queensland government Ignite Ideas grant to commercialise social media sentiment analytics, but found it a challenging commercial space. The company pivoted to Daily Fantasy Sports (DFS) analytics off the back of market headwinds in the USA and founder knowledge / passion in this space. During this time, the company participated in the Blue Chilli Accelerator. Hypometer successfully rolled out consumer facing DFS analytics offerings with hundreds of customers in Australia, but revenue was not self-sustaining. The company further pivoted to providing sports team / player analytics directly to sports wagering and media companies. Business grew sharply and merged with Dimers to form Cipher Sports Technology Group in 2022 to focussed on emerging high growth US Wagering market as the market was being legalised. Cipher closed a $5M investment round and the team grew from 12 to 28 people and currently turning over 7-figure revenue. The company regularly access the R&D tax incentive program.

Interactions With Universities: Original patent application around social media analytics / sentiment were licenced from QUT. Patent was eventually lapsed a couple of years later due to change in business direction. Protracted negotiations around IP value in early days were challenging, however the university did help to provide some credibility in early investment rounds. The company is not actively working with universities and has hired a full spectrum of engineers, developers, marketing and content specialist to deliver their product to the market.