

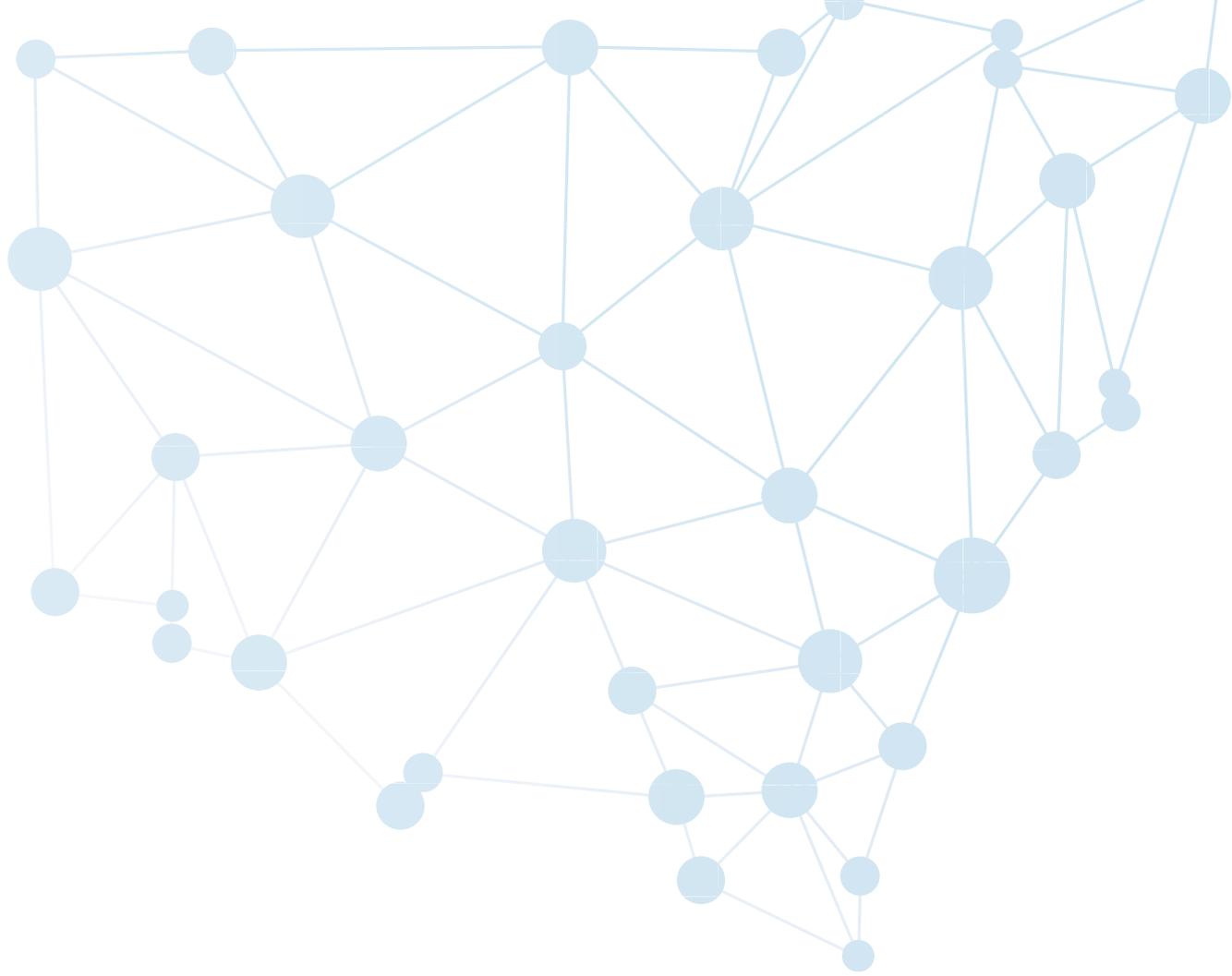
ACTION PLAN

Turning ideas into jobs

Accelerating research and development in NSW

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1 Messages

Message from the Hon. Gabrielle Upton MP, Parliamentary Secretary to the Premier

We are living in a time of increasing economic disruption. Natural disasters and the COVID-19 global pandemic are forcing governments and businesses to adapt at an unprecedented rate. Jobs and industries are being transformed by new technology and NSW's future depends on us having an innovative economy.

The NSW Government has a big role to play in fostering an innovative economy. NSW is already the nation's leader in 'hard' (built) infrastructure investment. We must complement this with an equally ambitious plan to make NSW the nation's leader in 'soft' infrastructure - research and development (R&D). R&D creates the ideas that turn into new industries, jobs, products and services.

The NSW Premier tasked me with accelerating this opportunity for NSW. To guide the task, I appointed an Advisory Council chaired by David Gonski AC. Its membership included eminent leaders in innovation, business, government and the tertiary sector. This Action Plan is the result of our deliberations - it will propel NSW to become the R&D leader in Australia and a world-class contributor.



The Hon. Gabrielle Upton MP
Parliamentary Secretary to the Premier

This Action Plan presents five Priority Actions. Some of these initiatives have previously been attempted in various forms, but their impact fell short of expectations because there was no strong and coherent commitment to their success. The Advisory Council sees a fresh and unique opportunity for the NSW Government to realise the huge job-creating potential of this comprehensive set of actions through sustained leadership, implementation and accountability across the whole of government.

This Action Plan also recommends a suite of 16 Supporting Actions to address the limitations and gaps in the existing innovation ecosystem, along with the launch of an ambitious NSW R&D Mission to demonstrate its effectiveness. The implementation and funding of this Action Plan is vitally important and is the subject of a companion piece of work.

I want to thank all of the Advisory Council members for guiding this Action Plan, and especially the NSW Chief Scientist & Engineer, Professor Hugh Durrant-Whyte, for his wise counsel. I also want to thank the many researchers, business people, academics, universities, start-ups, scale-ups and investors who shared their views through written submissions, one-on-one meetings, roundtable discussions and events. This Action Plan would not have been possible without their generous input.

Message from David Gonski AC, Chair of the Accelerating R&D in NSW Advisory Council

Gabrielle Upton asked me to chair a council tasked with advising the NSW Government on opportunities to make the state a national leader in R&D. I accepted her offer with alacrity. As the Chancellor of the University of New South Wales for the past 15 years, I have seen the positive impact that translating research into new products and services has had on people's lives. From new medical treatments to predicting climate extremes, the research occurring in NSW universities, government institutes and innovative companies is laying the foundations for our future wellbeing and prosperity.

The Advisory Council brought a great breadth and depth of experience in research, the innovation ecosystem and government policy to bear on the issue. We considered the current state of government support for R&D and innovation, and identified a number of opportunities to introduce new impactful initiatives, improve existing programs and better coordinate R&D investment.

The Advisory Council recommends that five of the actions be Priority Actions for the NSW Government. These actions have a proven track

record of success in other Australian jurisdictions and globally. The devastating impact of COVID-19 on investment in R&D and the downstream effects on economic growth and job creation make this task an urgent one. Decisive government action to attract and leverage investment, improve cross-sector collaboration and rapidly translate ideas into new products and services will be integral to our recovery from this crisis.

I would like to thank all those who contributed their insights on how the government could accelerate R&D activity in NSW.

I also thank my colleagues on the Advisory Council for their thoughtful contributions: Maxine Brenner, Jillian Broadbent AC, Professor Hugh Durrant-Whyte, Professor Barney Glover AO, Professor Brigid Heywood, Catherine Livingstone AO, Philip Marcus Clark AO, Dr Larry Marshall, Professor Mary O'Kane AC, Daniel Petre AO, Professor Michelle Simmons AO, David Shein, Neville Stevens AO, David Thodey AO, Professor Paul Wellings CBE and Jennifer Westacott AO.



David Gonski AC
Chair, Accelerating R&D in NSW Advisory Council

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2 Executive summary

In October 2019, the NSW Premier, the Hon. Gladys Berejiklian MP, asked the Parliamentary Secretary to the Premier, the Hon. Gabrielle Upton MP, to lead an initiative to help accelerate research and development (R&D) in NSW, with the objective of making NSW the R&D leader in Australia and a world-class contributor.

To guide the initiative, the Parliamentary Secretary established the Accelerating R&D in NSW Advisory Council (ARDAC), chaired by David Gonski AC. Its members are eminent leaders in innovation, business, government and the tertiary sector.

A strong, vibrant and high-quality research and innovation ecosystem is vital for driving future economic and social wellbeing in NSW. The translation of research delivers new ideas, products and services; creates high-value, sustainable jobs; and attracts international investment. It is also crucial for the state's recovery from COVID-19.

NSW has world-class research strengths in key science and technology areas including advanced manufacturing and instrumentation, digital and communications technologies, quantum computing and photonics, robotics and autonomous systems, aerospace and defence, decarbonisation and energy transition, the circular economy and medical technologies. NSW universities are ranked highly on a global scale and make substantial contributions to both research and the delivery of technology-skilled graduates. Federally supported research organisations, including the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia's Nuclear Science and Technology Organisation (ANSTO) and the Defence Science and Technology Group also contribute significantly to research in NSW.

Despite these considerable strengths, NSW is relatively poor at translating research

into new commercially viable technologies, products and services. The rate of collaboration between universities and business is well below Organisation for Economic Co-operation and Development (OECD) averages. Research translation and commercialisation, while improving, is also well below our economic peers. Additionally, the government itself has not been a good customer for, or active supporter of, technology-led innovation.

Accelerating the translation of NSW's world-class research strengths into new industries, products, services and jobs is the focus of this Action Plan. Effective research translation will:

- attract global investment and international businesses looking for new ideas, competitive technologies and a skilled workforce to NSW
- build and support an ecosystem of technology-rich start-ups, scale-ups, and small and medium-sized enterprises (SMEs)¹ that will create new products, services and jobs
- anchor technologies and skills in our metropolitan and regional precincts through deep research partnerships
- deliver innovative solutions to key government challenges.

The NSW Government will increasingly need to be proactive in attracting and creating new businesses, especially in so-called 'future industries'² that will sustain economic growth, productivity and employment. In a post-COVID-19 world, this means the NSW Government's

1 In Australia, a small business is one with 0-19 employees; a medium-sized business has 20-199 employees; and a large business has more than 199 employees, viewed on 22 October 2020, <www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/rp1920/SmallBusinessSectorAustralianEconomy>.

2 NSW Treasury 2019, *NSW 2040 Economic Blueprint*, viewed on 14 October 2020, <www.treasury.nsw.gov.au/nsw-economy/nsw-2040-economic-blueprint>.

investment in 'hard' (built) infrastructure must be complemented by strategic investment in 'soft' (ideas) infrastructure – R&D – that will drive these growing and emerging future industries.

The ARDAC's recommended Action Plan presents the case for seizing a critical and timely opportunity for NSW to accelerate R&D and turn ideas into jobs through the implementation of five Priority Actions:

- 1 Launch a Small Business Innovation Research (SBIR) program** – provide competitive grants for SMEs to find and commercialise innovative solutions to NSW Government agencies' specific, well-defined problems.
- 2 Boost open data** – target the strategic release of new NSW Government datasets so that businesses can improve their decision-making; entrepreneurs can build new businesses; and the government can solve complex challenges.
- 3 Turbocharge precincts** – systematically develop precincts to attract national and global technology industries and investment, and drive collaboration with universities, research organisations, start-ups, scale-ups and SMEs to commercialise R&D.
- 4 Target strategic support for NSW universities** – collaborate on research that will drive the state's future strategic growth industries and research-led attraction of industry, and form partnerships to better leverage Commonwealth Government research funding.
- 5 Establish an R&D matchmaking platform** – better connect research 'sellers' and 'buyers' and link researchers to research infrastructure and expertise.

These five Priority Actions are not new ideas. What is new is this Action Plan's specific focus on how to implement them in a coherent, integrated and sustainable way to accelerate the translation and commercialisation of research in NSW. The internationally demonstrated benefits of their implementation cannot be achieved quickly – it will require leadership and a strong whole-of-government commitment.

In support of the five Priority Actions, this Action Plan has also recommended 16 Supporting Actions. These are grouped under four levers that the NSW Government can use to accelerate R&D: government action, attraction, translation and collaboration. The Supporting Actions range from training start-up founders and aspiring entrepreneurs to implementing a procurement system that drives innovation, developing a NSW R&D Roadmap and scaling up successful NSW Government commercialisation programs such as the Medical Devices Fund (MDF).

In addition, this Action Plan recommends that the NSW Government launches a program of NSW R&D Missions aimed at solving its long-term strategic challenges. The missions would exercise all of the ARDAC's five Priority Actions and Supporting Actions, and could include bushfire response, drought resilience, healthier and longer living, or the transition to renewable energies. The missions would bring researchers, industry and government together in deep collaboration to translate research; develop and commercialise new technologies and services; and spawn new businesses and industries in areas of major significance to NSW and the world.

In preparing this Action Plan, the ARDAC undertook a comprehensive public consultation process to build an understanding of the complex issues surrounding the R&D ecosystem. It received 98 submissions from businesses, academics, research organisations, government agencies, investors, not-for-profit organisations and peak bodies. There were meetings with more than 60 individual stakeholders. In addition, there were a series of workshops, forums and roundtables with stakeholders from large-scale industry, SMEs, industry peak bodies, research providers, entrepreneurs, and Commonwealth and NSW government representatives. The ideas that emerged from these consultations were valuable in helping to shape this Action Plan.



CleanSpace Respirators - a revolution in respiratory protection. Cleanspace was funded by the NSW Medical Devices Fund.



Carbonix Drone. Carbonix was funded by the NSW Physical Sciences Fund.

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3 Turning ideas into jobs: Accelerating R&D in NSW

3.1 Research and innovation are key drivers of economic growth

A strong, vibrant and high-quality research and innovation ecosystem is vital for driving future economic and social wellbeing in NSW. Research delivers new ideas, products, services and skills in areas including advanced manufacturing, digital technologies, aerospace and defence, energy transition and decarbonisation, and medical technologies. The take-up of technological innovations in these and other areas is essential to NSW's future economic and productivity growth, the attraction of international investment and the creation of high-value, sustainable jobs.

Turning ideas into jobs

This Action Plan aims to address the key challenge of how to turn high-quality research and innovation into positive economic, social and environmental outcomes for NSW. This challenge has been a key focus of many global policymakers and continues to drive investment policies in R&D and innovation internationally. While the NSW Government has historically had a limited focus on R&D policy, the challenges of building and attracting future industries, creating new jobs and delivering continued economic and social prosperity means it must actively accelerate and better translate its R&D capabilities.

The *NSW 2040 Economic Blueprint* identified seven NSW Government policy levers to improve economic performance³, including innovation and industry development. The Economic Blueprint describes a range of 'industries of the future' (see Section 3.3) and highlights the crucial role that R&D will play in building NSW's capacity in these industry sectors. The Economic Blueprint notes that NSW has many foundational capabilities to be an R&D leader in Australia and internationally: a highly educated workforce with Australia's largest group of science, technology, engineering and mathematics (STEM) graduates; a world-leading tertiary education sector with four of the 11 NSW-based universities ranked in the global top 200⁴; and a vibrant and growing industry capability in sectors including software, advanced manufacturing and medical technologies.

The R&D sector currently benefits from many NSW Government policies and programs. A useful way to understand the scope and interaction of these policies and programs is to map them against the Technology Readiness Level (TRL) scale⁵ in the following diagram.

3 NSW Treasury 2019, *NSW 2040 Economic Blueprint*, viewed on 14 October 2020, <www.treasury.nsw.gov.au/nsw-economy/nsw-2040-economic-blueprint>.

4 Times Higher Education 2020, 'World University Rankings', <www.timeshighereducation.com/world-university-rankings/2021/world-ranking#survey-answer>.

5 NASA 2011, Technology Readiness Level, viewed on 14 October 2020, <www.nasa.gov/directorates/heo/scan/engineering/technology/txt_accordion1.html>.

Selected NSW Government policies and programs mapped against the Technology Readiness Level (TRL) Scale

Initiative	Agency	TRL 1 Basic principles observed	TRL 2 Basic principles formulated	TRL 3 Experimental proof of concept	TRL 4 Technology validated in lab	
Business innovation programs	Treasury	Boosting Business Innovation Program				
					TechVouchers	
Research Attraction and Acceleration Program	Office of the Chief Scientist & Engineer	Research & Innovation Networks				
		Co-funding ARC Centres of Excellence and Cooperative Research Centres and Programs				
		Co-funding National Collaborative Research Infrastructure Strategy				
Research translation grant programs	Office of the Chief Scientist & Engineer			Physical Sciences Fund		
	Office for Health and Medical Research			Medical Devices Fund		
Precincts	Treasury	Western Sydney Aerotropolis, Westmead Health and Innovation Precinct and Tech Central				
	Regional NSW	Special Activation Precincts				
Funding for research to support agency priorities (example)	Office for Health and Medical Research			COVID-19 Research Grants program		



Research and experimental development



Research enabling investment



Research and knowledge translation

TRL 5
Technology validated in relevant environment

TRL 6
Technology demonstrated in operational environment

TRL 7
Prototypes demonstrated in operational environment

TRL 8
System complete and qualified

TRL 9
System proven/ manufactured in operating environment

Innovation Districts COVID-19 R&D Challenges

Minimum Viable Product grants

Building Partnerships grants

However, NSW, like Australia as a whole, is much better at conducting research than using it to establish and grow new companies, products, services and jobs. The rate of collaboration between universities and industry is well below OECD averages; research translation and commercialisation, while improving, is also well below our economic peers^{6,7}; and the NSW Government itself has historically not been a good customer for, or active supporter of, technology-led innovation, products and services.

So this Action Plan focuses on how the NSW Government can turn ideas into jobs by:

- better harnessing the high-quality research undertaken in NSW and globally
- fostering an entrepreneurial environment in which R&D is readily translated into new products and services
- promoting and supporting the ecosystem of innovative businesses and industries that will drive future economic growth in NSW.

Accelerating R&D in NSW

The Commonwealth Government continues to play the major role in policies that promote and sustain R&D in Australia. However, the NSW Government also has a vital role in developing industries, attracting investment and creating jobs – a role that is underpinned and driven by effectively harnessing and translating R&D. Furthermore, many of the most promising and high growth industries of the future – including advanced manufacturing, software and digital technologies, medical devices and clinical technologies, renewable energy and decarbonisation – are increasingly underpinned by high levels of research and innovation.

For the NSW Government to develop these future industries and attract new high-value technology jobs, it must invest in research and accelerate its ability to translate research into commercial and industry outcomes. ARDAC identified four broad levers the NSW Government can apply to accelerate and translate R&D:

- **Government action** – Using government policy and actions:
 - › Take a strategic and coordinated whole-of-government approach to R&D investment, activity and accountability.
 - › Open up and make government data more readily available.
 - › Implement innovation-friendly procurement policies.
- **Attraction** – Attracting the best research, businesses and investment:
 - › Focus on building and scaling research and translation in precincts.
 - › Locate core research, equipment and facilities in precincts.
 - › Use a skilled research workforce to attract international companies and investment.
 - › Promote industry attraction policies and funding targets in key growth sectors.
 - › Provide a single point of contact or ‘front door’ for stakeholders to access government R&D grants, opportunities and information.
- **Translation** – Building a culture of translating research into commercial outcomes through new and existing companies:
 - › Develop start-ups, scale-ups and SMEs by providing access to entrepreneurial and business skills.
 - › Extend innovation programs and their funding life cycles.
 - › Launch NSW R&D Missions to galvanise R&D expertise to solve the government’s long-term strategic challenges.
- **Collaboration** – Building stronger collaborations between research providers, industry and all levels of government:
 - › Create opportunities for collaboration on government challenges and in precincts.
 - › Establish new Research & Innovation Networks in specific industry sectors.
 - › Facilitate the development of research-industry ecosystems through shared spaces and seed funding for projects.

6 OECD 2017, ‘OECD Economic Surveys: Australia 2017’, viewed on 14 October 2020, <www.oecd-ilibrary.org/economics/oecd-economic-surveys-australia-2017_eco_surveys-aus-2017-en>.

7 Australian Government, Innovation and Science Australia 2017, *Australia 2030 Prosperity through innovation – a plan for Australia to thrive in the global innovation race*, viewed on 14 October 2020, <www.aced.edu.au/downloads/Australia-2030-Prosperity-through-Innovation-Full-Report.pdf>.

- ▶ Better coordinate and leverage Commonwealth Government funding opportunities, including Cooperative Research Centres and the National Collaborative Research Infrastructure Strategy (NCRIS), and special programs such as those run by the Australian Space Agency⁸ and the recently announced *Modern Manufacturing Strategy*.⁹
- ▶ Build partnerships and learn from international best practice in research translation.

These levers provide a clear opportunity for the NSW Government to complement its nation-leading delivery of 'hard' infrastructure with equally ambitious whole-of-government action to deliver the 'soft' infrastructure essential for driving future economic and social wellbeing in the state.

3.2 Government investment in R&D and the return on investment

Governments invest in R&D because of the strong link with economic growth

Innovation drives improved economic productivity¹⁰, reducing the costs of production, increasing the quality of goods and services and, in turn, driving employment. The innovation pipeline spans basic research through to research translation and commercialisation. Economic opportunities and new jobs are only possible when all aspects of this pipeline are connected.¹¹ Australia consistently leads in research (at the start of the pipeline), but too often lags in the commercialisation of the research (at the end of the pipeline). It ranked 31st out of 129 countries for innovation outputs in the 2020 Global Innovation Index.¹²

R&D activity by both the public and private sectors has an important role to play in fostering innovation. Public sector R&D has a strong spillover effect on productivity in the wider economy, bringing economic benefits to a wide range of end users beyond the original researchers.¹³ Private sector R&D tends to be

motivated by solving problems and is a key driver for new products and services. In both cases, R&D investment is a key precursor for the creation of new businesses, and the transformation and growth of existing and future industries.

Globally, data shows that start-ups and scale-ups, often created through R&D activities, contribute significantly to the economy and disproportionately to long-term sustainable jobs. Firms that are less than five years old are responsible for 47 per cent of new jobs, despite accounting for only 21 per cent of total employment.¹⁴ In Australia, start-ups that are less than two years old created more than 1.6 million new jobs between 2003 and 2014.¹⁵

Attracting larger national and global companies – which often spend a higher proportion of their revenue on R&D – can also drive employment, both directly and through the creation of a supporting supply chain of smaller companies. Defence is one example of an industry where Australia, through significant growth in Commonwealth Government defence spending, is attracting global companies to co-locate research and production in Australia. In turn, these global companies are sub-contracting local suppliers of components and systems, building an ecosystem of local research translation, technology capability and jobs. There are potentially other industry sectors where this process could be replicated, incentivised by government action and investment.

While investment in R&D is essential in making innovation possible, investment in research translation and commercialisation is as important in delivering an economic outcome. If NSW is to play a significant role in the new global innovation economy, it must better connect the parts of the innovation pipeline.

8 <www.industry.gov.au/strategies-for-the-future/australian-space-agency>, viewed on 22 October 2020.

9 <www.industry.gov.au/data-and-publications/make-it-happen-the-australian-governments-modern-manufacturing-strategy>, viewed on 22 October 2020.

10 Guellec, D & van Pottelsberghe de la Potterie, B 2001, 'R&D and Productivity Growth: Panel Data Analysis of 16 OECD Countries', *OECD Economic Studies* no. 33, OECD, Paris.

11 Anyadike-Danes, M, Hart, M & Du, J 2013, *Firm Dynamics and Job Creation in the UK: White Paper No. 6*, Enterprise Research Council.

12 Cornell University, INSEAD & WIPO 2020, *The Global Innovation Index 2020: Who Will Finance Innovation?*

13 Elnasri, A & Fox, KJ 2017, 'The contribution of research and innovation to productivity', *Journal of Productivity Analysis*, vol. 47, no. 3, pp. 291-308.

14 OECD 2016, *No Country for Young Firms? Policy failures and regulations are a greater obstacle for start-ups than for incumbents*, viewed on 15 October 2020, <www.oecd.org/sti/ind/Policy-Note-No-Country-For-Young-Firms.pdf>.

15 Glenys Beauchamp PSM, Secretary, Department of Industry, Innovation and Science, 2016, speech, Committee for Economic Development of Australia, 'The innovation agenda: we need to work together', <www.youtube.com/watch?v=A_yOD4YUKG4>.

Levels of R&D investment in NSW and Australia

Appendix 7.1 provides a detailed picture of investment in R&D in NSW and Australia compared to our international peers. Broadly, Australia spends about \$33 billion on R&D or 1.8 per cent of gross domestic product (GDP). R&D expenditure as a percentage of GDP has been declining for well over a decade and is substantially behind the OECD average of 2.37 per cent. Most of this shortfall is in business R&D. Government investment in R&D, at 0.17 per cent, is close to the OECD average of 0.18 per cent. This speaks again to our relatively poor record in translating research.

Within Australia, NSW consistently ranks second behind Victoria in combined Commonwealth and state government expenditure on R&D (GOVERD) by location of expenditure. Over three reporting periods, NSW averaged about \$638 million per year compared with Victoria at \$802 million per year. NSW GOVERD intensity, at 0.11 per cent of gross state product (GSP), is also poor compared to other states.¹⁶

In 2018–19, the Waratah Research Network (WRN)¹⁷ determined that the NSW Government invested at least \$386 million to support R&D (\$254 million) and related activity (\$132 million) through cash and in-kind contributions. Just over \$50 million (20 per cent) of this was provided to NSW universities for R&D. The Department of Primary Industries and the Ministry of Health were the two largest funders of R&D in 2018–19, each investing over \$110 million.

R&D investment by NSW businesses is high compared with other states and territories, with an average of about \$6.6 billion per year invested over 2014, 2016 and 2018.¹⁸ This represents a potential opportunity for the NSW Government to leverage existing levels of business R&D investment to improve the state's innovation ecosystem.

Impact of NSW Government targeted investment in R&D

The Office of the NSW Chief Scientist & Engineer (OCSE) provides annual investments of about \$15 million to \$20 million to NSW's research and innovation sectors through the Research Attraction and Acceleration Program (RAAP) and the Quantum Computing Fund. As part of the RAAP, the OCSE provides co-investment to NSW-based research centres established under Commonwealth Government programs. These include the Australian Research Council Centres of Excellence program, the NCRIS and the Cooperative Research Centres Program. The RAAP also provides funding to Research & Innovation Networks¹⁹, competitive research translation and commercialisation projects, and science and technology education initiatives.

The OCSE recently evaluated the economic impacts of its investments in NSW R&D over the past 15 years. Impacts considered included:

- direct returns from incoming investment or cost savings
- job creation through new listed companies and support for regional industry development
- product innovation, including new initiatives, clinical advances and effective collaborations leading to commercial prospects
- retaining R&D and companies within NSW, which would otherwise move to research facilities overseas
- leveraging Commonwealth Government funding to ensure the benefits occur in NSW.

Noting that measuring the economic impacts of R&D investments can be challenging, the study developed a model and methodology based on an estimate of aggregated benefits using available quantitative data. In two example investments, the study estimated the following:

- The economic activity generated by the nine NSW-based research centres studied exceeds \$1.5 billion per year. The OCSE contribution to these centres was \$31 million over 10 years.

16 Figures shown as the average across three Australian Bureau of Statistics reporting periods: 2014–15, 2016–17 and 2018–19, <www.abs.gov.au/statistics/industry/technology-and-innovation/research-and-experimental-development-government-and-private-non-profit-organisations-australia>.

17 'The WRN brings together NSW Government agencies with high impact research teams from universities and industry', viewed on 22 October 2020, <www.nsw.gov.au/waratah-research>.

18 <www.abs.gov.au/statistics/industry/technology-and-innovation/research-and-experimental-development-businesses-australia/latest-release#:~:text=During%202017%2D18%2C%20expenditure%20on,volume%20terms%20from%202015%2D16%3E>.

19 <www.chiefscientist.nsw.gov.au/science-in-nsw/nsw-networks>.

Key examples are the Australian Centre for Advanced Photovoltaics at the University of New South Wales (UNSW) and the RoZetta Institute (formerly the Capital Markets Cooperative Research Centre), including its commercial arm.

- The National Collaborative Research Infrastructure and Strategy includes the Australian National Fabrication Facility, Microscopy Australia and Bioplatforms Australia. The OCSE invested \$6 million over a number of years in Microscopy Australia (headquartered in NSW), contributing \$212 million per year in direct economic impacts through industry projects, new high-skilled jobs and the creation of 11 start-ups.

The RAAP has provided a key mechanism to attract and accelerate research investment from the Commonwealth Government, industry and university sectors. To date, the RAAP has delivered substantial outcomes for NSW, which include securing several new major research centres of excellence, critical national research infrastructure facilities and headquarters of nationally supported research organisations. Further, without these investments, NSW would be at risk of losing more Commonwealth Government and industry research investment to other jurisdictions that are willing to develop and invest in these capabilities.

3.3 Collaboration between sectors in the innovation ecosystem

Industry–university research collaboration

Collaboration between universities and industry on R&D projects leads to a range of mutual benefits. University researchers gain a better understanding of the problems facing business and can direct their research accordingly. Industry gains access to research expertise and infrastructure as well as awareness of new intellectual property (IP) and emerging technologies. Modelling conducted for Universities Australia found that industry–university collaboration generated \$12.8 billion in direct benefits to business, \$26.5 billion in benefits to the economy and 38,500 jobs (in the 2018–19 financial year).²⁰

Despite these obvious benefits, Australia performs relatively poorly in industry–university collaborations. In a recent CSIRO assessment comparing Australia with other OECD countries, Australia ranked 27th out of 29 on large business collaboration with the higher education sector or other non-commercial research institutions. It ranked 29th out of 29 on SMEs collaborating with the higher education sector or other non-commercial research institutions.²¹ This is surprising considering that four in five Australian start-up founders are university graduates, demonstrating the value of graduates with both technical and entrepreneurial capabilities.²² Data on startup collaborations with the higher education system or other businesses is limited.

Analysis by the World Economic Forum ranks Australia 20th out of 131 in the Innovation Linkages category. This incorporates rankings of 39th for university–industry research collaboration and 38th for the state of cluster development (for example, geographic concentrations of firms, suppliers, producers of related products and services, and specialised institutions).²³ In NSW specifically, 31.8 per cent of higher education research was funded by industry in 2017 – less than both Victoria and Queensland, each at about 35 per cent.

Business–business collaboration

According to the Australian Bureau of Statistics (ABS) Business Characteristics Survey for 2016–17 (most recent data), in Australia, only 18 per cent of all innovation-active businesses collaborated with another organisation for innovation, with most collaborating with ‘suppliers of equipment, materials, components or software’ and ‘clients, customers or buyers’. Universities were ranked last in terms of collaboration partners for innovation. In the same survey, 53 per cent of active-innovation businesses sourced new ideas and information from within their business or a business owned by the same company. For businesses employing zero to four staff, the top two factors preventing or limiting collaboration were ‘insufficient funds’ and ‘insufficient time’.²⁴

20 <www.universitiesaustralia.edu.au/project/clever-collaborations/>, viewed on 14 October 2020.

21 CSIRO 2019, ‘Australian National Outlook 2019’, viewed on 14 October 2020, <www.csiro.au/-/media/Showcases/ANO/ANO2_MainReport_WEB_190614.pdf?la=en&hash=905F75CF58D3CCF4DBD86F3FE34DCFOFCDED81D6>.

22 Universities Australia, Startup Smarts: Universities and the Startup Economy, <www.universitiesaustralia.edu.au/wp-content/uploads/2019/06/Startup_press-v2-web-1.pdf>.

23 Cornell University, INSEAD & WIPO 2020, ‘Global Innovation Index 2020: Who Will Finance Innovation?’, viewed on 14 October 2020, <www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020.pdf>.

24 <www.abs.gov.au/statistics/industry/technology-and-innovation/innovation-australian-business/2016-17>.

Reasons for poor collaboration

There are many potential reasons why Australian universities in particular are relatively poor at collaborating with industry. Several are linked to the strong motivation and rewards at universities to focus on academic outcomes – publications and measures of esteem²⁵ – rather than on positive economic and social impact. Australian industry has also been historically limited in its capacity to absorb research outcomes, often focusing on lower-technology businesses including primary industries, retail and services. Added to this is the challenge of apportioning IP ownership between start-ups and universities, and a significant lack of connectivity between Australian universities and industries to address common problems and invest in beneficial outcomes.

Alignment of R&D investment

The *NSW 2040 Economic Blueprint* identified 13 future industries with the potential to drive growth and jobs.²⁶ These industries have scale and comparative advantage, current high spending on R&D and a capacity to disrupt, and be disrupted, through the application of new technologies. Key also is an alignment of these industries with R&D investment and expertise in NSW. The identified future industries are:

- **industries where NSW is already strong:** finance and fintech, mining, education, tourism, major events and business events, arts, culture and creative industries
- **industries that service our domestic needs:** digital and cyber security, medtech, health and biomedical sciences, waste management and the circular economy
- **emerging industries:** advanced manufacturing, agtech and food production, aerospace and defence, space and hydrogen for fuel.

The NSW Government's *20-Year Economic Vision for Regional NSW* also identified 'engine industries' that will drive our regional economies over the next two decades.²⁷ These are:

- **established:** agribusiness and forestry, resources and mining, tourism and hospitality, tertiary education and skills, health and residential care, freight and logistics, and defence
- **emerging:** advanced manufacturing, renewable energy and technology-enabled primary industries.

The NSW Government has developed strategies for some of these industries, including the NSW Space Industry Development Strategy (2020), NSW Advanced Manufacturing Industry Development Strategy (2018), NSW Medical Technology Industry Development Strategy (2018) and the NSW Government Defence and Industry Strategy (2017).

3.4 Accelerating R&D in NSW

In summary, the challenge to accelerating R&D in NSW spans three areas:

1. The NSW Government needs to build and attract future industries to drive economic and social wellbeing in NSW. These future industries are built on an ability to translate R&D into commercial outcomes.
2. NSW has a high-performing research sector, but performs relatively poorly in industry collaboration, research translation and commercialisation.
3. The NSW Government has put some good initial thinking into future industries and is developing a path, focused around precincts, to building these industries. However, the government has not yet harnessed the research sector and innovative businesses to drive the creation of these industries.

This Action Plan provides a coherent, comprehensive and sustainable way to address this R&D acceleration challenge.

25 <www.arc.gov.au/sites/default/files/minisite/static/10419/ERA2015/s2-8_esteem-measure.html>.

26 NSW Treasury 2019, *NSW 2040 Economic Blueprint*, viewed on 14 October 2020, <www.treasury.nsw.gov.au/nsw-economy/nsw-2040-economic-blueprint>.

27 NSW Government 2018, *A 20-Year Economic Vision for Regional NSW*, viewed on 14 October 2020, <www.nsw.gov.au/a-20-year-economic-vision-for-regional-nsw>.

Students from across seven NSW universities competed in the NSW Smart Sensing Network (NSSN) DataHack as part of CEBIT 2019. NSSN is a Research & Innovation Network supported by the Office of the NSW Chief Scientist & Engineer.



Students at work at the Sydney School of Entrepreneurship (SSE). SSE is supported by a foundational grant from the NSW Government.

4



4 An action plan for accelerating R&D in NSW

The recommended five Priority Actions and 16 Supporting Actions set out below focus on how the NSW Government can better harness R&D and translate research into commercial outcomes, creating new businesses, industries, jobs, products and services.

Accelerating R&D to deliver economic and social outcomes for NSW

	Priority Actions	Supporting Actions		
NSW Government Levels	Government action (4.1.2) Boost open data	R&D Governance: Ministerial and Departmental roles: [1,2,3,4,5]	R&D roadmap [6]	Procurement [7]
	Attraction (4.1.3) Turbocharge precincts (4.1.4) Target strategic support for NSW Universities	'Front door' for R&D activities [8]	Tax incentives [9]	Access to research facilities and infrastructure [10]
	Translation (4.1.1) Launch a NSW SBIR program	Build early-stage companies: challenges, missions, grants and capital [11, 13, 14]	Access to business and entrepreneurship skills training to support R&D translation [12]	
	Collaboration (4.1.5) Establish an R&D matchmaking platform	Establish new Research & Innovation Networks [15]	International collaborations [16]	

4.1 Recommended Priority Actions

4.1.1 Launch a NSW Small Business Innovation Research program

The idea

SMEs with a substantial presence in NSW apply to receive an investment to develop innovative products and services to solve NSW Government challenges and problems.

Key features:

- There is an investment in SMEs undertaking R&D activities in NSW to find innovative solutions to specific, well-defined problems for NSW Government agencies.

- Funding is provided for feasibility studies and developing proofs of concept that support SMEs to commercialise their solution to address the defined problem and to offer this to the wider market.
- The program is delivered by a central NSW Government agency in partnership with the NSW Government line agencies that could use the solutions.
- The program supports a larger and faster pipeline of innovative, fit-for-purpose products and services developed in NSW for the government, which also have broader market appeal.

Objectives

The SBIR program will aim to:

- leverage the capacity of SMEs' NSW-based R&D to address the NSW Government's needs
- increase the commercialisation of NSW Government-funded R&D
- support the technology and innovation sector in NSW, with the NSW Government being a proactive customer for innovation
- grow the number of innovative products, services and jobs in NSW.

Implementation

The SBIR program

The NSW Government would regularly invite SMEs to develop innovative solutions to specific challenges and well-defined problems. SMEs would secure funding from the NSW SBIR program in an open and competitive process to address these challenges. The broader goal is for SMEs involved in the program to commercialise their solutions for use by the broader market.

The success of the initiative will depend on the quality of the challenges and problems. Challenges should:

- only define problems that require new solutions – this will promote technology innovation by the SME sector
- only invite solutions that the NSW Government wants to buy – this will help to de-risk R&D investment by ensuring that successful SMEs have the government as their 'first customer'
- invite solutions that may have broader market appeal – this will help grow developed products and services into sustainable businesses, industries and jobs
- leverage existing government assets such as open data and R&D equipment, infrastructure and facilities.

The program should be modelled on successful Australian and international small business R&D programs (such as the US SBIR program²⁸ and the Commonwealth Government's Business Research and Innovation Initiative (BRII)²⁹). SMEs would apply to the NSW Government for feasibility

study funding (around \$100,000). SMEs that are successful would then be eligible to apply for a second, larger government investment to develop a proof of concept (around \$1 million). SMEs retain the rights to any IP generated at the completion of the challenge and would be required to repay the government's investment if the innovation achieves a specified level of economic success. The process for repaying grants from the MDF should be used as a model. With this fund, the specific terms of repayment are agreed as part of the contract negotiations, based on financial information provided annually to the government and an independent financial adviser.

Participation in the SBIR program cannot be a guarantee that a NSW Government agency will purchase the resulting product or service. However, while the agency should assess market demand for the product or service, it is expected that the SBIR recipient would be in a good position to secure the delivery contract. Depending on the complexity of the product or service, an SME may need additional funding to scale-up and commercialise its solution. This would be addressed by the relevant government agency outside the SBIR program.

Only SMEs would be eligible for the program (that is, Australian-based enterprises with fewer than 200 full-time equivalent employees³⁰). An additional eligibility requirement would be included to ensure that the R&D activity was conducted within NSW.

The SBIR program needs to be able to tolerate failure as an essential part of innovation engagement. This recognises that not all innovations will be successful, but that the rewards from success can be sizable for both SMEs and the government.

SBIR governance

Experience from other jurisdictions suggests that a hybrid of central coordination and decentralised responsibility for 'challenges' works best in the early years of the program. The government agencies participating in the program, with the assistance of a central agency, would be responsible for formulating the challenges and short-listing applications. These agencies would

28 <<https://www.sbir.gov>>.

29 Department of Industry, Science, Energy and Resources 2018, 'Business Research and Innovation Initiative', viewed 14 October 2020, <www.industry.gov.au/funding-and-incentives/business-research-and-innovation-initiative>.

30 buy.nsw 2020, 'SME and Regional Procurement Policy', viewed on 15 October 2020, <<https://buy.nsw.gov.au/policy-library/policies/sme-and-regional-procurement-policy>>.

bring technical expertise and knowledge of their business needs. Importantly, the agencies would deploy specialist program managers to work closely with successful SMEs. Their role would be to support SMEs to develop solutions that are fit-for-purpose, including by enabling access to expert advice, facilities, resources and government open data (see section 4.1.2). Agencies such as the Ministry of Health, Department of Planning, Industry and Environment (DPIE), Transport for NSW and the Department of Regional NSW would be ideal first participants due to their already significant R&D expenditure.

A central agency would be responsible for coordinating and evaluating programs. This agency would draw on the advice of an external expert panel when selecting the challenges and approving funding applications. Other functions, such as promoting the program to SMEs performing relevant R&D and administering the investment funding allocation, would also be managed centrally. A dedicated budget allocation would fund the investment – potentially a fixed percentage of existing NSW Government R&D expenditure.

The application process would be streamlined, timely and designed to enable SMEs with limited time and resources to apply. Applications would be assessed against eligibility and selection criteria (quality of proposal, market opportunity, and the technical and commercial capacity/capability of the applicant). The dates for accepting applications, approving applications and providing funding would be published and consistent so that SMEs can best plan the use of their limited resources. SMEs could also be encouraged to apply for the SBIR in partnership with NSW-based public research organisations.

Measures of success

A successful program would support participating SMEs to:

- increase their innovative capacity
- grow and create jobs in NSW
- commercialise their IP
- gain valuable experience by working with the NSW Government.

A successful program would give the NSW Government:

- access to innovative solutions to policy and service delivery challenges
- insights into different problem-solving approaches through working directly with SMEs
- a sustainable job creation mechanism.

Potential measures of success are:

- more SMEs establish and grow their R&D activities and jobs in NSW
- NSW SMEs translate more ideas into innovative products and services
- NSW Government agencies deliver better services to the NSW community by using innovative solutions.

Background

The first program of this type (the US SBIR program) was introduced by the US Government in 1982. It has since been replicated by 17 national governments, including in Canada, the UK and Australia. These innovation support programs target the small business sector and assist companies to move technologies from basic research to a proof of concept – roughly equivalent to moving from TRL 3 to TRL 6.

The US SBIR program uses a decentralised model, with 11 federal agencies administering their own individual programs. The US Small Business Administration provides oversight and guidance, including monitoring agencies, reporting to Congress, providing policy and program guidance, and managing data. The 2019–20 financial year budget for the program was US\$3.28 billion, which is calculated as a percentage of agencies' extramural research budgets.³¹ Ring-fencing the program funding in this way has helped ensure SBIR's longevity and encouraged ownership by agencies.

Indicators of the US SBIR's success include a high rate of technologies that received Stage II funding (prototype development) being commercialised (over 50 per cent) and tax receipts from SBIR funded companies (US\$4.16 in federal taxes were collected from companies for every dollar spent on the SBIR).

31 US Small Business Administration 2020, *Leveraging America's Seed Fund Small Business Innovation Research (SBIR) Small Business Technology Transfer (STTR)*, viewed on 14 October 2020, <www.sbir.gov/sites/default/files/SBA_SBIR_Overview_March2020.pdf>.

The US Department of Defense, which runs the largest SBIR program, reported a return on SBIR investment of 22 to 1, the creation of over 1.5 million jobs, the generation of US\$121 billion in total sales of new products and services, and a total economic impact of US\$347 billion.³²

The UK Government established the Small Business Research Initiative (SBRI) in 2001, which is based on the US SBIR model. The SBRI has since been relaunched and refocused to increase uptake by funding agencies and increase its impact on innovative businesses. Over 80 public sector bodies have used the SBRI, which provides successful businesses with a government contract to help develop and demonstrate their ideas. A 2015 review of the SBRI found a benefit:cost ratio of 1.63 where the effects were self-reported and 2.40 based on an econometric estimate.³³

The Commonwealth Government launched the BRII in 2015 as part of the 'Government as Exemplar' pillar of the National Innovation and Science Agenda. The BRII is modelled on the US SBIR and UK SBRI programs and is administered centrally by the Department of Industry, Science, Energy and Resources. Five challenges are issued per round; two rounds have been completed and a third is in progress. An independent post-commencement evaluation published in 2019 found that the pilot program (the first round) had supported diverse SMEs, stimulated the innovation capacity of SMEs and supported the commercialisation of ideas (just under half of the SMEs that progressed to the proof-of-concept stage had started to commercialise their IP). The evaluation also found that government agencies valued working with SMEs and that the program had acted as a catalyst for agency innovation.³⁴

4.1.2 Boost open data

The idea

Open data is a strategic asset for government, providing the basis for powerful insights, discoveries and inventions that translate into digital products and services, and the creation of digital businesses and jobs. The NSW Government has made considerable strides in building open data environments and platforms, especially through Data.NSW³⁵, the NSW Data Analytics Centre³⁶, the Department of Customer Service³⁷ and Transport for NSW.³⁸ However, this proposal is focused on maximising the use of government data in R&D to build industry capability and new businesses in NSW through:

- targeted strategic release of further NSW Government datasets so that businesses can improve decision-making; entrepreneurs can build new businesses; and government can solve complex challenges
- identifying challenges and opportunities that can be addressed by providing government datasets
- developing an ecosystem of research providers and SMEs that can support industry and government in developing the necessary analytics, machine learning and artificial intelligence (AI) tools and skills to maximise the use of open data assets.

Objectives

The objectives of boosting open data are to enable and sustain an open data ecosystem that:

- ensures NSW Government data is open and accessible by default and empowers open data access by industry and academia
- encourages the use of open data by businesses and researchers to develop solutions to NSW challenges and to accelerate the commercialisation of data-driven R&D

32 US Department of Defense 2019, National Economic Impacts from the DOD SBIR/STTR Program 1995–2018, viewed on 14 October 2020, <www.sbir.gov/sites/default/files/DOD_SBIR%20Economic%20Impacts_1995-2018_03OCT19_releasedbyDOPSR_upload_SBIR_16OCT19.pdf>.

33 Manchester Institute of Innovation Research, Enterprise Research Centre & OMB Research Ltd 2015, A Review of the Small Business Research Initiative: Final Report, viewed on 14 October 2020, <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/662657/A_Review_of_the_Small_Business_Research_Initiative_.pdf>.

34 Nous 2019, Business Research and Innovation Initiative Pilot: Post-commencement Evaluation, viewed on 14 October 2020, <www.industry.gov.au/data-and-publications/business-research-and-innovation-initiative-pilot-post-commencement-evaluation-report>.

35 <<https://data.nsw.gov.au>>.

36 <<https://data.nsw.gov.au/nsw-data-analytics-centre>>.

37 The Department of Customer Service houses a number of key agencies that manage a range of open data initiatives and platforms such as the Data Analytics Centre, Data.NSW and Spatial Services.

38 Over 2,500 developers are active participants in Transport for NSW's open data community, which has seen the development of several popular transport-based apps including TripView, Opal Travel, TripChecker and TripGo.

- attracts and builds new data-centric businesses that create products, services and value from data, and make NSW an attractive environment for data and digital companies.

Implementation

Data release

While the NSW Government makes available a large range of high-quality, open datasets, there are many opportunities to release new datasets that can support R&D and innovation activity. These include:

- environmental data³⁹ – release regulatory and legislative environmental data that impacts industries including agriculture, forestry, gas extraction mining, and chemical processing activities. Datasets could include those concerning water, forestry and biodiversity
- planning, construction and spatial data – release data that supports better planning, design and modelling for NSW’s future needs, including the use of ‘digital twins’ for cities, energy and roads
- health data⁴⁰ – release de-identified and aggregated health data that drives epidemiology, community health issues and live operational data; for example, on hospital waiting times or emergency department capacity
- workforce data – release data collected by NSW Government agencies such as SafeWork NSW and the State Insurance Regulatory Authority to play a role in developing innovative solutions for workforce and emergency management.

The NSW Government should ensure that available datasets are complete, accurate, accessible and discoverable according to commonly accepted open data standards. The NSW Government should also ensure appropriate licences are being applied to datasets to enable their best use.

The NSW Data Analytics Centre is already leading the way in developing a secure sharing framework for data that might be sensitive for privacy, security and/or ethical reasons. This framework needs to be uniformly and consistently applied across the whole of government.

Opportunities from data

Increasing access to government data provides opportunities for a range of stakeholders, such as innovators, industry and researchers, to create

new ways to tackle problems. Stakeholders could be incentivised to analyse and derive insights from government data through:

- a public ‘hackathon’ event: the NSW Government could, for example, build on the Commonwealth Government-sponsored and highly successful GovHack annual event in which participants use open data to solve a variety of social, economic and environmental challenges
- targeted problem-solving via a competition in which open data is used to generate solutions to problems and where the winner is assisted to commercialise the resulting service or product – for example, algorithmic scheduling of asset use and maintenance.

These initiatives differ from the SBIR program (see Section 4.1.1) as they focus on using data to develop products and services for the private sector or general public use (for example, commuters), and the NSW Government is not necessarily a customer. The government can play a role in fostering greater collaboration between government, industry and researchers. This can also help the government better understand user needs around open data, which will support the design, development and publication of future datasets.

The data research ecosystem

The value of data lies in its ability to be used to deliver new products and services that address needs and solve problems, and that improve economic, social and environmental outcomes. This value is delivered through applying software algorithms and systems – based primarily on methods in data analytics, machine learning and AI – that use data to deliver information and decisions required by industry and government. There is a huge business opportunity in translating R&D gained through these methods into new start-ups and existing SMEs.

NSW should incentivise and build this dynamic ecosystem through activities including:

- proactively opening up government data to the analytics, machine learning and AI development community
- offering problems for solving, backed by potential government procurement of the result – focusing on or even requiring that this be done by local companies

39 <www.seed.nsw.gov.au/>.

40 <www.ehealth.nsw.gov.au/>.

- requiring new large-scale infrastructure investment in NSW to adopt an open data and data usage plan – incorporating whole-of-life management of roads and buildings, the use of ‘digital twins’ for asset management, the monitoring of environmental impacts and the subsequent engagement of NSW data companies⁴¹
- attracting substantial international data companies to NSW with the prospect of access to data and a supporting ecosystem with the required skills and knowledge, and the opportunity to work directly with the NSW Government. Key initial areas of focus could be health, energy and environmental information.

The opportunity to build a global-scale data ecosystem would be aided by the already strong national position NSW has in digital service delivery.⁴²

Measures of success

Successfully boosting open data would:

- increase the number of datasets made available and discoverable on Data.NSW
- increase the number of users, downloads of datasets and new combined datasets
- lead to proactive sharing, maintenance and updating of datasets by NSW Government agencies
- increase the development and use of data challenges to drive NSW Government engagement with data analytics, machine learning and AI businesses
- increase the number of start-ups, scale-ups and businesses using government data and working with researchers to develop and commercialise innovative data products and services.

Background

The NSW Government has implemented a range of policies and programs to promote open data in the state. Most notably, Data.NSW was launched in 2009 as the state’s online central data repository. The website contains about 350 catalogue entries,

providing access to over 10,000 government datasets on a searchable, public platform. Other NSW Government open data platforms include the SEED environmental data portal⁴³, the NSW Education Data Hub⁴⁴, the NSW Bureau of Crime Statistics and Research⁴⁵, the NSW Spatial Data Catalogue⁴⁶ and ePlanning.⁴⁷

The NSW Open Data Policy was implemented in 2013 to encourage the release of high-value datasets for use by industry and the community. The policy also aims to assist government agencies in embedding open data principles in their operations.

The policy was refreshed in 2016, focusing on the release of more datasets, in improved open formats, using automated processes for faster publication. This was complemented by the establishment of the role of Open Data Advocate. The Open Data Advocate encourages the release of data by NSW Government agencies with data sharing safeguards, by providing information, advice and assistance to agencies and the NSW public on access to government information.

4.1.3 Turbocharge precincts

The idea

R&D and research translation should be developed as a key activity in NSW precincts, using universities and research providers to attract large business investment, scale growing technology industries and translate the best research into start-up, scale-up and SME opportunities. This focus will drive the development of new products, services and jobs based on the technologies and sectors relevant to individual precincts.

It builds on the recommendations of the *NSW 2040 Economic Blueprint* to 1) establish R&D and commercialisation facilities in the innovation precincts, and 2) use the innovation precincts and industry strategies to concentrate research strengths, drive collaboration between researchers and industry, and speed up innovation.

41 See for example, Government News 2020, ‘NSW smart places strategy to embed sensors in cities’, Government News, viewed on 14 October 2020, <www.governmentnews.com.au/nsw-smart-places-strategy-to-embed-sensors-in-cities/>.

42 Innovation Australia 2020, ‘NSW plants \$1.6b in digital-led recovery’, InnovationAus, viewed on 14 October 2020, <www.innovationaus.com/nsw-plants-1-6b-in-digital-led-recovery/>.

43 <www.seed.nsw.gov.au/>.

44 <data.cese.nsw.gov.au/>.

45 <www.bocsar.nsw.gov.au/>.

46 <sdi.nsw.gov.au/nswsdi/catalog/main/home.page>.

47 <<https://www.planningportal.nsw.gov.au/opendata/>>.

The most suitable precincts for applying this initiative are the priority metropolitan precincts: Western Sydney Aerotropolis, Westmead Health and Innovation Precinct, and Tech Central; and the key Special Activation Precincts at Wagga Wagga, Parkes and Williamstown.

Objectives

Precinct-based R&D aim to:

- attract large businesses to invest in NSW R&D and co-locate with start-ups, scale-ups and SMEs in NSW precincts
- scale high-growth SMEs through supporting new ecosystems, developing new products and services, and creating technology-led business opportunities and jobs
- translate ideas generated by universities, research organisations and start-ups into new products and services
- coordinate universities and other research providers, industry and government to support R&D and innovation ecosystems across the priority metropolitan precincts and regional Special Activation Precincts
- build on the *NSW 2040 Economic Blueprint* to develop a clear articulation of current and emerging NSW research, technology and industry strengths, culminating in a 20-year NSW R&D Roadmap (see Supporting Action 6). A Competitive Advantage Summit led by the NSW Chief Scientist & Engineer and the NSW Chief Economist will kickstart the scoping of the Roadmap.

Implementation

Strategy

The NSW R&D Roadmap will drive the focus and scale of the six precincts nominated above. The Roadmap will help create technology ecosystems capable of high levels of growth through a virtuous cycle of ideas driving the attraction, scaling and formation of companies delivering new products, services and jobs.

This will be achieved through the following:

- R&D investment should focus on precinct-aligned technologies. Examples include advanced manufacturing and aerospace at the Western Sydney Aerotropolis; health and medical devices at the Westmead Health and Innovation Precinct; digital technologies at Tech Central; and defence, energy and agriculture technologies in the Special Activation Precincts. R&D investment in precincts could include research infrastructure (such as the planned Advanced Manufacturing Research Facility at the Aerotropolis⁴⁸) to drive attraction, expand government challenge opportunities (such as the data and digital challenges developed by Transport for NSW⁴⁹) to connect and scale medium-sized companies, and expand translational funding programs, including the MDF⁵⁰ and the Physical Sciences Fund (PSF).⁵¹
- There will be a focus on building and fostering technology and research-led ecosystems in each of the priority precincts. Mechanisms to drive this include:
 - ▶ providing seed funding for collaboration to link researchers to larger companies targeted by precinct business development
 - ▶ partnering with research providers, including universities and the CSIRO, to support the development of an innovation ecosystem and attract more investment
 - ▶ partnering with leading global organisations that have delivered substantial translational R&D capacity in areas aligned to NSW's precincts (see Supporting Action 16)
 - ▶ further developing the successful Research & Innovation Networks program⁵² to scale existing companies to develop new technology-driven products and services, and locate them within precincts – for example, the Defence Innovation Network at the Western Sydney Aerotropolis and NSW Circular in a Special Activation Precinct (see Supporting Action 15).

48 Western Sydney Parklands Authority, 'The Aerotropolis Core', viewed on 14 October 2020, <www.nsw.gov.au/media-releases/sheffields-advanced-manufacturing-facility-to-support-local-jobs-western-sydney>.

49 Transport for NSW 2017, 'Research Hub', viewed on 14 October 2020, <www.transport.nsw.gov.au/data-and-research/research-hub>.

50 NSW Health 2020, Medical Devices Fund – Office for Health and Medical Research – NSW Health, NSW Health & Medical Research, viewed on 14 October 2020, <www.medicalresearch.nsw.gov.au/medical-devices-fund/>.

51 NSW Office of the Chief Scientist & Engineer 2020, 'NSW Physical Sciences Fund', viewed on 14 October 2020, <www.chiefscientist.nsw.gov.au/funding/research-and-development/nsw-physical-sciences-fund>.

52 NSW Office of the Chief Scientist & Engineer 2020, 'NSW Research Networks', viewed on 14 October 2020, <www.chiefscientist.nsw.gov.au/science-in-nsw/nsw-networks>.

- Other mechanisms include:
 - › building and supporting commercialisation training partnerships with organisations such as the Sydney School of Entrepreneurship and Cicada Innovations
 - › funding shared facilities, communal spaces, equipment and research infrastructure that connects industry and research, and drives informal exchanges of ideas, networks and partnerships
 - › locating technology-oriented incubators and accelerators in precincts.

Each of these initiatives will benefit from and build on the visibility and connectedness of the proposed R&D matchmaking platform (see Section 4.1.5).

R&D strengths

Precinct-based R&D must be led by a better understanding of NSW's competitive advantages in research and by the growth potential of future industry sectors. The *NSW 2040 Economic Blueprint* identifies 13 industry sectors that are supported by high-quality research expertise and facilities, and have industry growth potential. A Competitive Advantage Summit will build on this initial work to identify research strengths that can be embedded into our precincts.

Measures of success

Effective turbocharged precincts would result in:

- sustained technology ecosystems that engage universities and research providers in business and jobs creation
- five or more clusters of precinct-specific R&D activity that align with NSW's research and industry strengths
- a pipeline of major research infrastructure in priority metropolitan precincts and Special Activation Precincts by 2025.

Background

Innovation precincts are defined as:

“Geographic areas where leading-edge anchor institutions and companies cluster and connect with start-ups, business incubators, and accelerators. They are also physically compact, transit-accessible, and technically-wired and offer mixed use housing, office, and retail.”⁵³

The concentration of innovative and entrepreneurial collaborative activity in precincts makes them a strong vehicle of economic growth. Precincts should make productive use of land and buildings, and ensure a return on public investment in infrastructure, R&D, education and training, and hospitals.

The NSW Innovation and Productivity Council's *NSW Innovation Precincts* report⁵⁴ identified seven features that make a precinct successful:

- market drivers
- competitive advantage
- collaboration
- infrastructure
- amenity
- enterprise culture
- leadership.

While it takes years to build a successful precinct, there are benefits at the individual, industry, state and national levels. These include jobs growth and higher value employment; superior products and services; greater productivity; export growth; and social, environmental and cultural benefits. The close proximity of industries, researchers and entrepreneurs allows collaboration, knowledge flows and spillovers, which create the ideas that lead to new jobs, products and services.

⁵³ Brookings Institute 2014, *The Rise of Innovation Districts: A New Geography of Innovation in America*.

⁵⁴ NSW Innovation and Productivity Council 2018, *NSW Innovation Precincts: Lessons from International Experience*, p. 5.



The Digital Farmhand, developed by Agerris. The Office of the NSW Chief Scientist & Engineer funded a three-year Ag Robotic STEM program using Agerris agriculture robots.



Australian Astronomical Optics (AAO) engineers working on the HERMES instrument. AAO has been co-funded by the Office of the NSW Chief Scientist & Engineer. Photo Credit: Fred Kamphues.

4.1.4 Target strategic support for NSW universities

The idea

NSW is home to 11 universities, four of which rank in the top 200 research universities in the world. Combined, they are a powerhouse of research creativity in areas ranging from quantum computing and robotics to medical devices and agriculture. The NSW Government and NSW universities need to improve the ways they work together to harness their resources to build new technology-intensive industries, deliver economic growth and create the jobs of the future.

Targeting strategic support for our universities involves:

- building stronger collaborations between NSW universities and the NSW Government, between universities and industry, and among research providers, including the CSIRO, ANSTO and the Defence Science and Technology Group⁵⁵
- working and partnering with universities to attract a much larger portion of Commonwealth Government R&D funding to NSW
- actively engaging and working collaboratively with universities to accelerate R&D in areas of economic and strategic advantage to NSW.

Objectives

The objectives of targeting strategic support for NSW universities are to:

- better harness NSW university research strengths to deliver economic growth and job creation in NSW
- increase collaboration and support the engagement of research providers with government and industry, focusing on research-led attraction of industry to NSW
- increase the connectedness of universities with the start-up and scale-up communities and increase the rate of translation of university research into new companies, products and services

- secure a greater share of Commonwealth Government R&D funding for NSW universities
- build a culture of collaboration between NSW universities to partner in and deliver research that supports future NSW industries.

Implementation

Building collaborations

The NSW Government has recently made good progress in building much stronger collaborations with the university sector through the WRN.⁵⁶ This has improved the coordination of university engagement across government, made the research objectives of various government departments and agencies transparent, and enabled central publication of funding and collaboration opportunities. The NSW Government should strengthen the WRN's governance structure so that it can collaborate more effectively. Changes should include formalising government membership and the role of university and industry representatives. It would also be necessary to increase and sustain funding for a program office supporting the WRN.

In addition to the WRN, the NSW Government should grow programs that support universities to collaborate with each other and with industry. This should include expanding the Research & Innovation Networks⁵⁷ into new areas that align with the Premier's Priorities⁵⁸ and the priorities of individual government departments and agencies⁵⁹ (see Supporting Action 15). The Research & Innovation Networks are an example of a successful research collaboration initiative attracting significant R&D investment to NSW. For example, in its first two years of operation, the Defence Innovation Network attracted over \$22 million in Australian and international R&D investment to NSW universities and businesses. This was well in excess of the \$3.5 million the OCSE's RAAP invested to establish the network.

55 <<https://www.dst.defence.gov.au/>>.

56 NSW Government 2020, Waratah Research, viewed on 14 October 2020, <www.nsw.gov.au/waratah-research>.

57 NSW Office of the Chief Scientist & Engineer 2020, 'NSW Research Networks', viewed on 14 October 2020, <www.chiefscientist.nsw.gov.au/science-in-nsw/nsw-networks>.

58 NSW Government 2020, 'Premier's Priorities', viewed on 14 October 2020, <www.nsw.gov.au/premiers-priorities>.

59 NSW Government 2020, 'Priorities and collaboration | NSW Government', viewed on 14 October 2020, <www.nsw.gov.au/waratah-research/priorities-and-collaboration>.

Securing Commonwealth Government R&D funding

The NSW Government needs to play a much stronger role in partnering with universities and other research providers to maximise the state's share of Commonwealth Government research funding. Currently, the OCSE, through the RAAP, provides responsive co-funding support⁶⁰ to universities for schemes including Centres of Excellence (Australian Research Council), Cooperative Research Centres (Department of Industry, Science, Energy and Resources) and the NCRIS (Department of Education, Skills and Employment). However, NSW has never had a system in place to proactively coordinate funding bids and play a significant role in large new national initiatives such as the Australian Space Agency. As a result, NSW does not secure the quantum of funding or leadership roles that it should be capable of relative to other states and territories.

NSW needs to develop a function that engages strongly and proactively with Commonwealth Government agencies and actively build foresight of upcoming R&D programs. This function, supported by the WRN, the Research & Innovation Networks and the many industry networks, will proactively work to align NSW university capabilities with Commonwealth Government research funding opportunities. In special cases like the NCRIS, and in new initiatives such as the Commonwealth Government's Modern Manufacturing Strategy, this function will be a catalyst in promoting NSW leadership of these initiatives. It will also aim to use the Research & Innovation Network model to promote a unified NSW capability and 'face' for Commonwealth Government funding agencies. An example of this is the Defence Innovation Network⁶¹, which has become a successful gateway into Commonwealth Government and international defence funding for NSW universities and businesses.

Strategic industries

The *NSW 2040 Economic Blueprint*⁶² identified 13 future industries (see Section 3.3). The NSW Government needs to start supporting and developing many of these industries, attracting and growing companies, building internationally

competitive products and services, and creating jobs now and into the future. It can achieve this by:

- developing a 20-year R&D Roadmap to guide NSW Government support for public research that builds on the state's competitive advantages and supports future growth industries. The R&D Roadmap will complement the *NSW 2040 Economic Blueprint* in attracting and guiding investment
- using the R&D Roadmap and working in partnership with our universities to identify areas of research growth, skills and education development and research infrastructure investment, especially in precincts (see Section 4.1.3). The ARDAC is well placed to advise and guide the overall approach in the R&D Roadmap including horizon and trend scanning
- building the NSW Government's capacity to be receptive and responsive to new R&D initiatives. This capacity will work across government departments to triage, coordinate, evaluate and respond to unsolicited R&D proposals (for example, COVID-19 led to researchers making a large number of unsolicited research proposals to government agencies, most of which could not be addressed). Where relevant, researchers should receive timely advice on how to progress or improve their proposals.

Measures of success

Successfully targeting strategic support for NSW universities would:

- increase the rate of collaboration between universities, government and industry, and grow the value of R&D initiatives involving universities
- increase the success rate of universities and NSW companies applying for Commonwealth Government R&D funding, and raise the number of Commonwealth Government R&D initiatives being led from NSW
- lead to partnerships with the research community to identify, invest in and create a set of focused new technology sectors, with the aim of securing future industries and jobs.

60 NSW Office of the Chief Scientist & Engineer 2020, 'Funding', viewed on 14 October 2020, <www.chiefscientist.nsw.gov.au/funding>.

61 NSW Defence Innovation Network, viewed on 14 October 2020, <<https://defenceinnovationnetwork.com>>.

62 <www.treasury.nsw.gov.au/nsw-economy/nsw-2040-economic-blueprint>.

Background

In 2018, NSW universities received 29 per cent of the total research funding provided by the Commonwealth Government.⁶³ While NSW universities received more funding than any other state, they are lagging behind on a *per capita* basis (NSW has 32 per cent of Australia's population). NSW universities perform well in securing Australian Research Council grant funding, and in 2018 gained 34 per cent of Discovery Projects funding. However, they underperform in securing competitive grants from the National Health and Medical Research Council (NHMRC). In 2019, NSW gained only 26 per cent of NHMRC grant funding, compared to Victoria, which received 44 per cent.⁶⁴ This was despite NSW having strengths in the medical and pharmaceutical industries.

In 2017–18, spending on R&D performed by Australian higher education institutions contributed about 34 per cent to Australia's total spending on R&D.⁶⁵ Overall, NSW universities spend \$3.8 billion a year on research.⁶⁶ Universities themselves use general funds, including revenue from overseas student fees and philanthropy, for over 50 per cent of their spending on R&D.⁶⁷ Commonwealth Government-funded research agencies, including the CSIRO, ANSTO and the Defence Science and Technology Group, collectively also invest over \$1 billion a year in NSW.

The Office for Health and Medical Research has an important role in supporting applications for large grants such as the Commonwealth Government's Medical Research Future Fund and the Biomedical Translation Fund. Although the office does not co-fund projects, researchers can seek endorsement of their applications, access government health data, and connect with public health experts and parts of the NSW Health cluster.

4.1.5 Establish an R&D matchmaking platform

The idea

Launch an open-access online R&D matchmaking platform for NSW that links research 'sellers' and infrastructure to research 'buyers' and investors.

The platform will improve knowledge, visibility and transparency of all parts of the R&D ecosystem to better connect universities and research providers to government, industry and investors. The matchmaking platform will reduce transactional complexity and uncertainty for sellers and buyers of R&D, leading to higher and faster rates of commercialisation and the creation of new products, services and jobs.⁶⁸

A strong theme emerging from stakeholder consultations was the need for better connectivity to accelerate R&D commercialisation in NSW. The NSW Government has an important role in bringing together all the parts of the innovation ecosystem. NSW has hubs of quality research and innovation and sources of guidance and advice, but these are often not widely known or promoted, and stakeholders do not always know where they can go to forge the relationships they need to thrive. NSW does not have the same advantages as Silicon Valley, for example, where access to research, knowledge and expertise easily occurs due to the critical mass of like-minded people and existing networks. Therefore, in NSW there is a strong need to facilitate the sharing of information and research infrastructure as well as collaboration between stakeholders.

Objectives

The objective of establishing an R&D matchmaking platform is to match and connect participants in the R&D ecosystem to facilitate collaboration where:

- researchers work closely with government and industry to solve problems and translate ideas into new products, services and jobs

63 Department of Education, Skills and Employment, Australian Government 2020, Research Income Data (1994–2018), viewed on 14 October 2020, <www.education.gov.au/higher-education-research-data-collection>.

64 National Health and Medical Research Council 2020, 'Summary of the results of the NHMRC 2019 Grant Application Round', viewed on 14 October 2020, <www.nhmrc.gov.au/funding/data-research/outcomes-funding-rounds>.

65 Department of Industry, Science, Energy and Resources 2020, 'Australian Innovation System Monitor', viewed on 14 October 2020, <<https://publications.industry.gov.au/publications/australianinnovationsystemmonitor/index.html>>.

66 Australian Bureau of Statistics 2020, 'Research and Experimental Development, Higher Education Organisations, Australia, 2018', viewed on 14 October 2020, <www.abs.gov.au/statistics/industry/technology-and-innovation/research-and-experimental-development-higher-education-organisations-australia/2018>.

67 Ibid.

68 The platform aligns with the Premier's Priority 'Government made easy', viewed on 15 October 2020, <www.nsw.gov.au/premiers-priorities/government-made-easy>.

- industry, government, start-ups, scale-ups and SMEs gain easy access to the best technology, research infrastructure and expertise
- research infrastructure and services across NSW are identified, promoted and better utilised to address the problems and needs of researchers, government and industry.

Implementation

The platform will build on existing online platforms⁶⁹ to provide a solution that addresses the three matchmaking objectives:

Research and development

The R&D matchmaking platform will support interactions between research buyers and sellers and help identify research expertise to translate ideas into new products, services and jobs.

The platform will:

- enable industry to put forward problems requiring collaboration with universities and the broader research community
- allow members of the research community to present information about their expertise, capabilities, facilities and projects and to seek R&D opportunities with industry and investors
- categorise R&D projects according to their sector, potential customers and TRL
- assist investors to more easily identify experts, entrepreneurs and new investment opportunities.

The WRN⁷⁰ has developed Research Connections⁷¹, an online platform that allows NSW Government departments and agencies to showcase their research problems requiring collaboration to the research sector. Research Connections should be incorporated into the R&D matchmaking platform.

Business expertise and mentorship

Translating good ideas into products, services and jobs requires considerable experience and skills in commercialisation and business development. The matching of good ideas to relevant business skills is arguably the single most important area

of relative weakness in NSW and Australia's research translation and creation of sustainable start-ups. The importance of entrepreneurial skills was highlighted in consultations with the start-up community, researchers and university technology transfer offices. It also featured in the experiences of the MDF and the PSF.

The R&D matchmaking platform will link 'good ideas' and technology opportunities to business expertise and mentors:

- experts and mentors can list skills, technology or business area of expertise, and potential availability.
- researchers, start-ups and SMEs can post their required business expertise and mentorship requirements.
- established providers, such as incubators and accelerators, can also be linked through the platform.⁷²

Consultations with start-ups and scale-ups also highlighted that access to services such as legal advice, accounting and financial advice, commercial and business advice, and grant writing expertise would maximise their potential for success.

Equipment, facilities and infrastructure

Major research equipment, facilities and infrastructure should be easily identifiable and searchable on the R&D matchmaking platform and information about potential use shared with the research community and industry. Equipment and facilities can be an especially effective way to build collaboration between research providers and business, and can serve as the shared foundation of an industry ecosystem. A recent impact study undertaken for the OCSE⁷³ made clear the value of major research facilities in attracting and building industry capabilities and outcomes.

69 CSIRO's Commercialisation Marketplace or the Waratah Research Network's 'Research Connections' platforms, for example.

70 <<https://www.nsw.gov.au/waratah-research>>.

71 NSW Government 2020, 'Research Connections', viewed on 14 October 2020, <www.nsw.gov.au/waratah-research/research-connections/submit>.

72 A range of commercialisation training programs are available in NSW such as Sponsored Incubation, The Foundations Program, The Growth Program and the Medical Device Commercialisation Training Program (all offered by Cicada Innovations) as well as some university-led programs and course offerings; and the Sydney School of Entrepreneurship's short entrepreneurial courses.

73 Office of the NSW Chief Scientist & Engineer 2020, Research Impact Study.

This element of the R&D matchmaking platform should begin with a stocktake of NSW Government-funded or supported major research equipment, facilities and infrastructure.⁷⁴ This could be augmented with links to the facilities of other research providers, including universities, ANSTO, the CSIRO, state government laboratories and research centres, and the private sector. This information sharing would also ensure the equipment, facilities and infrastructure, as well as the technical staff who operate and maintain them, are well utilised, maximising the NSW Government's return on investment. Private sector-owned equipment and facilities may also be included so that NSW businesses can build collaborations among themselves, while also reducing the net cost of operating the equipment and facilities.

Measures of success

An effective R&D matchmaking platform would:

- increase collaboration between government, industry and the research community to deliver solutions, research partnerships and joint ventures
- reduce navigational complexity for researchers and industry to find people, equipment, facilities, infrastructure, services and funding to help translate their R&D
- increase the use of already available and new equipment, facilities and infrastructure within government, research organisations and businesses to drive R&D
- increase the visibility of start-ups and scale-ups to enable links between them and investors and researchers
- increase the number of new jobs and businesses.

The R&D matchmaking platform itself will be used to develop quantitative values for these success measures.

4.2 Recommended Supporting Actions

Government action

Supporting Action 1: The NSW Premier, supported by a Parliamentary Secretary, leads the implementation of this Action Plan.

- **Rationale:** Stakeholder consultations identified the need for a whole-of-government R&D strategy led from the highest level of government to ensure NSW is a leader in R&D in Australia and a world-class contributor in research and innovation.
- **Implementation:** Define Ministry and the Parliamentary Secretary's responsibilities and accountabilities.

Supporting Action 2: Establish a new group, tentatively called 'R&D NSW', in the Department of Premier and Cabinet (DPC), which will have whole-of-government responsibility and accountability for R&D activities and investment. R&D NSW would comprise a number of groups already engaged in R&D activities across the NSW Government.

- **Rationale:** NSW Government R&D activity and investment needs to be better focused and coordinated if it is to fully harness and accelerate the translation of research into new products, services and jobs.
- **Implementation:** R&D NSW would:
 - › drive and be accountable for the delivery of this Action Plan and the NSW R&D Roadmap (see Supporting Action 6)
 - › provide oversight and accountability for whole-of-government R&D activities and expenditure (see Supporting Action 4)
 - › have oversight of NSW Government programs that fund R&D for start-ups, scale-ups, SMEs, universities, research organisations and industry

⁷⁴ The Commonwealth Government and the NSW Government, through the OCSE, have supported the National Collaborative Research Infrastructure Strategy's critical research infrastructure in NSW. The Australian Research Council provides funding for research infrastructure, equipment and facilities through the Linkage Infrastructure, Equipment and Facilities scheme. The National Health and Medical Research Council has provided grants through the Independent Research Institute Infrastructure Support grants and Equipment Grants to back research and the purchase and operations of research infrastructure and equipment. The Ministry of Health, through the OHMR, supports equipment and infrastructure purchases through its Medical Research Support Program.

- › have oversight of the WRN⁷⁵ as the body responsible for implementing whole-of-government R&D activities (see Supporting Action 4)
- › guide the government’s activities in relation to priority technology precincts and industries, and attracting technology-led investment.

Supporting Action 3: Establish an R&D Translation Board to provide oversight and accountability for the government’s R&D activities and investment. The Board could give effect to a new Government Circular for NSW R&D activities and investment that would set out principles, guidelines, and evaluation and reporting requirements.

- **Rationale:** Improve the transparency of the government’s R&D activities and investment aligned with this Action Plan and other key government strategies (for example, the *NSW COVID-19 Recovery Plan* and the *NSW 2040 Economic Blueprint*). This would accelerate research translation and the return on the government’s R&D investment.
- **Implementation:**
 - › The R&D Translation Board would consist of Deputy Secretary representation from each cluster⁷⁶ and be chaired by the head of R&D NSW. The R&D Translation Board would implement a new Government Circular for NSW R&D.
 - › The Government Circular would give effect to this Action Plan and the NSW R&D Roadmap (see Supporting Action 6) with:
 - principles and guidelines for R&D activities and investment
 - an evaluation framework to ensure R&D investment is maximised
 - cluster accountability and reporting requirements.
 - › The R&D Translation Board would standardise the reporting of government R&D expenditure by clusters and provide an annual assessment of best practice and research translation outcomes.

- › The activities of the R&D Translation Board would be supported by the WRN, which includes R&D practitioners from each cluster.

Supporting Action 4: Formalise the role of the WRN as the body accountable to the R&D Translation Board, responsible for implementing whole-of-government R&D activities in accordance with the new Government Circular for NSW R&D.

- **Rationale:** The WRN has built a community of R&D practice across the NSW Government, helped collect and share knowledge of R&D funding and opportunities, and represents a coordinated voice to external stakeholders. The WRN needs to have its role formalised by being accountable to the R&D Translation Board for coordinating and implementing whole-of-government R&D activities.
- **Implementation:** Formalise the role of the WRN as the whole-of-government R&D coordination body to:
 - › standardise R&D data gathering and external R&D engagements
 - › build stronger relationships with external research providers and users
 - › share and drive best practice for R&D across government as established by the new Government Circular for NSW R&D activities and investment
 - › report to the R&D Translation Board, which oversees and is accountable for aligning R&D activities and investment in accordance with the new Government Circular.

Supporting Action 5: Establish an independent advisory council comprising leaders in industry and in the innovation, university and research sectors to provide expertise, insights and advice to the NSW Government on R&D translation and commercialisation.

- **Rationale:** The NSW Government would benefit from directional guidance and advice from leaders in industry and in the innovation, university and research sectors to help frame its R&D research activities and investment.

⁷⁵ <www.nsw.gov.au/waratah-research>.

⁷⁶ NSW Government departments, agencies and organisations are arranged into nine groups, called clusters. See NSW Government 2020 departments and agencies, viewed on 14 October 2020, <www.nsw.gov.au/departments-and-agencies>.

- **Implementation:** The Premier or the Parliamentary Secretary will appoint the membership.

Supporting Action 6: Develop a 20-year NSW R&D Roadmap that identifies NSW's current and future research and industry competitive advantages.

- **Rationale:** Identify and communicate the state's current and future research and industry competitive advantages and ensure these inform NSW's R&D investment and activity over a 20-year timeframe.
- **Implementation:**
 - › R&D NSW, in collaboration with the Chief Economist and Chief Scientist & Engineer, should run a Competitive Advantage Summit with experts to identify NSW's research and industry strengths. The summit would identify priority sectors and sub-sectors (and activities along the supply chain) where NSW has or could develop a competitive advantage.
 - › Align the R&D Roadmap with the NSW Government's *COVID-19 Recovery Plan*, *NSW 2040 Economic Blueprint* and *Global NSW*.⁷⁷
 - › Ensure NSW R&D activities and investment are aligned with the R&D Roadmap including leveraging precincts across the state.

Supporting Action 7: Revise the NSW Government Procurement Innovation Stream⁷⁸ to enable 1) the awarding of larger contracts by increasing the threshold from \$1 million to \$5 million for prototypes; 2) a follow-on commercial contract (valued at up to \$5 million) if the prototype is successful; and 3) outcomes-focused procurement through government co-design of products and services with innovators.

- **Rationale:** Many stakeholders recommended that the NSW Government play a larger role as the first customer for start-ups and scale-ups developing innovative products and services. Start-ups and scale-ups are at a disadvantage when competing with larger, more established companies for government procurement contracts.⁷⁹ The NSW Innovation and Productivity Council's research into the environmental goods and services sector noted the importance of government procurement in driving innovation.⁸⁰ A revised Procurement Innovation Stream would better facilitate procurement from innovative businesses in NSW and support start-up and scale-up participation in government procurement.

- **Implementation:**
 - › The R&D Translation Board would set a target (for example, a percentage of NSW R&D expenditure or dollar value in each year) that would be channelled through the Procurement Innovation Stream. Each cluster, through the Board, would report on progress in meeting this metric.
 - › The R&D Translation Board would work closely with the NSW Procurement Board and the NSW Chief Procurement Officer to support a cultural change to procurement inside government and promote use of the Procurement Innovation Stream.
 - › The NSW ICT/Digital Sovereign Procurement Taskforce⁸¹ is developing strategies and policies to diversify the NSW Government's ICT/digital partnership ecosystem and investment. This would also likely support procurement from innovative NSW businesses. The ARDAC supports the taskforce considering objectives to:
 - allow procurement to favour suppliers that retain IP and R&D activity in NSW
 - better promote government procurement opportunities for SMEs

77 NSW Government 2019, 'Global NSW', viewed on 14 October 2020, <https://global.nsw.gov.au/sites/default/files/2020-01/GOVT1009_Global%20NSW_Flyer_LR%20%5Baccessible%5D.pdf>.

78 NSW ProcurePoint 2016, PBD-2016-05-Procurement Innovation Stream, viewed on 14 October 2020, <<https://arp.nsw.gov.au/pbd-2016-05-procurement-innovation-stream>>.

79 For example, Mazzucato, M, *The Entrepreneurial State*, 2013, 'Nearly every state-of-the-art technology found in the iPod, iPhone and iPad is an often overlooked and ignored achievement of the research efforts and funding support of the government and military'.

80 NSW Innovation and Productivity Council 2019, 'Innovation in the NSW environmental goods and services sector', viewed on 14 October 2020, <www.treasury.nsw.gov.au/nsw-economy/nsw-innovation-and-productivity-council/our-publications/innovation-nsw-environmental>.

81 NSW Government 2020, ICT/Digital Sovereign Procurement Taskforce, buy.nsw, viewed on 14 October 2020, <<https://buy.nsw.gov.au/consultations/ictdigital-sovereign-procurement-taskforce>>.

- set explicit procurement targets for SMEs, similar to mechanisms in the US⁸²
- simplify procurement contracts so that more suppliers can engage with government, including developing guidance materials and training for SMEs on the NSW procurement process
- allow procurement to favour larger businesses that partner with NSW SMEs when SMEs are unlikely to be able to respond to tenders, and consider setting explicit targets, such as a percentage of the tender being channelled through a NSW SME partner(s).

- › Create a navigation support feature to manage R&D translation-related enquiries, including idea/product pitches or partnership opportunities. This should be supported by a rapid triage, assessment and response function located within R&D NSW and linking to the WRN. Initial responses to R&D translation enquiries should be delivered within one week.

Supporting Action 9: Provide targeted tax incentives to start-ups and other businesses undertaking deep technology R&D (for example, AI, robotics and quantum computing) in NSW, particularly R&D with a recognised NSW research organisation.

Attraction

Supporting Action 8: Establish a ‘front door’ for R&D activities in NSW, connecting government with businesses and organisations wanting to undertake research in NSW.

- **Rationale:** There is no front door for organisations to pitch R&D activities that address NSW Government challenges, or for businesses and organisations to find out what support the government provides for innovation and R&D translation. This means NSW often misses out on valuable opportunities to support the creation of new jobs, products and services across the state.
- **Implementation:**
 - › R&D NSW, in collaboration with the Department of Customer Service, should establish a single landing page online linking to information about the NSW Government R&D priorities and available government supports. This could be achieved through expanding the WRN webpage⁸³ that currently links to research opportunities, including all other translational R&D supports such as Minimum Viable Product grants and TechVouchers.

- **Rationale:** Companies that invest in deep technology R&D would be attracted to undertake R&D in NSW and, if national or multinational, invest in research in NSW. In turn, this would support the creation of new high-value technology products, services and jobs.
- **Implementation:**
 - › NSW Treasury should determine the most effective way to target tax concessions to achieve the desired outcome and be administratively practicable. This might be a payroll tax concession linked to businesses that access the Commonwealth Government’s R&D Tax Incentive. Alternatively, a more targeted approach might be a rebate against qualifying expenditure, such as the 10 per cent Post, Digital & Visual Effects (PDV) rebate for work carried out in NSW.⁸⁴
 - › Concessions would specifically target technology R&D investment, especially by scale-ups and SMEs, with strong metrics to attract these companies to NSW.⁸⁵

82 The US Small Business Administration sets government-wide goals for procurement from small business. The current overall small business goal is 23 per cent of annual expenditure, viewed on 22 October 2020, <www.sba.gov/about-sba/sba-locations/headquarters-offices/office-government-contracting-business-development>

83 NSW Government 2020, ‘Grants and opportunities’, viewed on 14 October 2020, <www.nsw.gov.au/waratah-research/grants-and-opportunities>.

84 PDV work includes creating, editing and mixing audio or visual elements and other related activities (other than principal photography, pick-ups or the creation of physical elements such as sets, props or costumes). Examples of expenditure that qualifies for the rebate include payments to PDV suppliers whose principal place of business is in NSW or that have an office or branch in NSW that is supplying the goods or services; and salaries and associated payments to PDV crew, including employees and independent contractors. See ‘Screen NSW 2020, Post, Digital & Visual Effects (PDV)’, viewed on 14 October 2020, <<https://screen.nsw.gov.au/funding/incentives/post-digital-visual-effects-pdv>>.

85 It is also recognised that payroll tax concessions already apply to companies with payroll below \$950,000.

Supporting Action 10: Maximise access to research equipment, facilities and infrastructure located in NSW.

- **Rationale:** Access to major research infrastructure, including specialised fabrication and measurement equipment, pilot plants and large test facilities, is both a critical enabler for technology start-ups and a key attractor for larger companies seeking to develop new technology.
- **Implementation:**
 - › Incentivise research providers to open up research facilities, equipment and infrastructure to research users including start-ups, scale-ups and larger businesses.
 - › When it funds research infrastructure, the NSW Government should mandate that start-ups, scale-ups and businesses can access it and that it is located in or accessible from relevant NSW metropolitan and regional precincts.
 - › Identify and promote key research facilities in precincts – such as the Advanced Manufacturing Research Facility at the Western Sydney Aerotropolis, the Viral Vector Manufacturing capability at Westmead Health and Innovation Precinct, and energy research infrastructure in Newcastle and at other regional precincts.
 - › Use the R&D matchmaking platform (see Section 4.1.5) to map the location of research equipment, facilities and infrastructure, and their accessibility.
 - › R&D NSW should be responsible for this initiative.

Translation

Supporting Action 11: Broaden, scale up and promote translational research funding based on the success of the existing Medical Devices Fund (MDF) and the Physical Sciences Fund (PSF), by establishing a new overarching Translational Research Fund.

- **Rationale:** Translational research funds aim to address a market failure where early-stage R&D translators have limited access to investment capital. Translational funds help deep technology companies bridge the funding ‘valley of death’, enabling them to secure later stage capital and remain in NSW while they grow and scale. Existing translational funding programs (such as the MDF and the PSF) have demonstrated a strong return on NSW Government investment.⁸⁶
- **Implementation:**
 - › The Translational Research Fund would have several subsidiary funds targeting priority areas for accelerated research translation, based on areas identified by the NSW R&D Roadmap (see Supporting Action 6).
 - › Funds would replicate the MDF and the PSF methodology, targeting deep technology companies in the TRL 3 to TRL 7 stages, with a competitive but agile application process, guided by expert external advisory boards that include both domain specialists and technology investors.
 - › Adopt clear success metrics on attracting technology SMEs, creating new companies and the economic returns to NSW, in line with metrics used by the MDF and the PSF.
 - › Adopt a mechanism for repaying funds invested once the innovation reaches a specific level of economic success, and for reinvesting the returns.
 - › R&D NSW would administer the new Translational Research Fund.

⁸⁶ Since 2013, NSW Health’s Medical Devices Fund has supported individuals, companies, public and private hospitals, medical research institutes and universities to take local innovation to market. It has awarded more than \$58.37 million in grants to 35 technologies, with the organisations raising more than \$790.54 million, leading to the treatment of over 300,000 patients and the sale of 200,000 medical devices into global markets. NSW Government unpublished report.

Supporting Action 12: Leverage business and entrepreneurial skills providers to help R&D translation grant recipients access the skills they need to successfully translate, scale and commercialise their research.

- **Rationale:** Successful innovation requires great technology as well as an ability to translate the technology into a business proposition for which there is market demand. The MDF and the PSF provide business and entrepreneurial skills training to recipients. This support should be available to all NSW Government R&D translation grant recipients.

- **Implementation:**

- › Build start-up, scale-up and SME business and entrepreneurial capacity through programs such as those offered by Cicada Innovations and the Sydney School of Entrepreneurship.
- › Enable the matching of start-ups, scale-ups and SMEs with mentors through the R&D matchmaking platform (see Section 4.1.5).
- › Measure success by tracking the average time it takes to successfully commercialise IP, the number of successful matches and the uptake by both metropolitan and regional entrepreneurial communities.
- › R&D NSW would be responsible for implementation.

Supporting Action 13: The Premier will launch NSW R&D Missions to inspire and galvanise R&D expertise to solve major challenges facing the NSW Government and to deliver ambitious, innovative outcomes for the state (see Section 4.3).

- **Rationale:** R&D Missions would aim to address substantive longer-term state goals that require cross-government collaboration and demonstrate how the ARDAC's Priority Actions (see Section 4.1) and Supporting Actions can accelerate R&D in practice.⁸⁷

- **Implementation:**

- › The ARDAC recommends that the first mission should be to establish NSW as a major world centre of bushfire research, and technology development and commercialisation, acting on a recommendation of the 2020 NSW Bushfire Inquiry.⁸⁸
- › Other missions could focus on extreme drought resilience, healthier and longer living, or building on opportunities to decarbonise the NSW economy.⁸⁹
- › NSW R&D Missions should leverage Commonwealth Government support and research activity – for example, the CSIRO and the proposed Natural Hazards Research Centre.⁹⁰
- › R&D NSW would coordinate NSW R&D Missions.

Supporting Action 14: Extend innovation program and funding life cycles from 1-2 years to 3-5 years to better deliver innovation outcomes through greater funding certainty.

- **Rationale:** Stakeholders such as start-ups and scale-ups that use government funding and programs (for example, Minimum Viable Product grants and TechVouchers) would better and more confidently resource their R&D translation activities if there were longer program and funding life cycles. The hallmark of internationally successful programs (such as those administered by the US Defense Advanced Research Projects Agency⁹¹ and the US Small Business Administration⁹²) has been a commitment to their duration.

- **Implementation:**

- › Cluster R&D budgets (and R&D supporting programs) are normally part of their general operating budget and are not considered over forward estimates, leading to annual uncertainty for R&D programs and funding. Options to separate them include:

87 Since the success of the US *moon shot*, governments around the world have been exploring ways to use bold mission-led challenges to drive innovation and solve 'wicked' problems. Recent examples include the US Government's national mission to cure cancer (2016), the Japanese Government's national mission program (2019) and the EU's Horizon Europe missions (launch planned for 2021).

88 The 2020 NSW Bushfire Inquiry recommendation 5. See NSW Government 2020, Final Report of the NSW Bushfire Inquiry, viewed on 14 October 2020, <www.dpc.nsw.gov.au/assets/dpc-nsw-gov-au/publications/NSW-Bushfire-Inquiry-1630/Final-Report-of-the-NSW-Bushfire-Inquiry.pdf>.

89 NSW Office of the Chief Scientist & Engineer 2020, 'Decarbonisation', viewed on 14 October 2020, <www.chiefscientist.nsw.gov.au/independent-reports/decarbonisation>.

90 <www.minister.industry.gov.au/ministers/karenandrews/media-releases/881-million-new-world-class-disaster-research-centre>.

91 <<https://www.darpa.mil/>>.

92 <<https://www.sba.gov/>>.



The Sydney Nanoscience Hub.
The Office of the NSW Chief Scientist
& Engineer provides support for
the Australian Nano Fabrication Facility
across a number of sites in NSW.



- identifying and separately accounting for R&D budgets over a longer period. The benefit of longer tenured funding is recognised through the NSW Government's social impact investments⁹³, which are made for up to seven years and have outcomes-based contracts
- having an annual program and funding life cycle but permitting their use and evaluation over multiple years.⁹⁴

These changes would be embedded in the new Government Circular for NSW R&D.

Collaboration

Supporting Action 15: Establish new Research & Innovation Networks aligned with the NSW R&D Roadmap.

Rationale: Facilitate collaboration between industry and universities, provide a coordinated contact point in NSW for specific research sectors and accelerate sector research translation. Existing Research & Innovation Networks – the NSW Smart Sensing Network⁹⁵, the Defence Innovation Network⁹⁶ and NSW Circular⁹⁷ – have all achieved these objectives and delivered a substantial return on investment.⁹⁸

• Implementation:

- › R&D NSW should establish Research & Innovation Networks in priority sectors identified in the NSW R&D Roadmap (see Supporting Action 6). Research & Innovation Networks should focus on facilitating collaboration and on research translation.

- › Each Research & Innovation Network provides a coordinated point of contact for research collaboration and commercialisation opportunities, with some also providing leveraged seed funding for collaborative projects between industry and academia.
- › Individual Research & Innovation Networks should be embedded in particular precincts – such as drug discovery in the Westmead Health and Innovation Precinct and renewable energies in the regional Special Activation Precincts. This would also support collaboration between Research & Innovation Network participants.

Supporting Action 16: Partner with leading global organisations to drive research translation and maximise the impact of NSW research activities, particularly in precincts.

- **Rationale:** Many jurisdictions and organisations around the world have delivered substantial R&D translational capacity with large, positive economic and social impacts. By partnering with such leading global organisations, the NSW Government can adapt collaborative approaches to further accelerate R&D translation.

• Implementation:

- › Build on the example of the University of Sheffield/Western Sydney Aerotropolis Memorandum of Understanding (MOU) for the Advanced Manufacturing Research Centre with a focus on R&D translation in other precincts – for example, Viral Vector Manufacturing at the Westmead Health and Innovation Precinct or renewable energy in the regional Special Activation Precincts.

93 Office of Social Impact Investment, <<https://www.osii.nsw.gov.au>>.

94 An example is Australian Government-funded Cooperative Research Centres, which are allocated funding in one year that can be drawn over a seven-year period. See Australian Government 2020, Current Cooperative Research Centres (CRCs), viewed on 14 October 2020, <www.business.gov.au/Grants-and-Programs/Cooperative-Research-Centres-CRC-Grants/Current-Cooperative-Research-Centres-CRCs>.

95 <<https://www.nssn.org.au>>.

96 <<https://defenceinnovationnetwork.com>>.

97 <<https://www.nswcircular.org>>.

98 For example, the NSW Smart Sensing Network (NSSN) is a consortium of eight leading universities in NSW and the ACT. NSSN brings government, industry and academia together to work on smart sensing solutions to solve economic, environmental and societal challenges across industries. In FY2018–19 alone, the NSSN attracted \$6.4 million in commissioned research for three projects. The value of the NSSN to NSW extends beyond the commissioned research it facilitates. The NSSN is investing heavily in fostering a smart sensing ecosystem in NSW that draws together the manufacturers, fabricators, designers and deployers of smart sensors in NSW to communicate with one another and with the research community. Many NSSN projects have the potential for R&D industrial translation, with significant economic values. For example, the water leaks detection project, in partnership with Sydney Water and eight other water utility companies in Australia, is in the process of commercialising project outcomes.

- › Identify international organisations that have been successful in R&D translation that are relevant for NSW – notably from the UK, the US, Germany, Israel and Canada – to explore potential partnerships for an MOU.
- › R&D NSW would be responsible, in collaboration with individual precinct governance bodies.

4.3 NSW R&D Missions – tackling the big challenges

The ARDAC recommends that the NSW Government launch a direct incentive program of NSW R&D Missions, aimed at solving the government’s long-term strategic challenges through R&D translation. These are challenges that require deep collaboration between industry, government and research providers to develop and commercialise new technologies and services, and improve the quality of life for the citizens of NSW. R&D Missions will use all of the ARDAC’s Priority Actions and Supporting Actions to spawn new businesses and industries in areas of major significance to NSW and the world.

Background and context

Professor Mariana Mazzucato, an economist and international expert on innovation policy, has proposed three features for a successful mission-oriented policy:

1. Missions should be well defined – a granular definition of the technological challenge helps establish intermediate goals and deliverables, and facilitates monitoring and accountability.
2. Each mission should comprise a portfolio of R&D or innovation projects because R&D outcomes are uncertain and some projects will fail.
3. Missions should have a trickle-down effect, whereby the priorities are translated into concrete policy instruments and actions adopted by all levels of public institutions.⁹⁹

Professor Mazzucato also emphasises the need for missions to address a need in society, create a long-term public agenda for innovation policies and draw on the high potential of a country’s science and technology system to develop innovations.¹⁰⁰

In 2017, the former Innovation and Science Australia recommended that the Commonwealth Government boost the national innovation culture by launching national missions.¹⁰¹ It proposed three criteria for selecting missions – namely, that they are:

1. robust, credible and in the national interest – they should address a significant threat, gap or opportunity facing Australia that aligns with a current national priority
2. bold and new – they should be imaginative and inspiring
3. able to bring about a step-change in Australia’s innovation capacity and culture – they need to inspire Australians to aim high and dream big.

In mid-2020, the CSIRO announced a program of 12 national missions. They include mitigating the impact of natural disasters, creating a hydrogen industry, overcoming the growing resistance to antibiotics and ending plastic waste. The CSIRO has committed at least \$100 million annually to this program and is collaborating with government, industry, researchers and communities to launch and accomplish the missions.¹⁰² Some NSW Government agencies are partnering with the CSIRO on a number of them.

The CSIRO missions are designed to address national challenges by forming broad research collaborations. They are not tailored to the industry and R&D strengths of particular states or territories. The NSW Government has an opportunity to craft its own missions that inspire local researchers and innovators to aim for common state-based goals with potential global impact.

99 Mazzucato, M 2018, ‘Mission-oriented innovation policies: challenges and opportunities’, *Industrial and Corporate Change*, vol. 27, no. 5, p. 12.

100 Ibid.

101 Innovation and Science Australia 2017, *Australia 2030: prosperity through innovation*, Australian Government, Canberra, p. 91.

102 Ibid.

A few NSW Government agencies already use challenges to promote innovative solutions in different program areas. Recent examples include the Department of Primary Industries' Grand Challenge program and Transport for NSW's Innovation Challenges scheme. However, unlike the NSW R&D Missions being proposed here, these challenges aim to solve specific, small-scale problems in a short timeframe and don't drive cross-sector collaboration between industry, government and research providers.

Applying R&D Missions to innovate in NSW

The NSW R&D Missions proposed by the ARDAC address long-term strategic challenges, are complex and multi-faceted, and require integration and translation of research across multiple government agencies. The ARDAC discussed a range of potential R&D Missions of strategic importance to NSW. These include drought resilience, healthy and longer living, and the transition to renewable energies. Launching R&D Missions will offer NSW the opportunity to drive R&D translation, develop new products and services, and create jobs and new export-oriented businesses around focused areas of state and global need.

The ARDAC recommends that the first NSW R&D Mission should focus on improving planning, preparations for and responses to bushfires – aligning with recommendation five of the recent NSW Bushfire Inquiry.¹⁰³ The 2019–20 bushfires along the Australian East Coast were some of the worst in recorded history. A total of 5.5 million hectares were burnt, 26 people lost their lives and 2,476 homes were destroyed. The NSW Government commissioned an independent expert inquiry into the 2019–20 bushfire season and accepted in principle all 76 of the Inquiry's recommendations. Resilience NSW¹⁰⁴ has been tasked with coordinating and overseeing the implementation of the recommendations.

The Inquiry recommended that the government establish NSW as a major world centre of bushfire research, technology development and commercialisation. This includes:

- establishing a Bushfire Technology Fund, modelled on the MDF, to assist with the rapid development of technologies and services to sense, fight, clean up after and protect the state from bushfires
- commissioning further research into extreme fire behaviour and building up the research and research training capacity in this field. This will improve our ability to understand, model and predict the likelihood of extreme fire behaviour in the landscape and enable targeting of firefighting resources to areas where fires are likely to become most extreme.

The NSW Bushfire Response R&D Mission will aim to translate research and technology into globally relevant products and services, through existing and new technology-led companies. While being of vital relevance to NSW, new bushfire response technologies and services have national and global markets, and NSW expertise provides a significant comparable advantage.

The NSW Bushfire Response R&D Mission meets Professor Mazzucato's criteria – it is immediate, of high relevance and can drive innovation to demonstrable commercial outcomes. It is also bold and will be inspiring and motivating across the business and research sectors, and the communities in both regional and metropolitan NSW. The mission will bring together research including ecology and forestry, fire modelling, advanced sensing and data fusion, and firefighting autonomous systems, and will exercise the Priority Actions and Supporting Actions shown in the following diagram. Developing new and improved technologies to reduce the incidence and impact of bushfires will deliver significant social, economic and environmental outcomes for NSW and have a global impact as countries look for new ways to manage increasingly damaging bushfires.

103 NSW Government 2020, Final Report of the NSW Bushfire Inquiry, viewed on 14 October 2020, <www.dpc.nsw.gov.au/assets/dpc-nsw-gov-au/publications/NSW-Bushfire-Inquiry-1630/Final-Report-of-the-NSW-Bushfire-Inquiry.pdf>.

104 <www.nsw.gov.au/media-releases/nsw-government-releases-bushfire-inquiry-report>.

NSW R&D Mission: Establish NSW as a world centre of bushfire R&D commercialisation

Levers	Government action	Translation	Collaboration	Attraction
Launch a NSW SBIR program	Issue challenges to develop bushfire-related technology; e.g. remote fire detection			
Boost open data	Provide government data on climate, biodiversity and disaster response to allow private sector innovation			
Turbocharge precincts		Attract industry and R&D capacity with expertise in autonomous firefighting and remote piloted vehicles		
Target strategic support for NSW universities		Coordinate applications for Commonwealth Government research grants to undertake R&D on extreme fire behaviour and related issues		
Establish an R&D matchmaking platform		Set up an R&D Matchmaking Platform for research and industry in the bushfire technology sector		
Other recommended actions	Establish a Bushfire Technology Fund - development of technologies and services to sense, fight, mop up after and protect from bushfires			
		Establish a Bushfire Research & Innovation Network to complement the NSW Bushfire Management Research Hub ¹⁰⁵		

Priority Actions

Supporting Actions

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105 <<https://www.bushfirehub.org/>>.

5



5 What stakeholders said

The NSW Government invited public submissions from organisations and individuals on accelerating R&D in the state. Stakeholders were invited to respond to the following six questions:

- 1 How can the NSW Government better support you/your organisation's R&D efforts?
- 2 How can the NSW Government better support the R&D and innovation ecosystem in NSW?
- 3 What barriers for R&D in NSW have you experienced and how can the NSW Government address these?
- 4 What does the NSW Government do well in the R&D space and what are the key opportunities for the NSW Government to accelerate R&D in NSW?
- 5 How can NSW better leverage Commonwealth Government investment in R&D?
- 6 Are there examples from other jurisdictions supporting R&D that NSW can learn from/adopt?

Submissions opened on 28 October 2019 and closed on 13 December 2019.¹⁰⁶ A total of 98 submissions were received from businesses, academics, research organisations, government agencies, investors, not-for-profit groups, peak bodies and individuals (see the following table and Appendix 7.2).

The Hon. Gabrielle Upton MP held individual meetings with over 60 additional stakeholders to get direct feedback on their experiences and suggestions on how to accelerate R&D translation in NSW (see the following table and Appendix 7.3). The DPC also consulted with relevant government clusters. COVID-19 health restrictions meant most meetings were held online via videoconference.

Ms Upton and the NSW Chief Scientist & Engineer, Professor Hugh Durrant-Whyte, also spoke at various forums including those hosted by the Committee for Economic Development of Australia (CEDA), the Committee for Sydney, the Spark Festival and the Australia-Israel Chamber of Commerce (AICC). Separate roundtables were held with representatives from university technology transfer offices and the start-up community to test and refine the recommendations. Stone & Chalk hosted the start-up roundtable at the Sydney Startup Hub.

NSW Government should play a more active role in driving R&D

Most submissions focused on the role of government in promoting, conducting, procuring and directly supporting R&D. A recurring theme was the need for the NSW Government to have a whole-of-government strategy to guide its R&D investment and activities, and for that strategy to have a 'champion' inside government. Stakeholders suggested the NSW Government should improve its internal structures and processes to better support R&D, including creating a single point of contact for advice and information for stakeholders.

Many stakeholders said the NSW Government should increase funding and infrastructure for R&D activity, and leverage more Commonwealth Government R&D funding. This could involve supporting NSW universities and industry to establish more Cooperative Research Centres and assisting NSW universities to access more funding from the Medical Research Future Fund and other major Commonwealth Government funds.

¹⁰⁶ Some late submissions were also accepted.

Stakeholders also suggested that successful NSW Government programs – such as the MDF, the PSF and the Medical Research Support Program – should be scaled up and extended. Additionally, they recommended providing seed funding for early-stage commercialisation and establishing a NSW version of the Australian Research Council’s Linkage Program for grants.

The potential for the NSW Government to drive more innovation through its own procurement activities was frequently raised in submissions. Stakeholders recommended that the government play a larger role as the first customer for businesses developing innovative products and services. There were also suggestions to reduce or remove payroll tax for start-ups and to use state-based taxes and other incentives to attract both emerging and mature R&D SMEs to NSW.

Many stakeholders urged the NSW Government to be more proactive in connecting stakeholders in the innovation ecosystem – start-ups, scale-ups, universities, government research organisations, SMEs, industry and investors. They considered that the NSW Government could do more to promote the value of collaboration between universities and industry and to build awareness of the state’s research strengths. Stakeholders also wanted the government to publish more of its datasets, and to link and standardise them, making them easier to use.

NSW Government should encourage collaboration through place-based innovation

The NSW Government’s approach to building and curating innovation precincts received broad support from stakeholders. Precincts were viewed as an effective way to reach a critical mass of research activity and encourage collaboration between start-ups, scale-ups, SMEs and large businesses, research organisations and universities. Stakeholders recommended the NSW Government focus on a small number of precincts and activities in those precincts, so as not to dilute efforts.

Stakeholders supported the NSW Government establishing an R&D matchmaking platform so that research collaboration opportunities were more visible. Some stakeholders said the processes underpinning government research collaboration should be improved by standardising contracting guidelines and processes.

University research translation and venture capital roundtable

A virtual roundtable with NSW university research technology transfer offices and venture capitalists was held in August 2020. The discussion focused on ways to increase the number of university discoveries that are commercialised.

Attendees expressed support for a range of existing government programs such as the Boosting Business Innovation Program and TechVouchers. These programs were considered effective at building connections between universities and businesses. The MDF and PSF were viewed as good translational research models that deserved increased funding, and should be replicated in other fields. A common view was that researchers needed more funding to develop proofs of concept and address the ‘valley of death’ that exists before an innovative service or product can generate revenue from customers.

Attendees observed that universities and industry need to work more closely together. They also said that changes to university culture and incentive structures could encourage more academics to found start-ups based on their research discoveries.

Initiatives such as establishing incubators in universities (for example, INCUBATE at the University of Sydney), funding entrepreneurs-in-residence, and locating start-ups and SMEs in universities were considered important since they lead research activities to focus on real-world problems.

The management of IP by government and universities was viewed as an impediment to commercialisation. Suggested changes included implementing a single, simplified IP system across university and state-funded research organisations, with standard commercial terms.

Attendees suggested enhancing the proposed R&D matchmaking platform by including information on facilities, equipment and infrastructure held at research institutions so they were more visible and could be shared with other researchers.

Sydney Startup Hub roundtable

The Sydney Startup Hub and Stone & Chalk hosted a roundtable for start-ups and scale-ups in August 2020. There were a large number of attendees, either online or in person, with online attendees providing feedback using a chat function. Online attendees were asked two poll questions:

1. **Which incentive will have the biggest positive impact on a start-up's growth trajectory?**

The top three responses were:

- › a grants program to support feasibility studies and development (30 per cent)
- › access to capital (23 per cent)
- › procurement opportunities (20 per cent).

2. **What are the greatest barriers to success experienced by start-up and scale-up founders?**

The top three responses were:

- › access to capital (40 per cent)
- › customers (38 per cent)
- › availability of the right talent (16 per cent).

Attendees were asked about the role of co-working spaces, incubators and accelerators in helping start-ups to grow. Comments were made that simply providing a space for start-ups isn't enough – programs are needed to encourage interaction and collaboration. Other suggestions included giving them easy access to business and entrepreneurial skills, expert services and mentors.

The question of what direct action the NSW Government should take to support start-ups generated a number of suggestions. These included providing opportunities for start-ups to bid for government business, discounting payroll tax, expanding successful programs such as the MDF, and having the government improve communication about the problems it wants solved.

Breakdown of written submissions by sector and industry

Industry	Sector							
	Government	Private sector	Universities and academics	Research institutes and precincts	Not-for-profits and social enterprises	Peak bodies	Individuals	TOTAL
Business and finance	-	5	-	-	-	6	1	12
Research, policy and advocacy	-	-	-	2	6	1	-	9
University-based (education, training, research and programs)	-	1	19	2	-	-	-	22
Health, medical and life sciences	-	5	-	9	4	3	1	22
Professional, scientific and technical services	3	8	-	-	3	-	1	15
Manufacturing	-	6	-	-	-	-	-	6
Information, media and communications technologies, and data	1	3	1	1	1	2	-	9
Agriculture and environment	2	-	-	-	1	-	-	3
TOTAL	6	28	20	14	15	12	3	98

Stakeholder forums

Date	Attendees	
20 February 2020	CEDA forum	CEDA members and guests
9 March 2020	Inspiring Australia stakeholder briefing	Various
25 May 2020	Sydney Business Chamber and Western Sydney Business Chamber forum	Sydney Business Chamber and Western Sydney Business Chamber members
23 June 2020 30 September 2020 28 October 2020	NSW Vice Chancellors Committee meetings	NSW university vice chancellors
7 July 2020	Committee for Sydney forum	Committee for Sydney members and guests
17 August 2020	University research translation and venture capital roundtable	NSW university research technology transfer offices and venture capitalists
18 August 2020	Sydney Startup Hub roundtable hosted by Stone & Chalk	Sydney Startup Hub and Stone & Chalk members and guests
25 August 2020	AICC forum	Avi Luvton, Vice President, Israel Innovation Authority AICC members and guests
1 September 2020	CEDA roundtable	Selected CEDA trustees
15 October 2020	Spark Festival, Venture Café Sydney and CSIRO	Spark Festival attendees, Venture Café Sydney and CSIRO members and guests



Photo credit:
Destination NSW

6



6 Background information

Accelerating R&D in NSW Advisory Council

In October 2019, the NSW Premier, the Hon. Gladys Berejiklian MP, asked her Parliamentary Secretary, the Hon. Gabrielle Upton MP, to help accelerate R&D to make NSW Australia's R&D leader and a world-class contributor. Ms Upton appointed an Advisory Council of eminent leaders in innovation, business, government and the tertiary education sector to provide insights and advice to the NSW Government. The Advisory Council was chaired by David Gonski AC and comprised:

- Maxine Brenner
- Jillian Broadbent AC
- Professor Hugh Durrant-Whyte
- Professor Barney Glover AO
- Professor Brigid Heywood
- Catherine Livingstone AO
- Philip Marcus Clark AO
- Dr Larry Marshall
- Professor Mary O'Kane AC
- Daniel Petre AO
- Professor Michelle Simmons AO
- David Shein
- Neville Stevens AO
- David Thodey AO
- Professor Paul Wellings CBE
- Jennifer Westacott AO.

The Advisory Council committed to deliver an action plan to accelerate R&D. It met nine times between October 2019 and September 2020. There was a short hiatus in meetings between April and May 2020 due to the COVID-19 pandemic. DPC provided secretariat support.

7



7 Appendices

7.1 Background information on R&D expenditure

Australia lags other developed nations in R&D spending

In 2017-18, gross domestic expenditure on R&D (GERD) by all Australian resident companies, research institutes, universities and government laboratories totalled about \$33 billion. This represents about 1.79 per cent of gross domestic product (GDP).¹ This measure of GERD as a proportion of GDP is an indicator of research intensity in the economy, which, in Australia, has been declining over the past decade even though the total volume of spending has increased (see Figure 1).²

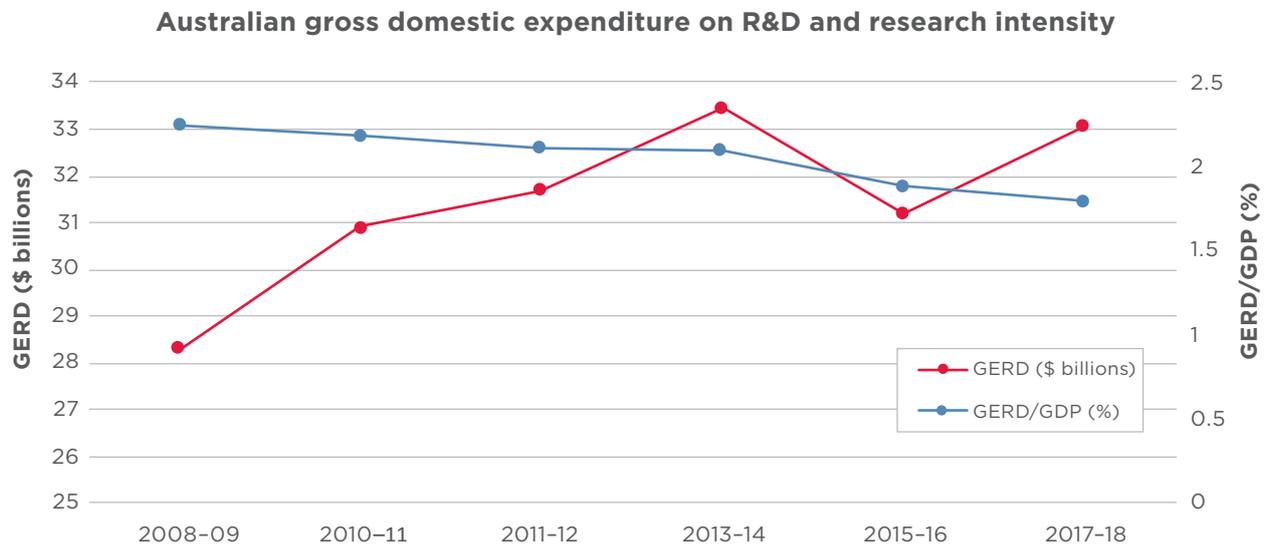


Figure 1 (Source: Australian Bureau of Statistics 2020, GERD)³

The most recent comparisons available from the Organisation for Economic Co-operation and Development (OECD)^{4,5} show that, among the 37 member nations, Australia ranks:

- 18th for GERD (see Figure 2)
- 8th for government tax relief for business expenditure on R&D (BERD)
- 30th for direct government investment in BERD
- 14th for total government spending (tax relief and government investment) on BERD (see Figure 3).

1 Australian Bureau of Statistics 2019, 'Research and Experimental Development, Businesses, Australia', 2017-18, viewed on 15 October 2020, <<https://www.abs.gov.au/AUSSTATS/abs@.nsf/Latestproducts/8104.0Main%20Features22017-18?opendocument&tabname=Summary&prodno=8104.0&issue=2017-18&num=&view=>>>.

2 Ibid.

3 Ibid.

4 OECD 2020, 'Gross domestic spending on R&D', viewed on 15 October 2020, <https://www.oecd-ilibrary.org/industry-and-services/gross-domestic-spending-on-r-d/indicator/english_d8b068b4-en>.

5 OECD 2020, 'Measuring Tax Support for R&D and Innovation', viewed on 15 October 2020, <<http://www.oecd.org/sti/rd-tax-stats.htm>>.

Australian R&D intensity is below the aggregated OECD total in both GERD by GDP (1.8 per cent versus 2.3 per cent) and total government spending on BERD by GDP (0.17 per cent versus 0.18 per cent). Australian R&D intensity is also below that of non-OECD countries such as Chinese Taipei, China and Singapore, as well as the European Union. These statistics are consistent with previous reports that Australia falls behind other developed nations in R&D spending, and instead relies heavily on indirect measures (such as tax incentives) to support BERD.⁶

OECD member nations' gross domestic spending on R&D (2017)

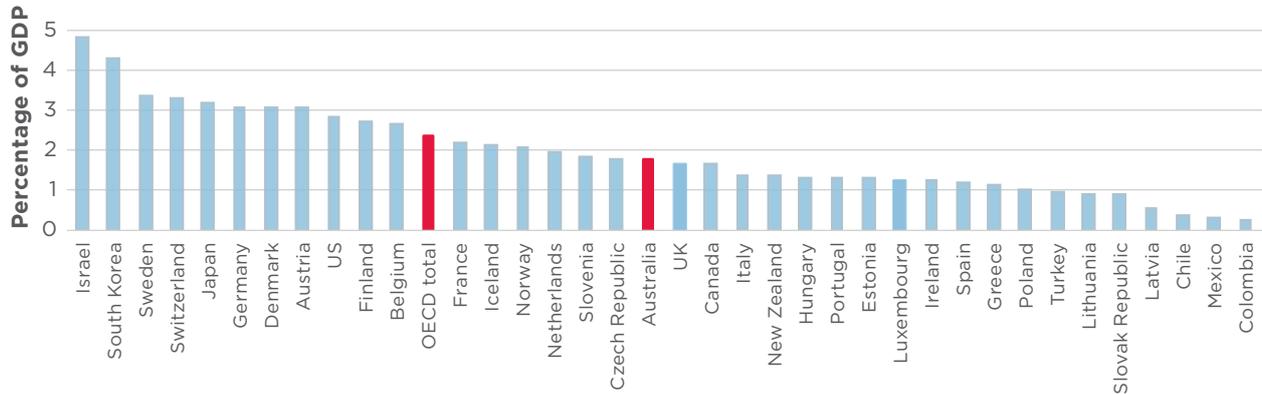


Figure 2 (Source: OECD 2020, GERD (indicator))⁷

OECD member nations' government support for BERD (2017)

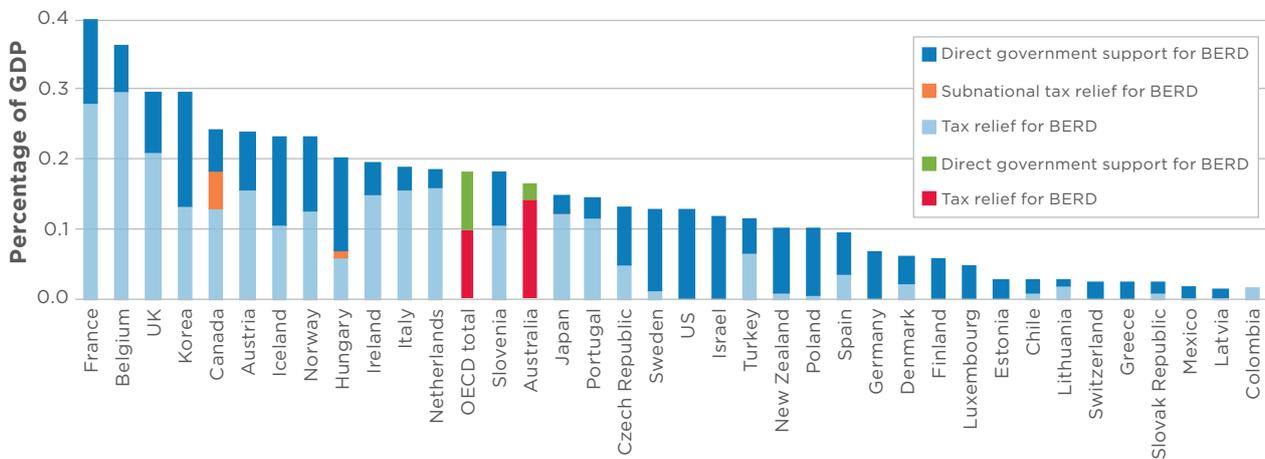


Figure 3 (Source: OECD 2020, R&D tax incentive database)⁸

6 Bell, J et al. 2015, *Translating research for economic and social benefit: country comparisons: final report*, Australian Council of Learned Academies (Acola).

7 <<https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm#indicator-chart>>.

8 <<https://stats.oecd.org/Index.aspx?DataSetCode=RDTAX>>.<https://stats.oecd.org/Index.aspx?DataSetCode=RDTAX>>.

NSW has mixed sector performance compared to other states and territories

While NSW has the strengths and capabilities to be a recognised leader in R&D, our current spending on R&D and our research intensity is below that of our global and domestic peers. In 2018, about \$11 billion was spent on R&D in NSW, which is equivalent to 1.9 per cent of gross state product (GSP).⁹

By volume of spending, NSW consistently ranks second behind Victoria in combined federal, state and territory government expenditure on R&D (GOVERD) by location. NSW's average annual GOVERD was about \$638 million, compared to Victoria's average of about \$802 million, for the three reporting periods examined (FY2015, FY2017 and FY2019) (see Figure 4). NSW's R&D intensity (spending as a proportion of GSP) averaged 0.11 per cent, which is a poor result compared to other states and territories in the same three reporting periods (see Figure 5).

By contrast, businesses' R&D spending and intensity are high in NSW compared to other states and territories – average annual expenditure was about \$6.6 billion in FY2014, FY2016 and FY2018 (see Figure 6). Businesses in the state also outperformed other states and territories for BERD and GSP.

Together, the data shows that while NSW is not the national leader for GOVERD, NSW businesses invest more than those in other states and territories and have higher R&D intensity. As a result, the NSW Government has an opportunity to leverage existing levels of BERD to improve the state's innovation ecosystem.

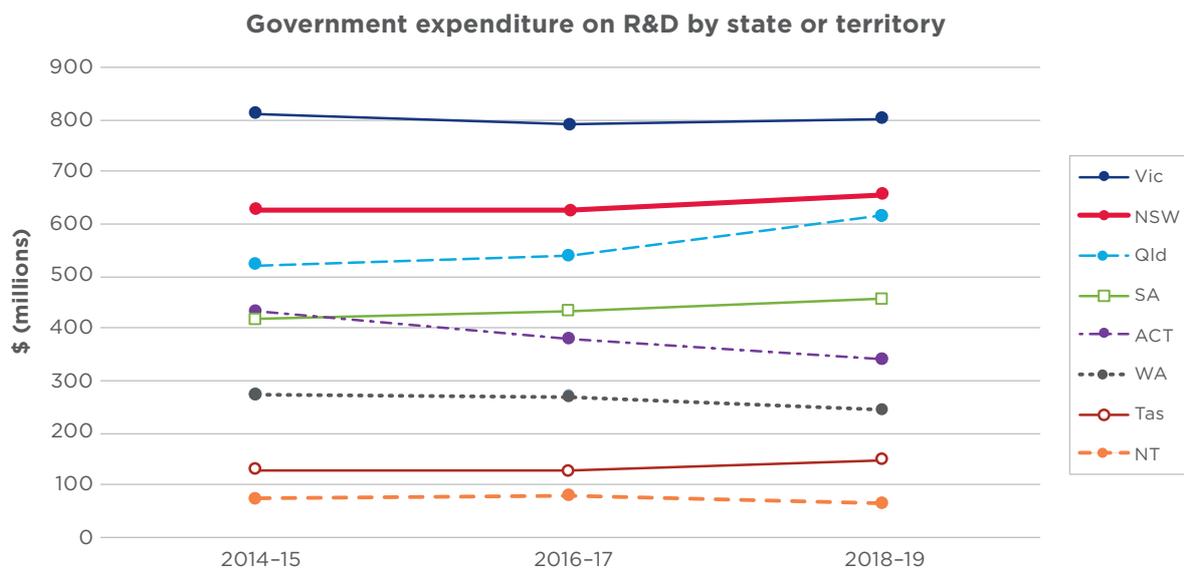


Figure 4 (source: Australian Bureau of Statistics, total government (federal, state and territory) expenditure on R&D, summary statistics, 2014-19)¹⁰

⁹ Innovation and Productivity Council, NSW Innovation and Productivity Scorecard 2019.

¹⁰ <<https://www.abs.gov.au/statistics/industry/technology-and-innovation/research-and-experimental-development-government-and-private-non-profit-organisations-australia/latest-release#data-download>>.

Government expenditure on R&D as a percentage of gross state product (GSP)

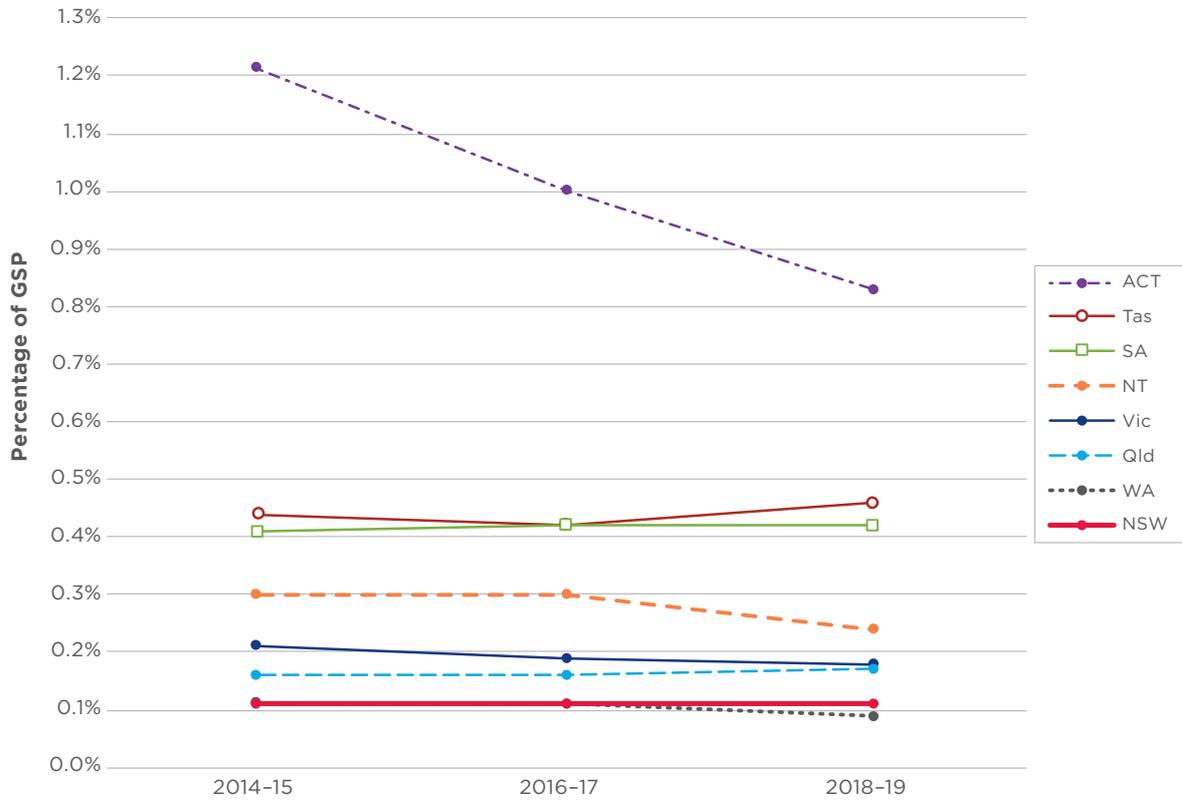


Figure 5 (source: Australian Bureau of Statistics, total government (federal, state and territory) expenditure on R&D per GSP, summary statistics, 2014-19)¹¹

¹¹ <<https://www.abs.gov.au/statistics/industry/technology-and-innovation/research-and-experimental-development-government-and-private-non-profit-organisations-australia/latest-release#data-download>>.

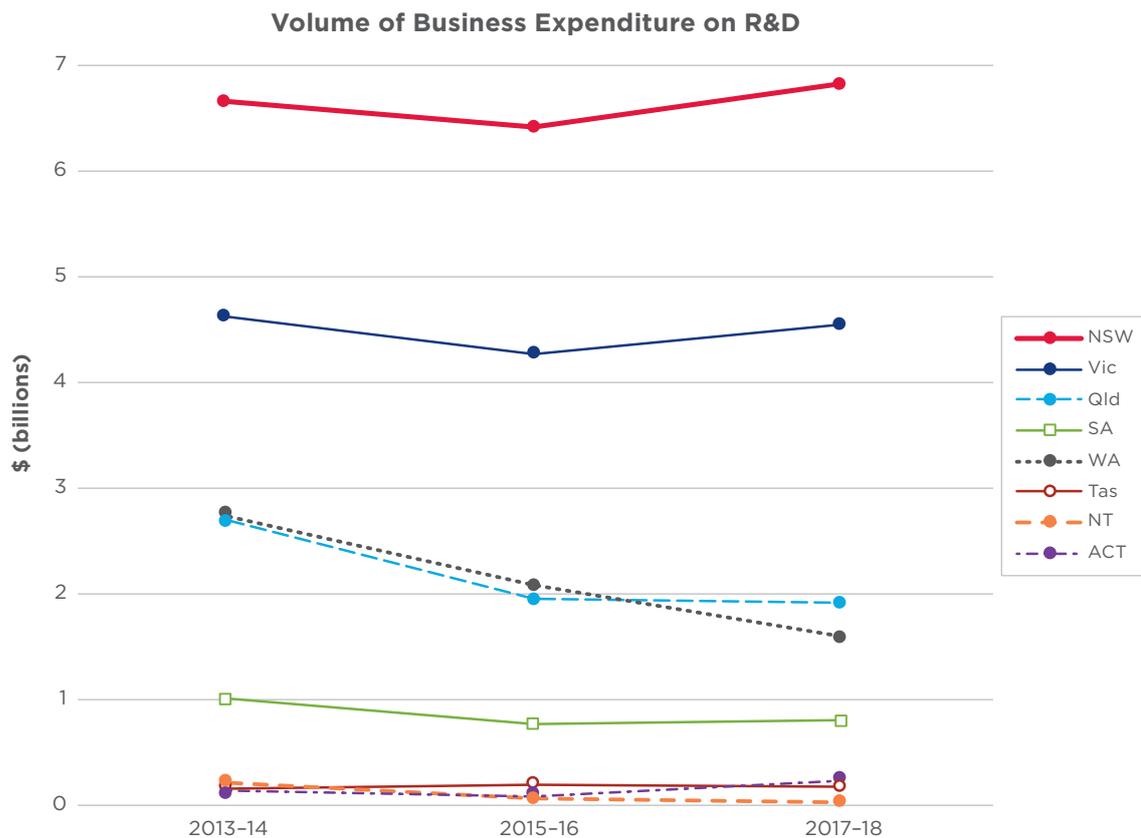


Figure 6 (Source: Australian Bureau of Statistics, total business expenditure on R&D, summary statistics, 2013-18)¹²

Increasing R&D expenditure is important to ensure NSW can create jobs and economic growth, both now and into the future. According to analysis conducted by the Committee for Sydney¹³, increasing national R&D spending to the OECD’s level of 2.3 per cent could result in an economic uplift of \$6.8 billion, supporting 19,000 jobs each year. It could also result in productivity gains throughout the economy, which could support an additional 8,000 jobs and add \$4 billion to Australia’s GDP annually. Combined, these two developments could amount to a \$10 billion increase in Australia’s GDP and 22,000 additional jobs each year. While these estimates are at a national level, the implications for NSW remain the same – increasing R&D expenditure will increase productivity, jobs and economic growth.

NSW Government expenditure on R&D

In 2018-19, the NSW Government invested at least \$386 million to support R&D (\$254 million) and related activity (\$132 million). Just over \$50 million (20 per cent) of this was provided to NSW universities for R&D. As described in Section 3.2, the Department of Primary Industries (DPI) and the Ministry of Health were the two largest funders of R&D in 2018-19, each investing over \$110 million.

The DPI is a significant investor in R&D, employing over 600 scientific and technical staff, managing 21 agricultural research sites and maintaining research assets valued at \$1.3 billion. Most of the DPI’s funding is sourced from external industry partners and invested in DPI research or in partnerships with other organisations. The DPI provides very little cash funding to NSW universities for research. The Ministry of Health supports several research projects and programs, as well as research infrastructure, across the state each year. Successful programs include the MDF, the Medical Research Support Program, the Translational

¹² <<https://www.abs.gov.au/statistics/industry/technology-and-innovation/research-and-experimental-development-businesses-australia/latest-release#:~:text=During%202017%2D18%2C%20expenditure%20on,volume%20terms%20from%202015%2D16>>.

¹³ The Committee for Sydney 2020, *Unleashing Sydney’s Innovation Economy*.

Research Grants Scheme and Early-Mid Career Fellowships. Local Health Districts (LHDs) across the state also support research; however, the above figures do not include their R&D investment or investments by other shared health delivery organisations. This is because LHDs are not required to report R&D expenditure to the Ministry of Health (as per their service agreements).

The 2018-19 total of about \$386 million invested by the NSW Government includes support that departments or agencies provided to external organisations such as universities, research institutes, not-for-profit groups, start-ups, SMEs and larger businesses. NSW has a range of programs to support R&D and innovation across sectors listed in the following table. The total also includes funding to support research conducted by departments and agencies themselves (for example, the Department of Planning, Industry and Environment (DPIE) – Environment, Energy and Science Group; DPI; and Taronga Zoo).

NSW definitions of research and experimental development activity and NSW support programs

Category	Examples/inclusions	NSW support programs (not exhaustive) <i>* supports commercialisation</i>
Research and experimental development	<ul style="list-style-type: none"> • Novel R&D conducted where the outcome is unknown. • Research and experimental development as defined by the Organisation for Economic Co-operation and Development (OECD) Frascati Manual 2015. • Uses a methodology that can be replicated for the purposes of discovery. This can include: <ul style="list-style-type: none"> › unique data collection, analysis or linkage conducted for the purposes of R&D (routine and administrative data collection and analysis is excluded from this category) › randomised controlled trials and experimental interventions › evaluation of an R&D project, program pilot or policy intervention that has resulted from R&D, for the purposes of improvement or new design. 	<ul style="list-style-type: none"> • COVID-19 Research Grants (OHMR – Ministry of Health) • Early-Mid Career Fellowships (OHMR – Ministry of Health) • Co-investment towards Australian Research Council Centres of Excellence, Cooperative Research Centres (CRCs), and CRC Projects (Office of the NSW Chief Scientist & Engineer [OCSE]) • Strategic research investments (OCSE) • Education Strategic Research Fund (Department of Education) • NSW Environmental Trust Environmental Research Grants Program • Spinal Cord Injury Research Grants (OHMR – Ministry of Health) • Quantum Computing Fund (OCSE) • Agency for Clinical Innovation Research Grants Scheme (OHMR – Ministry of Health) • DPIE Environment, Energy and Science Group research programs • Cardiovascular Research Capacity Program (OHMR – Ministry of Health)

Category	Examples/inclusions	NSW support programs (not exhaustive) * supports commercialisation
Research-enabling investment	<ul style="list-style-type: none"> • Investment in facilities, tools, human resources, equipment or other infrastructure that enables R&D to occur, including: <ul style="list-style-type: none"> › designing and investing in precincts › co-contributing to capital works facilities or equipment › contributing costs associated with making systematic data collections publicly accessible (government agencies only) › evaluating ‘current state’ policy and practice. 	<ul style="list-style-type: none"> • Co-investment in the National Collaborative Research Infrastructure Strategy (NCRIS) • Precincts: Western Sydney Aerotropolis, Tech Central, Westmead Health and Innovation District, Special Activation Precincts; for example, space for start-ups and laboratories (multiple agencies) • Sydney Startup Hub (NSW Treasury) • Biospecimen Collection Grants (OHMR – Ministry of Health) • Medical Research Support Program (OHMR – Ministry of Health)
Research and knowledge translation	<ul style="list-style-type: none"> • The results of research being included in or scaled to policy and program interventions, including: <ul style="list-style-type: none"> › professional, scientific and technical services › policy recommendations or expert advice to government or other stakeholders based on R&D interventions or expert academic knowledge › policy analysis, literature reviews, white papers and changes to evaluation or impact methodologies used by government agencies › funding schemes that are investing in research and knowledge translation and capacity-building activities › product development and research commercialisation, including start-ups or seed funding › consultancies or specialised training conducted by academics › conferences, sponsorships, internships or scholarships › expert panel or committee contributions. 	<ul style="list-style-type: none"> • Minimum Viable Product* • DPI Global Ag-Tech Ecosystem (DPI)* • Translational Research Grants (OHMR – Ministry of Health) • Physical Sciences Fund* (OCSE) • Medical Devices Fund* (OHMR – Ministry of Health) • Conference Sponsorship Program (OCSE) • Co-investment in the Industrial Transformation Research Program (OCSE) • TechVouchers* (NSW Treasury) • R&D Commercialisation Fund* (NSW Treasury) • Boosting Business Innovation Program* (NSW Treasury) • PhD Partnership Program (OHMR – Ministry of Health) • Health & Medical Research Sponsorship Program (OHMR – Ministry of Health) • Medical Device Commercialisation Training Program (OHMR – Ministry of Health) • Sydney School of Entrepreneurship (NSW Treasury) • NSW Research & Innovation Networks (OCSE)

Impact of NSW Government targeted investment in R&D

The OCSE provides annual investments of \$15–\$20 million to NSW's research and innovation sectors through the Research Attraction and Acceleration Program (RAAP) and the Quantum Computing Fund. The RAAP is a key mechanism for attracting and accelerating research investment from the Commonwealth Government, as well as industry and the university sector. The RAAP has delivered substantial outcomes for NSW, including several new major research centres of excellence, critical national research infrastructure facilities headquarters of nationally supported research organisations, and research innovation networks to attract collaborative research to NSW.

As part of the RAAP, the OCSE provides co-investment to NSW-based research centres established under Commonwealth Government programs. These include the ARC Centres of Excellence, the NCRIS and the CRC program. Since 2006–07, the OCSE has invested more than \$70 million in these three programs alone.

Measuring the economic impacts of such R&D investments can be challenging. This is due to issues around data and reporting; limited impact assessment capabilities and funding; longer timelines to achieve project success; and restricted visibility into, as well as minimal documentary evidence for, the pathways to economic benefit. To better understand and assess the impacts of R&D investments, the OCSE recently engaged an independent consultant, Dr Phil Robertson, to measure and evaluate the economic effect of a select number of RAAP investments made over the last decade.

The study considered impacts including:

- direct returns from incoming investment or cost savings
- job creation through new listed companies and support for regional industrial development
- product innovation, including new initiatives, clinical advances and effective collaborations that lead to commercial prospects
- retention of research development projects and companies in NSW that would otherwise move to research facilities overseas
- ability to leverage Commonwealth funding to ensure NSW benefits.

Using available quantitative data, the study developed a model and methodology based on an estimate of aggregated benefits.

The results were submitted to the OCSE in August 2020. The study's major finding was that between 2007 and 2019, the nine NSW-based research centres, that the OCSE contributed funding to, generated an estimated annual return to the Australian economy of more than \$3 billion, and an estimated annual return to the NSW economy in excess of \$1.5 billion. The OCSE contributed \$31 million in funding to these centres over this period. Established centres with demonstrated global impacts could create billions in economic impacts through tax, company revenues and cost savings for industry and the community. Examples are the Australian Centre for Advanced Photovoltaics at the University of New South Wales and the commercial arm of the Rozetta Institute (formerly the Capital Markets Cooperative Research Centre).

National technology centres, including NCRIS facilities such as the Australian National Fabrication Facility, Microscopy Australia and Bioplatforms Australia, each generate an annual return of well over \$100 million to the NSW economy.

For example, Microscopy Australia (headquartered in NSW) now delivers \$212 million per annum in direct economic benefits through industry projects as well as the creation of highly skilled jobs and start-ups.

The University of Sydney's spin-off company Elastagen is an example of a company that benefited from Microscopy Australia's facilities, which it used to develop its biotechnical products. Allergan, a leading global biopharmaceutical company, acquired Elastagen for an estimated \$345 million in 2018, to commercialise and manufacture its products.

At the time of Dr Robertson's study, the OCSE had invested \$6 million in Microscopy Australia. This amounts to a return on investment of 34:1 for NSW projects after the centre reached steady state.

The findings of the study demonstrate the value of the OCSE's investment, providing a sound basis for increased and targeted R&D investment in NSW to drive innovation and increase prosperity.

7.2 Submissions received

1. Advance
2. American Chamber of Commerce in Australia
3. AMSL Aero
4. Anna Grocholsky, Macquarie University
5. ANZAC Research Institute; Centenary Institute; Heart Research Institute; and Woolcock Institute joint submission
6. Associate Professor Danielle Logue, University of Technology Sydney
7. AusBiotech
8. Australia-Israel Chamber of Commerce (NSW)
9. Australian Academy of Technology & Engineering
10. Australian Association of Medical Research Institutes
11. Australian Institute of Company Directors
12. Australian National Fabrication Facility Pty Ltd
13. Australian Nuclear Science and Technology Organisation
14. Australian Research Council
15. Australian Research Council Centre of Excellence in Engineered Quantum Systems
16. Australian Stock Exchange
17. Barlow Advisory Pty Ltd
18. Biotechnology and Life Sciences Industry Association
19. Black Dog Institute
20. Bondi Bio
21. Brandon Capital Partners, Medical Research Commercialisation Fund
22. Business Council of Australia
23. Business Council of Co-operatives and Mutuals
24. Canio Fierravanti, University of Wollongong
25. Charles Sturt University
26. Children's Medical Research Institute
27. Chuhao Liu, University of Wollongong
28. Cinglevue International
29. Clarivate Analytics
30. CRC for Low Carbon Living
31. CSIRO
32. Curious Thing
33. CyberBUND
34. Design + Industry Pty Limited
35. Digivizer PTY LTD
36. Directional
37. Dr Ellen Zhao, University of Wollongong
38. Dr Marlene Kanga AM
39. Dr. Natalie Curach, Bioplatforms
40. DTH Supplies
41. Energy Consumers Australia
42. European Australian Business Council
43. Gumbooya Pty Ltd
44. Hugh Forehead, University of Wollongong
45. Hunter Medical Research Foundation
46. Ingham Institute for Applied Medical Research
47. Interactive Games & Entertainment Association
48. Intersect Australia
49. Kairos Now
50. Knowledge Commercialisation Australasia
51. Lendlease
52. Liverpool Innovation Precinct
53. Maridulu Budyari Gumal Sydney Partnership for Health, Education, Research and Enterprise
54. MetaChip Pty. Ltd. T/A BitScope Designs
55. Meteorical
56. MPT AgTech
57. Mr Andrew Jones
58. Mr Stephan Wagner
59. Professor Robyn Ward, University of Sydney
60. Newie Ventures Pty Ltd
61. NSW Business Chamber
62. NSW Department of Planning, Industry and Environment – Environment, Energy and Science Group
63. NSW Department of Planning, Industry and Environment – Regions, Industry, Agriculture and Resources
64. NSW Regional Health Partners
65. NSW Smart Sensing Network
66. NSW Vice Chancellors Committee
67. O'Connell Street Associates
68. Professor Isak S. Pretorius, Macquarie University
69. Professor Kathryn McGrath, University of Technology Sydney
70. Randwick Health and Education Precinct
71. Rigetti Quantum Cloud Services
72. Roobuck Pty Limited
73. Royal Society of New South Wales
74. Sangui Bio Pty Ltd and Drop Bio Pty Ltd
75. SEVENmile Venture Lab
76. SMART Infrastructure Facility
77. Square Peg
78. StartUp Aus
79. Steber International
80. Stryker South Pacific
81. Sydney Health Partners (SHP); Maridulu Budyari Gumal Sydney Partnership for Health, Education, Research and Enterprise (SPHERE); and NSW Regional Health Partners (NSWRHP) joint submission

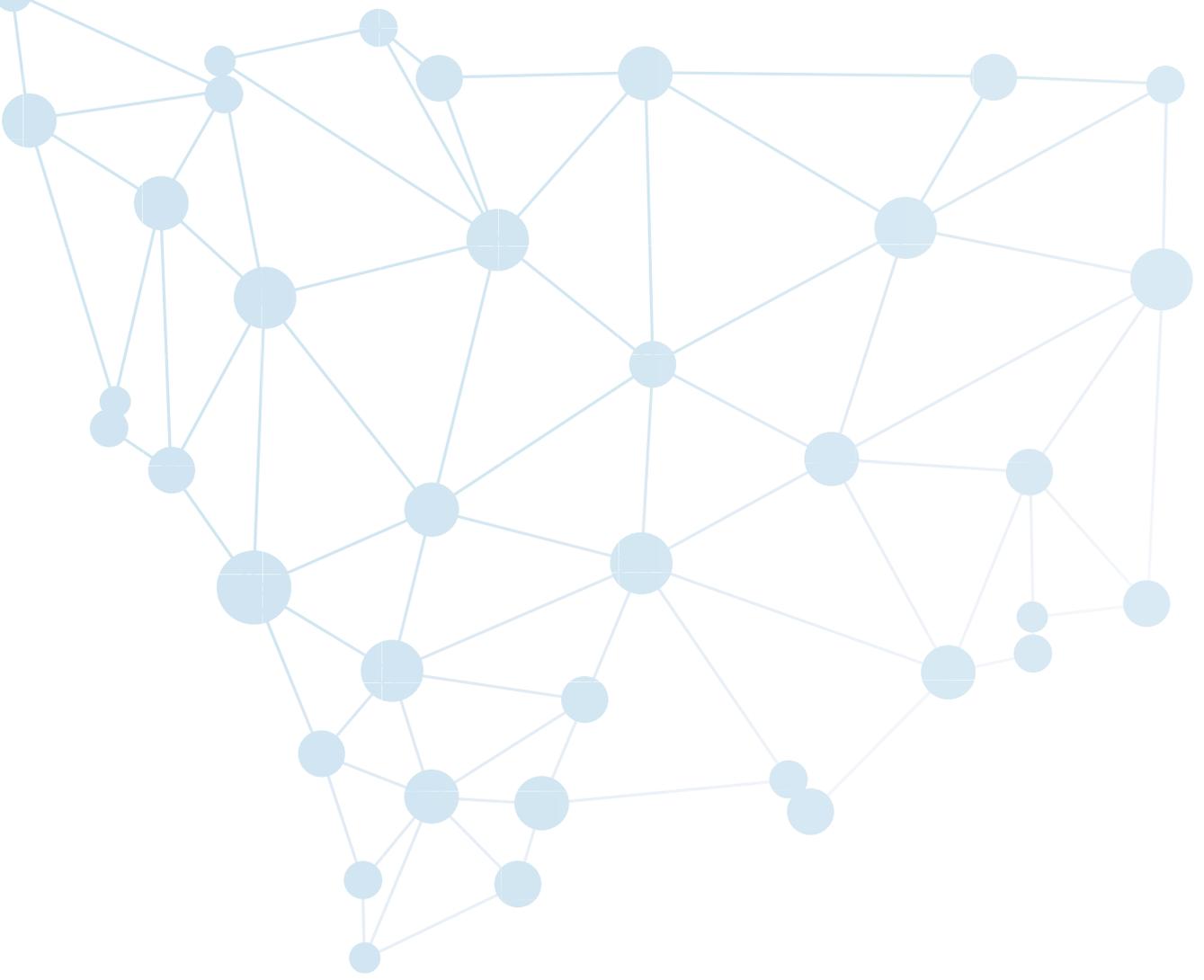
82. Sydney Institute of Marine Science (SIMS)
83. Telix Pharmaceuticals Limited
84. The Australian Centre for Social Innovation
85. The Committee for Sydney
86. The George Institute for Global Health
87. The Ian Potter Foundation
88. The Lowy Institute
89. The Studio Ltd
90. The University of Sydney
91. The Westmead Institute for Medical Research.
92. UNE SMART Region Incubator
93. United States Study Centre at the University of Sydney
94. University of New South Wales
95. University of Newcastle
96. UTS Engineering and IT Techcelerator
97. Venture Studio Group
98. Western Sydney University

7.3 List of stakeholder consultations

1. 360 Med Care
2. Advance
3. American Chamber of Commerce In Australia
4. ANZSA
5. AusBiotech
6. Australian Investment Council
7. Baraja
8. Biodiem
9. BioIntelect
10. Blackbird Ventures
11. Blue Chilli
12. Blue River Group
13. Bluescope
14. Bolt Bikes
15. Brandon Capital Partners
16. CEFC
17. Cellabs Pty Ltd
18. Children's Medical Research Institute
19. Cicada Innovations
20. Cisco Australia
21. Cochlear Limited
22. Coxswain Alliance
23. CSIRO
24. Customer Crunch
25. Dexus
26. Eftsure
27. Engineers Australia
28. Fishburners
29. Go1
30. Heads Over Heels
31. Hyperdot
32. Innovate UK
33. Inventia Life Science
34. IP Group Australia
35. Lumira Ventures
36. Macquarie Bank
37. Macquarie University – Business School
38. Main Sequence Ventures
39. Mirvac
40. NSW Business Chamber
41. NSW Smart Sensing Network
42. NUW Alliance
43. Ranalytics
44. Reejig
45. RFS Ambrian Limited
46. Rigetti Computing
47. SMART Infrastructure Facility
48. Speedx
49. Square Peg
50. Standards Australia
51. Stockland
52. Stryker
53. Sydney School of Entrepreneurship
54. Thales
55. The George Institute
56. UNE SMART Region Incubator
57. Uniseed
58. United States Studies Centre
59. University of Sydney
60. Maridulu Budyari Gumal SPHERE
61. Sydney Institute of Marine Science (SIMS)
62. UTS
63. v2food
64. Vestech
65. Volt
66. W23
67. ZeroAvia

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