

# NSW R&D Matchmaking Platform

## Scoping Paper: Building an online R&D Marketplace Platform for Matchmaking (Attachments)

The Office of NSW Chief Scientist & Engineer (OCSE) and R&D NSW undertook a range of scoping activities during the scoping stage for the NSW R&D Matchmaking Platform, a priority initiative under the [Turning ideas into jobs: Accelerating R&D in NSW Action Plan](#).

These scoping activities are stocktaking exercises to collect quality data and information and their objectives are:

- Providing a holistic view of NSW innovation ecosystem and industry landscape with quality information
- Informing the function and services design of the Matchmaking Platform; and
- Building the foundation of a database for the Matchmaking Platform initial pilot.

The summary of scoping activity findings was presented as Appendix 2 in the Scoping Paper and detailed results of Attachments were included in this document. These scoping activities were not meant to be exhaustive, and these Attachments will be kept as living documents reflecting the dynamic development in research and science.

### **Attachment List**

Attachment A - Platform interactions with actions under the Action Plan

Attachment B - Preliminary product scan of matchmaking platforms

Attachment C - Map 1.1 Research infrastructure supported or funded by NSW Government

Attachment D - Map 1.2 Startups communities and scaling up services

Attachment E - Map 1.3 NSW Government policies and programs supporting R&D

Attachment F - Map 2.1 Priority sectors and R&D capabilities of selected industries

Attachment G - Map 2.2 Regional industry profiles and development opportunities

Attachment H - Map 2.3 Innovation precincts and innovation networks

## Platform Interactions with other ARDAC Actions

This document presents information about potential interactions between the R&D Platform with other four priority actions and supporting actions under the NSW R&D Action Plan, titled 'Turning ideas into jobs – Accelerating research and development in NSW'. It also lists relevant stocktaking documents undertaken for the R&D Platform Scoping Report can provide information and support progress those action items in R&D and commercialisation.

### Interactions with Priority Actions

Priority Action with Brief Description	Proposed Interactions with the Platform	Relevant Maps of Scoping Report
<p><b>Small Business Innovation Research (SBIR) Program:</b> provide competitive grants for SMEs to find and commercialise innovative solutions to specific, well-defined problems for NSW Government agencies.</p>	<ul style="list-style-type: none"> <li>- Platform could facilitate SBIR program by identifying and connecting industry and research that have common interest in providing solutions for government challenges</li> <li>- SBIR works as a financial incentive for SMEs to provide information in building Platform's database</li> </ul>	<ul style="list-style-type: none"> <li>- Map 1.1 Research Infrastructure</li> <li>- Map 1.2 Startup Supporting Services</li> <li>- Map 2.1 Priority Industries and R&amp;D Capabilities</li> <li>- Map 2.2 Regional Industry Profiles and Opportunities</li> </ul>
<p><b>Boost open data:</b> target the strategic release of further NSW Government datasets so that businesses can make better decisions, entrepreneurs can build new businesses and the government can solve complex challenges.</p>	<ul style="list-style-type: none"> <li>- Platform could strategic release NSW Government datasets and match data users that have common interest to boost collaboration</li> <li>- Platform could inform government about data needs through platform users from industry and research</li> </ul>	<ul style="list-style-type: none"> <li>- Map 1.1 Research Infrastructure</li> <li>- Map 1.3 NSW Government R&amp;D Policy and Funding Support</li> </ul>
<p><b>Turbocharge precincts:</b> 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&amp;D.</p>	<ul style="list-style-type: none"> <li>- Platform could post building new research infrastructure and technology solutions as industry/government challenges calling for collaborative efforts to develop innovation precincts</li> <li>- Identify the need of new research infrastructure in precincts and co-locate technology developers and end-users to share research facilities e.g Advanced</li> </ul>	<ul style="list-style-type: none"> <li>- Map 1.1 Research Infrastructure</li> <li>- Map 1.3 NSW Government R&amp;D Policy and Funding Support</li> <li>- Map 2.1 Priority Industries and R&amp;D Capabilities</li> <li>- Map 2.2 Regional Industry Profiles and Opportunities</li> <li>- Map 2.3 Innovation Precincts and Innovation Networks</li> </ul>

Priority Action with Brief Description	Proposed Interactions with the Platform	Relevant Maps of Scoping Report
	<p>Manufacturing Research Centre in Aerotropolis</p> <ul style="list-style-type: none"> <li>- Platform could visualise NSW Innovation Precincts, research infrastructure with an interactive and geographic map (e.g. OCSE research map) and connect stakeholders that have common interest in the precincts and attract investment</li> </ul>	
<p><b>Targeted strategic support for NSW universities:</b> collaborate on research that drives future NSW strategic growth industries and research-led industry attraction, and partner to better leverage Commonwealth Government research funding.</p>	<ul style="list-style-type: none"> <li>- Systematically capability mapping of each NSW university as a first step to understand their strength in sector and industry. These capability datasets will build database required from the research side for the Platform.</li> <li>- Platform could have an ongoing role to monitor and identify research capability and strength of NSW universities in terms of projects, IPs, expertise, research infrastructure to inform NSW Government for targeted strategic support</li> <li>- Platform could inform NSW Government about existing collaboration between universities and support needed for priorities areas with new innovation networks</li> </ul>	<ul style="list-style-type: none"> <li>- Map 1.2 Startup Supporting Services</li> <li>- Map 1.3 NSW Government R&amp;D Policy and Funding Support</li> <li>- Map 2.1 Priority Industries and R&amp;D Capabilities</li> <li>- Map 2.2 Regional Industry Profiles and Opportunities</li> <li>- Map 2.3 Innovation Precincts and Innovation Networks</li> </ul>

## Interactions with Supporting Actions

## Supporting Actions Directly Related to the R&amp;D Platform

Relationship	Supporting Action	Proposed Interaction with the Platform	Relevant Maps of Scoping Report
<b>Supporting Actions require Platform for their implementation.</b>	Supporting Action 10: Maximise access to research equipment, facilities and infrastructure located in NSW	<ul style="list-style-type: none"> <li>- Building on NSW <a href="#">Research Interactive Map</a> as visual presentation to show location of research facilities and infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>- Map 1.1 Research Infrastructure</li> </ul>
	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	<ul style="list-style-type: none"> <li>- Matching successful grants applicants of commercialisation funding programs (e.g. MDF, PSF, SBIR) to early career researchers or startups for their needs to support their technology industrial translation.</li> </ul>	<ul style="list-style-type: none"> <li>- Map 1.2 Startup Supporting Services</li> <li>- Map 2.1 Priority Industries and R&amp;D Capabilities</li> </ul>
<b>Supporting Actions for the Platform as Government Lever of collaboration to accelerate R&amp;D</b>	Supporting Action 15: Establish new Innovation Networks aligned with the NSW R&D Roadmap.	<ul style="list-style-type: none"> <li>- Platform could consider having innovation networks 'shopfront' as one stop shop for funding opportunities, industry partners and government policy support.</li> <li>- Platform activities could inform government about new and emerging industry that have significant interest and demand for collaboration for new networks</li> </ul>	<ul style="list-style-type: none"> <li>- Map 2.3 Innovation Precincts and Innovation Networks</li> <li>- Map 2.1 Priority Industries and R&amp;D Capabilities</li> <li>- Map 2.2 Regional Industry Profiles and Opportunities</li> </ul>
	Supporting Action 16: Partner with leading global organisations	<ul style="list-style-type: none"> <li>- Place-based matching between government (land owner and precinct planner), industry (end-</li> </ul>	<ul style="list-style-type: none"> <li>- Map 2.3 Innovation Precincts and Innovation Networks</li> </ul>

Relationship	Supporting Action	Proposed Interaction with the Platform	Relevant Maps of Scoping Report
	to drive research translation and maximise the impact of NSW research activities, particularly in precincts.	<p>users), research (technology inventors) and investor</p> <ul style="list-style-type: none"> <li>- NSW R&amp;D capability extracted by Platform's database can help prompting NSW research sector in high level strategies (e.g. Global NSW, 2040 Economic Blueprint) to attract international organisations</li> <li>- Platform's database can generate creditable capability mapping down to project level for investment attraction</li> <li>- Targeted and coordinated engagement with international buyers for NSW R&amp;D products and services</li> </ul>	<ul style="list-style-type: none"> <li>- Map 2.2 Regional Industry Profiles and Opportunities</li> <li>- Map 2.1 Priority Industries and R&amp;D Capabilities</li> </ul>

## Other Supporting Actions

Supporting Action	Relevant Maps of Scoping Report
Supporting Action 6 Develop a 20-year NSW R&D Roadmap that identifies NSW's current and future research and industry competitive advantages.	<ul style="list-style-type: none"> <li>- Map 1.1 Research Infrastructure</li> <li>- Map 1.2 Startup Supporting Services</li> <li>- Map 1.3 NSW Government R&amp;D Policy and Funding Support</li> <li>- Map 2.1 Priority Industries and R&amp;D Capabilities</li> <li>- Map 2.2 Regional Industry Profiles and Opportunities</li> <li>- Map 2.3 Innovation Precincts and Innovation Networks</li> </ul>
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.	<ul style="list-style-type: none"> <li>- Map 1.1 Research Infrastructure</li> <li>- Map 1.2 Startup Supporting Services</li> <li>- Map 1.3 NSW Government R&amp;D Policy and Funding Support</li> <li>- Map 2.1 Priority Industries and R&amp;D Capabilities</li> <li>- Map 2.2 Regional Industry Profiles and Opportunities</li> <li>- Map 2.3 Innovation Precincts and Innovation Networks</li> </ul>
Supporting Action 9: Provide targeted tax	<ul style="list-style-type: none"> <li>- Map 1.2 Startup Supporting Services</li> </ul>

Supporting Action	Relevant Maps of Scoping Report
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	<ul style="list-style-type: none"> <li>- Map 1.3 NSW Government R&amp;D Policy and Funding Support</li> <li>- Map 2.1 Priority Industries and R&amp;D Capabilities</li> </ul>
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.	<ul style="list-style-type: none"> <li>- Map 1.3 NSW Government R&amp;D Policy and Funding Support</li> <li>- Map 2.1 Priority Industries and R&amp;D Capabilities</li> </ul>
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)	<ul style="list-style-type: none"> <li>- Map 1.3 NSW Government R&amp;D Policy and Funding Support</li> <li>- Map 2.1 Priority Industries and R&amp;D Capabilities</li> <li>- Map 2.2 Regional Industry Profiles and Opportunities</li> </ul>
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.	<ul style="list-style-type: none"> <li>- Map 1.3 NSW Government R&amp;D Policy and Funding Support</li> </ul>

## Preliminary Product Scan for R&D Platforms

This mapping exercise was conducted for NSW Accelerating Research and Development in NSW Advisory Council (ARDAC)'s Action Plan Priority Action 5 of establishing an R&D platform. This stocktake provides information about existing platforms that connect buyers and sellers of R&D products and services in Australia and globally.

### Domestic Platforms

Platform	Government or Private Owned	Description (purpose, who and how it links stakeholders)	Technology/Product	Strength	Limitation
<a href="#">CSIRO Expert Connect</a>	Government	A database of Australia's research expertise with more than 70,000 expert profiles from over 220 research organisations. It aims to boost collaboration between industry and researchers.	Online database	<ul style="list-style-type: none"> <li>• Searchable database</li> <li>• Users can search for expertise by topic, name or field of interest/ knowledge</li> <li>• Data is ongoing and automatic – no need for researchers to manually update their Expert Connect profile</li> <li>• Interactive map that showcases Australia's national research infrastructures and innovation precincts</li> </ul>	
<a href="#">CSIRO Innovation Challenges</a>	Government	The platform aggregated challenges and matching with experts	Online database and challenge/mission based platform	<ul style="list-style-type: none"> <li>• Challenge focused</li> <li>• Easy search function for date, audiences and open/closed challenges</li> </ul>	<ul style="list-style-type: none"> <li>• Limited by challenge element</li> <li>• Not connected to other R&amp;D products and services</li> </ul>

Platform	Government or Private Owned	Description (purpose, who and how it links stakeholders)	Technology/Product	Strength	Limitation
<a href="#">CSIRO InnovationMap</a>	Government	An interactive, geographic visualisation of innovation related data. Built on CSIRO's Terria platform, InnovationMap allows users to overlay multiple datasets to build up a picture of a particular region and observe how it changes over time. The data always remains hosted at its original source and is automatically drawn in and visualised as required.		<ul style="list-style-type: none"> <li>• Currently has data and visualisation functions for SA3 region innovation data, innovation precincts and national research infrastructure.</li> <li>• Function to connect Expert Connect and Incubators/accelerators are under development</li> <li>• Visualisation and search function well developed</li> </ul>	<ul style="list-style-type: none"> <li>• Limited database and mainly on national infrastructure</li> </ul>
<a href="#">CSIRO Commercialisation Marketplace</a>	Government	Enables businesses, partners and investors to connect with technologies at different development stages (TRL) – early stage, mid stage and late stage.	Online database	<ul style="list-style-type: none"> <li>• Ability to filter search by industry sector, engagement opportunity, TRL and keywords – can select more than one box</li> <li>• Detailed information on the technology, applications, IP and the team for each of the results</li> </ul>	<ul style="list-style-type: none"> <li>• Can only search by keyword</li> <li>• Limited visual interaction</li> </ul>
<a href="#">SourceIP</a>	Government	Developed by CSIRO for IP Australia. Source IP is displaying patents filed by the Australian public research organisations listed under 'Research Organisations'. Source IP is focused on users from business and industry,	Database and search function	<ul style="list-style-type: none"> <li>• IP focused</li> <li>• Comprehensive database supported by organisation inputs</li> <li>• Visualisation and easy to search based on sector, licensing options and application status.</li> </ul>	<ul style="list-style-type: none"> <li>• No connected to other R&amp;D products and services</li> </ul>

Platform	Government or Private Owned	Description (purpose, who and how it links stakeholders)	Technology/Product	Strength	Limitation
		including small businesses, to access innovation and technology generated by the publicly funded research sector in Australia. The platform has been specifically created to help expose potential collaboration opportunities to businesses seeking to work with public sector research partners and to facilitate quick and easy contact.			
<a href="#">Australian Academy of Science – COVID-19 expert database</a>	Government	The COVID-19 Expert Database allows government, businesses, researchers and other decision makers to access expertise needed to inform their decision making.	Online database	<ul style="list-style-type: none"> <li>• Ability to recommend/register an expert that could contribute to the effort of recovering from COVID-19</li> <li>• Can filter search by areas of expertise, state and city</li> <li>• Option to view a list of all the experts</li> <li>• Provides a link to their profile at their organisation/institution, email and phone details.</li> </ul>	<ul style="list-style-type: none"> <li>• No search function by name and the areas of expertise function is only a drop down list</li> </ul>

Platform	Government or Private Owned	Description (purpose, who and how it links stakeholders)	Technology/Product	Strength	Limitation
<a href="#">Advanced Manufacturing Growth Centre COVID-19 Manufacture Response Register</a>	Government	Australian businesses can supply or purchase essential equipment for COVID-19 and is now open to international buyers. It facilitates capability and demand for companies seeking to purchase PPE, critical care and medical equipment or establish connections with Australian manufacturers and suppliers. It connects manufactures with customers; specialist component suppliers with finished goods providers; manufactures with potential collaborators and businesses.	Online and interactive platform	<ul style="list-style-type: none"> <li>• Users who register are able to choose who is able to view their details</li> <li>• Free of charge to participate</li> </ul>	
<a href="#">SHFTHero</a>	Private	SHFTHero is a platform that connects businesses with local hospitality and event professionals, helping businesses source last minute shift covers, flexible staff for events, full-time/part-time/casual positions. The app allows users to post a shift and connect with experienced, local individuals who are looking for shifts.	App that can be downloaded to your device	<ul style="list-style-type: none"> <li>• Can be managed and tracked regularly until completion</li> <li>• Can post a shift quickly</li> </ul>	<ul style="list-style-type: none"> <li>• Only available via the app</li> </ul>

Platform	Government or Private Owned	Description (purpose, who and how it links stakeholders)	Technology/Product	Strength	Limitation
<a href="#">Matchboard</a>	Private	Matchboard links businesses and companies to suppliers, where buyers enter their needs and the tool connects them with the best companies that match their needs.	Online tool	<ul style="list-style-type: none"> <li>• Short and simple questionnaire/survey to identify user needs</li> <li>• Provide a customer satisfaction survey</li> </ul>	
<a href="#">National Energy Research Agency – Capability Finder(AERCF)</a>	Government	Aims to strengthen the connection between Australia’s research community and the energy resources sector. It shows Australia’s energy research capability and digital technologies and enables users to identify current research projects and initiatives that solve industry challenges.	Online search engine	<ul style="list-style-type: none"> <li>• Can filter data by industry sector, subsector, and university/organisation name</li> <li>• Includes the number of total industry sectors, organisations, research centres &amp; initiatives that are involved.</li> <li>• Visuals (map) available</li> <li>• Click a link and it opens a new tab for more information about each result</li> </ul>	
<a href="#">Sydney Startup Community</a>	Government	Supported by NSW Startup Hub and funded by NSW Government, this platform help startup growing their networks by connecting with peers, mentors and investors. It also provide information about events, funding	Online, connect and match	<ul style="list-style-type: none"> <li>• Cover a few elements of people, startups, events, programs and jobs.</li> <li>• Mentorship function is well developed with information of expertise, availability and experience.</li> </ul>	

Platform	Government or Private Owned	Description (purpose, who and how it links stakeholders)	Technology/Product	Strength	Limitation
		opportunities and showcase successful startups.			
<a href="#">Ideaspies</a>	Private	Social media platform that focuses on sharing and discussing innovative ideas and new discoveries.	Social media	<ul style="list-style-type: none"> <li>Featuring simply written posts of 100 words or less, our stories aim to expand the mind and spark the imagination of all readers.</li> </ul>	
<a href="#">NSW Health and Medical Research Office</a>	Government	OHMR website has a search functions that allow research, entrepreneur and health professional to search and match for biobanking, clinical trial expertise and support, collaboration opportunities, funding and others.	MedTech, health and clinical trials	<ul style="list-style-type: none"> <li>Match users with their need in medical research</li> <li>Well-developed website with the support of internal database</li> </ul>	<ul style="list-style-type: none"> <li>Limited by industry</li> </ul>
<a href="#">NSW Department of Primary Industries R&amp;D Website</a>	Government	NSW DPI website has a R&D section that provides information of their major research institutions, research profile and key contacts.	Primary industry	<ul style="list-style-type: none"> <li>Interactive map of major research facilities</li> <li>Detailed description of research centre capabilities, research projects, facilities and infrastructure.</li> <li>Key contacts</li> </ul>	<ul style="list-style-type: none"> <li>Limited by industry</li> </ul>
<a href="#">SEARTEN</a>	Private	Searten is a research delivery and workflow platform that cuts out the administrative friction between stakeholders.		Platform is under development and not available for testing.	

## International Platforms

Company Name	Country	Description (purpose, who and how it links stakeholders)	Technology/Product	Pros	Cons
<a href="#">Innovation Partner for Impact (IPI)</a>	Singapore	Provide enterprises with access to innovative ideas and technologies. Facilitates and supports businesses with their innovation processes, including commercialisation and go-to-market strategies.		<ul style="list-style-type: none"> <li>• Can filter search by technology offers (for organisations looking for techs in the market) and technology needs (for organisations seeking specific tech and expertise to meet their innovation needs)</li> <li>• Descriptive information provided for each of the technology/results</li> <li>• Each search can be filtered further by TRL, category and location</li> </ul>	<ul style="list-style-type: none"> <li>• No search function – only keywords available</li> </ul>
<a href="#">UK Research and Innovation Gateway</a>	UK	Users (SMEs, academic institutions, public) are able to search and analyse information about publicly funded research – particularly for SMEs. Users can access information about current research projects and outcomes of past projects. The information/data is from nine UK funding organisations.		<ul style="list-style-type: none"> <li>• Information are processed against a set of business rules to determine suitability for publication.</li> <li>• Open and free for all to use</li> <li>• Can view the whole database/results by projects, publications, people, organisations, outcomes and classification.</li> <li>• Easy and straightforward to use/explore the system</li> </ul>	

Company Name	Country	Description (purpose, who and how it links stakeholders)	Technology/Product	Pros	Cons
<a href="#">IN-PART</a>	Worldwide	A platform for university and industry R&D collaboration – facilitates the the technology transfer between universities and companies. 250 universities and research institutes worldwide showcase their research and innovation on the platform to find new industry partnerships.	Digital/online platform	<ul style="list-style-type: none"> <li>• Free access to the platform</li> <li>• List of case studies</li> </ul>	<ul style="list-style-type: none"> <li>• Need to create account first to use the system</li> </ul>
<a href="#">Gartner</a>	Worldwide	Provide senior leaders across the enterprise (customer service & support, finance, human resources, IT, legal & compliance, marketing & communications, product management, R&D, sales, strategy, and supply chain) with business insights, advice and tools needed to achieve their priorities.			
<a href="#">BuyerZone</a>	US	BuyerZone brings together buyers and sellers with equipment, services or software to match business needs.		<ul style="list-style-type: none"> <li>• Search function</li> <li>• Tabs to select the specific equipment users are looking for</li> <li>• Additional questions to specify and match users need appropriately</li> </ul>	
<a href="#">Approved Index</a>	UK	Aims to find products that will make businesses more profitable, time effective and smarter. It matches businesses (buyers) with suppliers (sellers).	Online	<ul style="list-style-type: none"> <li>• Search function</li> <li>• Additional questions to specify and match users need appropriately</li> </ul>	

Company Name	Country	Description (purpose, who and how it links stakeholders)	Technology/Product	Pros	Cons
<a href="#">Eventtia</a>		Their B2B matchmaking software connects people at B2B events – helps match attendees to the right business at the events.	Software	<ul style="list-style-type: none"> <li>• Range of solutions, not only for B2B matchmaking such as event management software, event mobile app, virtual events platform, event marketing</li> </ul>	<ul style="list-style-type: none"> <li>• Create an account/login to use the system</li> </ul>
<a href="#">Powerlinx</a>	US	B2B matchmaking platform matching businesses to find the right strategic partners such as suppliers, distributors, manufacturers and investors. Users provide information about their company and goals and are then recommended with companies that are best suited and compatible to their needs.	Data driven platform	<ul style="list-style-type: none"> <li>• Video to show the process of matching stakeholders</li> <li>• Reviews and feedback provided on website</li> </ul>	<ul style="list-style-type: none"> <li>• Can't use unless users create an account or login but the video is beneficial to show the process</li> </ul>
<a href="#">AcademicLabs</a>	Worldwide	Platform that allows users to access and find the right academic experts to enable collaboration and innovation.	Online platform	<ul style="list-style-type: none"> <li>• Can find experts from 700+ universities from around the world</li> <li>• Search and filter function by research groups/researchers.</li> </ul>	<ul style="list-style-type: none"> <li>• Need to have account to use but can request for a live demo</li> </ul>

Company Name	Country	Description (purpose, who and how it links stakeholders)	Technology/Product	Pros	Cons
<a href="#">SAIRA</a> (operated by <a href="#">WAITRO</a> )	Europe	Aim is to foster international collaboration in R&D by bringing researchers together with companies, start-ups, NGOs, government agencies and impact investors.	Online account	<ul style="list-style-type: none"> <li>Clearly states vision, mission, core values etc.</li> <li>Option to select whether the user is a researcher, company, start-up, NGO, government agency to start the process</li> </ul>	<ul style="list-style-type: none"> <li>Limited visuals – video help to show the process especially if users need to create account first.</li> </ul>
<a href="#">goMed2Med</a>	Netherland	B2b matchmaking platform for buyers and suppliers based on mutual demands – for manufacturers, distributors, licensing companies, contract services and universities of medical devices, pharmaceuticals and basic ingredients. Allows users to expand their product ranges or markets in a particular region or worldwide.	Online platform		

## NSW Research Infrastructure Mapping

The Accelerating R&D in NSW Action Plan recommends a “**stocktake of NSW Government–funded or supported major research equipment, facilities and infrastructure**” to inform development of the R&D infrastructure element of the platform.

This mapping presents NSW research infrastructure including:

- national research infrastructure supported by the NSW Government for National Critical Research Infrastructure Strategy (NCRIS), Australian Research Council Centre of Excellence, Cooperation Research Centres and Industrial Transformation Centres and Hubs (Section 1 and 2);
- NSW government owned research infrastructure, laboratories and research centres (Section 3); and
- National research infrastructure managed by CSIRO and ANSTO (Section 4).

This mapping will build the foundation of NSW research infrastructure database for the R&D platform which will be further developed by selected tender. The information for this mapping is based on public available documents and OCSE internal database and has been validated by NSW government agencies, research institutions and other organisations.

## Contents

NSW Research Infrastructure Mapping .....	1
1. NSW research infrastructure under the National Collaborative Research Infrastructure Strategy .....	3
1.1 NCRIS facilities funded/supported by OCSE .....	3
1.2 Other NCRIS facilities .....	8
2. NSW research infrastructure under Australia Research Council's schemes .....	9
2.1. ARC Centres of Excellence .....	9
2.2. ARC Cooperation Research Centres .....	10
2.3. ARC Industrial Transformation Research Program .....	13
3. Other public funded research infrastructure in NSW .....	16
3.1. Australian Nuclear Science and Technology Organisation (ANSTO) .....	16
3.2. Commonwealth Scientific and Industrial Research Organisation (CSIRO) .....	17
4. NSW government research infrastructure .....	19
4.1. Premier and Cabinet Cluster .....	19
4.2. Planning, Industry and Environment Cluster .....	22
4.3. NSW Health Cluster .....	23
4.3.1. Sydney local health districts .....	23
4.3.2. Rural and regional NSW health districts .....	27
4.4. Regional NSW .....	29
4.5. Stronger Communities Cluster .....	41
4.6. Other clusters .....	43
Reference .....	44

## 1. NSW research infrastructure under the National Collaborative Research Infrastructure Strategy

The Commonwealth Government and the NSW Government have supported the National Collaborative Research Infrastructure Strategy (NCRIS)'s critical research infrastructure in NSW. OCSE provides financial support for NSW-based NCRIS and NCRIS-derived facilities.

### 1.1 NCRIS facilities funded/supported by OCSE

NCRIS Facility	NSW Node (Location)	Description	OCSE co-investment (FY2006 to FY2020)
<b>Australian Astronomical Observatory (AAO)</b>	Macquarie University	AAO Macquarie is a world leader in the development of innovative telescope instrumentation for astronomical surveys of the night skies. AAO-Macquarie has significant expertise in developing innovative technology for use in astronomical instruments, in developing data systems for the storage and access of data from such instruments, and in using these instruments for scientific research.	\$1,670,000
<b>Australian Centre for Neutron Scattering</b>	Australian Nuclear Science and Technology Organisation (ANSTO)	Australian Centre for Neutron Scattering is part of an international network of organisations with neutron sources that delivers world-competitive neutron scattering science from Australian and international users. Research at the Australian Centre for Neutron Scattering been used to determine the internal structure of many types of materials, helping scientists understand why materials have the properties they do, and helping tailor new materials, devices and systems.	\$304,000
<b>Australian National Fabrication Facility (ANFF)</b>		The Australian National Fabrication Facility (ANFF) was founded in 2007 to provide access to micro and nanofabrication equipment, essential to Australia's scientific future. Enabled by NCRIS, ANFF has become a cornerstone of research in Australia, and now represents an investment of more than \$400m in research infrastructure made by Commonwealth and State Governments, as well as partner organisations.	\$6,841,000
<b>Australian New Zealand Clinical Trials Registry</b>		The Australian New Zealand Clinical Trials Registry (ANZCTR) is an online register of clinical trials being undertaken in Australia, New Zealand and elsewhere. The ANZCTR includes trials from the full spectrum of therapeutic areas of pharmaceuticals, surgical procedures, preventive measures, lifestyle, devices, treatment and rehabilitation strategies and complementary therapies.	\$100,000

NCRIS Facility	NSW Node (Location)	Description	OCSE co-investment (FY2006 to FY2020)
		<p>In 2007 the ANZCTR was one of the first three trial registries to be recognised by the World Health Organization International Clinical Trials Registry Platform (WHO ICTRP) as a Primary Registry. WHO recognises registries as Primary Registries if they fulfil certain criteria with respect to data content, quality and validity, accessibility, unique identification, technical capacity and administration.</p>	
<b>Biologics Innovation Facility</b>	University of Technology Sydney (UTS)	<p>The Biologics Innovation Facility at the University of Technology Sydney (UTS) is an unmatched Good Manufacturing Practice (GMP) training and teaching facility designed to drive opportunities to invent, up-skill and scale-up projects using state of the art equipment and best practice processing techniques.</p> <p>The state-of-the-art single use biomanufacturing equipment gives the fast-changing biotech and pharmaceutical sector the opportunity to have employees locally trained and upskilled in both upstream and downstream processing techniques.</p>	\$100,000
<b>Bioplatfroms Australia</b>		<p>Bioplatfroms Australia enables Australian life science research by investing in state-of-the-art infrastructure and associated expertise in the specialist fields of genomics, proteomics, metabolomics and bioinformatics. Bioplatfroms Australia creates open-data initiatives through collaborative research projects, which build critical 'omic datasets that support scientific challenges of national importance.</p>	\$4,888,000
<b>Centre for Accelerator Science</b>	Australian Nuclear Science and Technology Organisation (ANSTO)	<p>The Centre for Accelerator Science is a world-leading centre for ion beam analysis and accelerator mass spectrometry. The Centre is recognised internationally for the excellence of its operations and expertise of its staff. It attracts national and international users from academia, publicly-funded research agencies, industry and government</p>	\$110,000

NCRIS Facility	NSW Node (Location)	Description	OCSE co-investment (FY2006 to FY2020)
<b>Earth Composition and Evolution</b>	Auscope - MQU	<p>AuScope provides geoscientists with world-class research ‘toolkit’ to help tackle Australia’s key geoscience challenges, and improve Australian life and the environment.</p> <p>Earth Composition &amp; Evolution provides researchers with tools necessary to understand the age and geochemical evolution of the Australian continent. This knowledge can be applied to mineral exploration, global change, and natural hazard research.</p>	\$550,000
<b>Groundwater Infrastructure Program</b>	UNSW Sydney	<p>\$15 million has been invested in groundwater infrastructure, to establish long-term groundwater monitoring sites across Australia with a particular emphasis on groundwater change in response to climate variability.</p> <p>UNSW, Australia with collaboration of expertise from Flinders University, Australian National University, University of Queensland and Monash University have developed sites to provide advanced groundwater monitoring facilities. Some sites are connected to the web and updated every 24 hours. The majority of sites are updated manually.</p> <p>There are six main groundwater monitoring sites in four states. The sites have been selected to cover the range of climate zones and aquifer properties experienced in Australia.</p>	\$270,000
<b>Integrated Marine Observing System</b>		<p>Since 2006, IMOS has been routinely operating a wide range of observing equipment throughout Australia’s coastal and open oceans, making all its data accessible to the marine and climate science community, other stakeholders and users, and international collaborators.</p>	\$2,530,000
<b>Intersect</b>		<p>Intersect provides robust, innovative and collaborative eResearch services, skills and technology to universities, Government entities, the wider research community. Intersect pursues synergistic grant funding across its membership, stimulates and fosters cross-member, cross-discipline collaboration, and augments in-house research IT.</p>	\$5,105,000

NCRIS Facility	NSW Node (Location)	Description	OCSE co-investment (FY2006 to FY2020)
		The Intersect NSW eResearch Nexus facility supports thousands of researchers and research projects with specialised research-tailored technology and expertise. It offers critical petascale data storage and terascale cloud and high performance computing exclusive to Intersect in NSW.	
<b>Microscopy Australia</b>	UNSW node USYD node	<p>Microscopy Australia is a consortium of university-based microscopy facilities united by values of collaboration, accessibility, excellence and innovation. Each year, over 3,500 researchers from universities and industry use our instruments and expertise in facilities around Australia. Over 150,000 trainee microscopists around the world use our online training tools.</p> <p>Microscopy Australia enables access to an array of high-end microscopy platforms and associated technical expertise in strategic locations to efficiently service Australia's microscopy needs. Microscopy Australia also has formal connections with a range of other specialised linked laboratories.</p>	\$2,000,000 \$2,000,000
<b>National Imaging Facility</b>	University of Sydney and ANSTO	The National Imaging Facility (NIF) provides state-of-the-art imaging capabilities for the imaging of human, animals, plants, and materials through three main themes of Molecular Imaging and Radiochemistry, Human Imaging, and Animals, Plants, and Materials Imaging.	\$4,102,000
<b>Secure Unified Research Environment (SURE)</b>	The Sax Institute	<p>SURE, the Secure Unified Research Environment, is a high-powered computing environment developed to help make best use of our national knowledge base. It is helping to bring researchers together from across Australia and the world to collaborate on large-scale projects tackling major health and social issues such as population ageing, diabetes and mental health.</p> <p>It has been purpose-built as a remote-access data research laboratory for analysing routinely collected data, allowing researchers to log in remotely</p>	\$375,000

NCRIS Facility	NSW Node (Location)	Description	OCSE co-investment (FY2006 to FY2020)
<b>Simulation, Analysis and Modelling (SAM)</b>	Auscope - USYD	<p>and securely analyse data from sources such as hospitals, general practice and cancer registries.</p> <p>AuScope provides geoscientists with world-class research 'toolkit' to help tackle Australia's key geoscience challenges, and improve Australian life and the environment.</p> <p>SAM will provide the community with specialised, high-quality software to interrogate Earth processes that affect life at its surface.</p>	\$300,000
<b>Sydney Cell and Gene Therapy</b>		<p>Sydney Cell and Gene Therapy has about 40 research staff involved in cellular therapeutics and gene therapy in the Westmead health precinct in the west of Sydney. SCGT is a joint venture by three of Sydney's leading Medical Research Institutes and two Area Health Services.</p> <p>SCGT is made up of The Children's Hospital at Westmead Westmead Hospital, Children's Medical Research Institute Westmead Millennium Institute, Kids Research Institute. The partners have used a co-operative approach to share common research technologies, to leverage their funding and to maximise their effectiveness. This has created a research unit with the highest clinical and research experience in cell and gene-based therapeutics in Australia.</p> <p>The development of the shared facilities and associated research synergies has led to the establishment of Sydney Cell and Gene Therapy, an entity created to support in-house innovative research and third-party research organisations.</p>	\$200,000
<b>Terrestrial Ecosystem Research Network</b>		<p>TERN observes, measures and records critical terrestrial ecosystem parameters and conditions for Australia over time from continental scale to field sites at hundreds of representative locations. This information is standardised, integrated and transformed into model-ready data, enabling researchers to discern and interpret changes in land ecosystems.</p>	\$1,127,000

NCRIS Facility	NSW Node (Location)	Description	OCSE co-investment (FY2006 to FY2020)
		Understanding ecosystem change, the rate of change, and underlying causes is essential for effectively protecting and managing Australia's environment and the many services it provides.	

### 1.2 Other NCRIS facilities

NCRIS Facility	NSW Node (Location)	Description
<b>National Deuteration Facility (NDF)</b>	ANSTO	Australia's only deuteration facility and one of the very few in the world. Deuteration means to replace the hydrogen atoms in a molecule with deuterium. Deuterium is a heavy isotope of hydrogen. This helps researchers understand those molecules better and how they interact with themselves and others, and also creates useful new materials with superior properties. At the NDF, deuteration can be done using chemical and/or biological techniques.
<b>Australian Research Data Commons (ARDC)</b>	UTS	The ARDC enables Australian researchers to better access and use data. They provide and support data, research analysis platforms, data expertise, and digital data skills and training.
<b>Therapeutic Innovation Australia (TIA)</b>	UTS, University of Sydney, Royal Prince Alfred Hospital, Westmead Precinct, Children's Cancer Institute, Victor Chang Cardiac Research Institute	TIA is focussed on helping researchers turn their discoveries into new treatments for the health sector. It also looks for areas where there are gaps in the tools, services and expertise needed for medical research and helps to fill those gaps.

## 2. NSW research infrastructure under Australia Research Council's schemes

### 2.1. ARC Centres of Excellence

Centre of Excellence	University	Description	OCSE co-investment	CoE Funding Round
<b>Centre of Excellence for Enabling Eco-Efficient Beneficiation of Minerals</b>	UoN	The Centre aims to ensure the sustainability of the minerals industry in Australia, through a significant reduction in cost, environmental impact, and through lower energy and water usage. The Centre will also establish a new generation of scientists and research leaders in minerals beneficiation (transformation to a higher product value) to support the innovation needed into the future.	\$800,000	2020
<b>Centre of Excellence in Synthetic Biology</b>	MQU	The Centre will provide the technical innovation critical for Australia to develop a vibrant bioeconomy building on Australia's strengths in agriculture. The Centre will pioneer new approaches to the design of synthetic microbes, enabling the development of custom-designed microbial communities, synthetic organelles and new to nature biological pathways and enzymes.	\$1,000,000	2020
<b>Centre of Excellence for Engineered Quantum Systems</b>	MQU	The centre aims to understand the quantum world in its full complexity and apply this to the construction of true quantum machines. The Centre will build complex, multi-component quantum machines to harness the quantum world for practical applications. It will also pioneer the designer quantum materials, quantum engines, and quantum imaging systems at the heart of these machines	\$1,000,00	2017
<b>Centre of Excellence for Quantum Computation and Communication Technology</b>	UNSW Sydney	The Centre will implement quantum processors to run error corrected algorithms and transfer information across networks with absolute security.	\$1,000,00	2017
<b>Centre of Excellence for Exciton Science</b>	UNSW Sydney	The Centre seeks to understand how photons interact with advanced molecular materials to improve the way we harness and use light energy.	\$1,000,00	2017

Centre of Excellence	University	Description	OCSE co-investment	CoE Funding Round
<b>Centre of Excellence for Future Low-Energy Electronics Technologies</b>	UNSW Sydney	The Centre aims to realise new materials and systems that can provide electronic conduction with exponentially small electrical resistance at room temperature, enabling revolutionary new device and interconnect technologies with ultra-low power consumption.	\$1,000,00	2017
<b>Centre of Excellence for Population Ageing Research</b>	UNSW Sydney	The Centre aims to generate crucial new knowledge to inform social and economic responses to one of the most important issues of the 21st century: population ageing.	\$1,000,00	2017
<b>Centre of Excellence for Australian Biodiversity and Heritage</b>	UoW	The Centre aims to establish an innovative program of research and research training to transform our understanding of Australia's natural and human history from 130,000 years ago until European arrival.	\$1,000,00	2017
<b>Centre of Excellence for Climate Extremes</b>	UNSW Sydney	The Centre will be the world's first fully integrated centre focused explicitly on the understanding and prediction of climate extremes. This understanding will be built into the Australian prediction system, thereby improving our capability to predict extremes into the future.	\$1,000,00	2017

## 2.2. ARC Cooperation Research Centres

Cooperation Research Centre	University	Description	OCSE co-investment	CoE Funding Round
<b>Renewable, Affordable and Clean Energy (RACE) for 2030</b>	UTS	RACE for 2030 CRC will lead collaborative innovation to catalyse enhanced reliability, business cost savings, improved energy affordability, reduced carbon emissions and will accelerate development/export potential for Australian energy technology businesses.	\$300,000	2020

Cooperation Research Centre	University	Description	OCSE co-investment	CoE Funding Round
<b>SmarCrete CRC</b>	MQU	The Smartcrete Cooperative Research Centre will improve the cost, application and durability of concrete to improve the productivity and sustainability of the supply chain.	\$300,000	2020
<b>Future Foods Systems</b>	UNSW Sydney	Agrifood leaders around Australia are seeking competitive advantage in emerging markets for customised, nutritious, provenance-verified quality foods and hybrid food/medical goods. The CRC will deliver multidisciplinary research and capability-building across: igniting food regions and supporting clusters of growers and manufacturers in getting their distinctive goods to market smart indoor cropping: science and technology for next-generation indoor horticulture Industry 4.0 food manufacturing: science and technology for the creation of customised, nutrient-dense foods and hybrid food/medical goods tailored to growing domestic and export markets.	\$300,000	2020
<b>SmartSAT CRC</b>	USYD (NSW node)	To accelerate the growth of the NSW space industry by: supporting projects that will create innovative communications-based solutions to problems helping grow the number of new space businesses including start-ups increasing research translation projects and university-industry engagement delivering targeted programs to schools, universities and industry, and other initiatives that will also benefit and grow the broader economy.	\$300,000	2020
<b>Digital Health CRC</b>	Digital Health CRC Ltd	The CRC has focuses areas on: <ul style="list-style-type: none"> <li>- Changing health trajectories in chronic disease</li> <li>- Transparency of data to optimise clinical practice and referral</li> <li>- Intelligent decision support to improve value and efficiency</li> <li>- Enabling information discovery and application</li> </ul>	\$273,500	2019

Cooperation Research Centre	University	Description	OCSE co-investment	CoE Funding Round
		<ul style="list-style-type: none"> <li>- Changing health trajectories in chronic disease in rural and remote settings</li> <li>- Digitally coordinated and supported rehabilitation management</li> <li>- Digitally supported and coordinated aged care management</li> </ul>		
<b>Future Fuels CRC</b>	UoW (NSW Node)	<p>The CRC has three key research areas:</p> <ul style="list-style-type: none"> <li>- Future Fuel Technologies, Systems and Markets. Understanding the technical, commercial, market barriers and opportunities for the use of future fuels</li> <li>- Social Acceptance, Public Safety and Security of Supply. Studying the social and policy context of the technology and infrastructure associated with future fuels, including public acceptance and safety</li> <li>- Network Lifecycle Management. Vital components of the energy transfer infrastructure are studied from concept to end of life to safely introduce low carbon fuels</li> </ul>	\$273,500	2019
<b>CRC for High Performance Soils</b>	UoN	<p>The CRC aims to find practical solutions for Australia's underperforming soils and enable farmers to increase their productivity and profitability with four streams of programs:</p> <ul style="list-style-type: none"> <li>- Program 1 – Investing in high performance soils</li> <li>- Program 2 – Soil performance metrics</li> <li>- Program 3 – New products for soil fertility and function</li> <li>- Program 4 – Integrated soil management solutions</li> </ul>	\$280,000	2018
<b>Food Agility CRC</b>	UTS	The CRC aims to create scalable data-driven digital solutions for the agrifood industry and forge new ways to do great research.	\$280,000	2018
<b>Capital Markets CRC</b>	Capital Markets CRC Ltd	The CRC is now the Rozetta Institute that hosts two specialist research centres in finance and derivate markets research.	\$100,000	2016
<b>HEARing CRC</b>	MQU (NSW Node)	The CRC undertakes a program of research that addresses the twin challenges of maximising lifetime hearing retention, and reducing	\$100,000	2016

Cooperation Research Centre	University	Description	OCSE co-investment	CoE Funding Round
		productivity losses from hearing loss, through improved remediation and better take-up of technology.		

### 2.3. ARC Industrial Transformation Research Program

ITRP	University	Description	OCSE co-investment	CoE Funding Round
<b>Research Hub for Microrecycling of Battery and Consumer Waste</b>	UNSW Sydney	RACE for 2030 CRC will lead collaborative innovation to catalyse enhanced reliability, business cost savings, improved energy affordability, reduced carbon emissions and will accelerate development/export potential for Australian energy technology businesses.	\$100,000	2020
<b>Research Hub to Combat Antimicrobial Resistance</b>	UNSW Sydney	The research hub will take on the global challenge of antimicrobial (AMR) resistance for Australia through a world-first partnership between industry, researcher and end users.	\$100,000	2020
<b>Data Analytics for Resources and Environments (DARE) Industrial Transformation Centre</b>	USYD	The Data Analytics for Resources and Environments Centre (DARE) will enable researchers to apply their data science models against real world challenges, such as water storage, biodiversity loss and the extraction of mineral resources.	\$100,000	2020
<b>Integrated Energy Storage Solutions</b>	UNSW Sydney	The Hub aims at facilitating the world's transition towards sustainable, reliable, secure and cost-effective energy sectors through the generation of new knowledge and pivotal technologies in the areas of storage technology manufacturing, integration, optimisation, management, life cycle assessment and economic valuation.	\$100,000	2018/19

ITRP	University	Description	OCSE co-investment	CoE Funding Round
<b>Advanced Technologies in Rail Track Infrastructure</b>	University of Wollongong	The key objective of ITTC Rail is the effective and rigorous training of young professionals through higher degree research that is both custom made and value added to find appropriate solutions to the current challenges and problems faced by the rail industry.	\$100,000	2017/18
<b>Fire Retardant Materials and Safety Technologies</b>	UNSW Sydney	The Centre ARC works on innovation in environmental friendly fire retardants, and early intervention with cutting-edge fire preventive measures for safer materials and applications. The key research areas include novel green and bio-inspired flame retardants; multi-scale fire modelling; advanced fire suppression and control strategies; and new fire testing and standards.	\$100,000	2017/18
<b>CUAVA (CubeSats, UAVs and their Applications)</b>	The University of Sydney	The Centre aims to train and create an Australian workforce in sustainable, advanced manufacturing, space and UAV industries of national importance. Focus areas include capabilities and applications of CubeSats, UAVs, and their instruments (plus those for larger satellites) for Earth observations, GPS, satellite communications, and space weather purposes; and progress these devices to create a major commercial value with wide applications across these and other areas.	\$100,000	2017/18
<b>Musculoskeletal Biomedical Technologies</b>	The University of Sydney	The Centre delivers training and research that can use engineering design and analysis to solve biological and medical problems.	\$100,000	2017/18
<b>Food Safety in the Fresh Produce Industry</b>	The University of Sydney	The Centre conducts industry-focused research to develop practical solutions to prevent or minimise food safety risks in fresh produce across the value chain, and train the next generation of industry-ready food safety researchers.	\$70,000	2016/17
<b>Integrated Device for End-User Analysis at Low Levels</b>	University of Technology Sydney	The Hub aims to create technologies that will enable industry to develop analytical devices with vastly improved detection capabilities but are also affordable, portable, fast and adaptable.	\$70,000	2016/17
<b>Automated Manufacture of Advanced Composites</b>	UNSW Sydney	The Centre aims to incubate the next generation of automated composite manufacturing innovations and innovators to drive future business in a highly collaborative environment.	\$70,000	2016/17

ITRP	University	Description	OCSE co-investment	CoE Funding Round
<b>Legumes for Sustainable Agriculture</b>	The University of Sydney	The Hub aims to provide Australian growers and industrial stakeholders with improved plant materials to maximise production, environmental sustainability and profitability. In particular, the research aims to improve the nitrogen delivery capacity of legumes and their resilience to abiotic stress.	\$70,000	2015/16
<b>Fruit Fly Biosecurity Innovation</b>	Macquarie University	The Centre aims to provide the Australian horticulture industries new, sustainable and environmentally friendly tools for controlling fruit fly pests. Research focuses on protecting horticulture industries and market access, and helping ensure Australia's food security.	\$70,000	2015/16
<b>Basin GENeSIS Hub</b>	The University of Sydney	The Hub brings together a broad range of expertise for the development and application of cutting-edge numerical modelling tools with the aim of improving the understanding of the formation and evolution of basins.	\$70,000	2014/15

### 3. Other public funded research infrastructure in NSW

#### 3.1. Australian Nuclear Science and Technology Organisation (ANSTO)

Facility	Location	Research capability	Description	Major equipment
<b>Centre for Accelerator Science (NCRIS facility)</b>	Lucas Heights	Physical Sciences, Chemical Sciences, Earth Sciences, Environmental Sciences, Biological Sciences, Technology, Medical and Health Sciences, History and Archaeology	The Centre provides world-leading national accelerator mass spectrometry (AMS) and ion beam analysis (IBA) facilities. These facilities are used for materials characterisation and environmental research using ion beam analysis, accelerator mass spectrometry and isotopic methods, e.g. for research related to climate change, archaeology, heritage, biology and materials science.	<ul style="list-style-type: none"> <li>Multi-wavelength absorption black carbon instrument (MABI) that can determine the source of black carbon in air pollution</li> <li>Accelerators range from 0-10 MW with 11 ion sources and 17 beam lines on accelerators</li> </ul>
<b>Australian Centre for Neutron Scattering (NCRIS facility, formerly Bragg Institute)</b>	Lucas Heights	Physical Sciences, Chemical Sciences, Biological Sciences, Engineering, Technology, Medical and Health Sciences	The Centre is the home of neutron science in Australia and a leading facility in the Asia Oceania region. It is part of an international network of organisations with neutron sources that delivers world-competitive neutron scattering science from Australian and international users. Research conducted at the Centre helps scientists understand why materials have the properties they do, and helping tailor new materials, devices and systems.	<ul style="list-style-type: none"> <li>15 neutron beam instruments, which are classified into four main groups: diffractometers, small-angle spectrometers imaging and reflectometry instruments and inelastic spectrometers.</li> <li>three X-ray instruments, a helium polarising instrument and a physical properties measurement system.</li> <li>BioRef reflectometer (Spatz) is currently being commissioned and can operate in the horizontal scattering plane and has an infrared spectrometer.</li> </ul>

Facility	Location	Research capability	Description	Major equipment
<b>OPAL multi-purpose reactor</b>	Lucas Heights	Physical Sciences, Earth Sciences, Agricultural and Veterinary Sciences, Engineering, Technology, Medical and Health Sciences	Australia's Open Pool Australian Lightwater (OPAL) reactor is a state-of-the-art 20 Megawatt reactor that uses low enriched uranium (LEU) fuel to achieve a range of nuclear medicine, research, scientific, industrial and production goals.	OPAL is one of a small number of reactors with the capacity to produce commercial quantities of radioisotopes. This capacity, combined with the open pool design, the use of LEU fuel and the wide range of applications, places OPAL amongst the best research reactors in the world.
<b>National Research Cyclotron (NCRIS facility)</b>	Camperdown	Physical Sciences, Nuclear Sciences, Medical and Health Sciences	The facility is Located at ANSTO's Camperdown campus and equipped with 18MeV cyclotron. It serves researchers using radioisotopes produced in the cyclotron with PET and SPECT imaging for pre-clinical studies to investigate molecules that have a role in neurological disorders and many other diseases.	<ul style="list-style-type: none"> <li>○ 18MeV cyclotron jointly operated by ANSTO and the University of Sydney as part of the National Imaging Facility (NIF)</li> <li>○ radiation-rated laboratories, PET-rated hot cells and shielded fume cupboards</li> </ul>

### 3.2. Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Centre	Location	Industry and research capability	Key equipment
<b>CSIRO Newcastle Energy Centre</b>	Newcastle	Solar and renewable energy	<ul style="list-style-type: none"> <li>○ high-temperature solar thermal research facility with two high-concentration solar thermal tower facilities. Each field contains a tower and a heliostat array that tracks the sun throughout the day, concentrating the solar heat to produce temperatures in excess of 1000° Celsius</li> </ul>
<b>Australia Telescope National Facility</b>	- Parkes Observatory (Parkes)	Space and astronomy	- Australia Telescope National Facility is made up of four radio telescopes, one in WA (new ASKAP radio telescope) and three in NSW which are:

	<ul style="list-style-type: none"> <li>- Paul Wild Observatory (Narrabri)</li> <li>- Mopra radio telescope (Narrabri)</li> </ul>		<ul style="list-style-type: none"> <li>○ Parkes radio telescope that can detect radio waves from seven millimetres to four metres long, and be pointed with an accuracy of better than 11 arcseconds;</li> <li>○ The Australian Telescope Compact Array comprises six 22-metre antennas that can provide detailed images for the study of early stage of star formation, molecules in space, supernovae, magnetic fields and other space related areas; and</li> <li>○ Mopra radio telescope is a single 22-metre diameter antenna primarily for large-scale millimetre-wavelength mapping projects such as clouds of cold interstellar gas and dust.</li> </ul>
<b>Boorowa Agricultural Research Station</b>	Boorowa	Agriculture	<ul style="list-style-type: none"> <li>○ 290 hectare research field with purpose-built facility for farms and agriculture research</li> </ul>
<b>Data61</b>	Australian Technology Park	Data	<p>Data61 team is supported by key labs and facilities including:</p> <ul style="list-style-type: none"> <li>○ Functional Programming Lab supports software engineering and computer programs design</li> <li>○ Immersive Environments Lab (Canberra-based) is a purpose built research facility can support research in Cloud Computing Architectures, Collaborative Systems, Internet of Things, Machine Learning, In-Situ Analytics and Robotics.</li> <li>○ Robotics Innovation Centre houses the biggest motion capture system in Australia, a 13x5m pool for testing aquatic robots, field-deployable UAVs, UGVs and legged robots, high-accuracy robot manipulators, sensors and telemetry systems</li> </ul>
<b>Other research teams and units</b>	Multiple location	Multiple industries	<ul style="list-style-type: none"> <li>○ Albury, Armidale and Myall Vale teams focus on agriculture research</li> <li>○ North Ryde and Marsfield team focus on information technology and data research</li> <li>○ Lindfield team focus on physics and material sciences</li> </ul>

## 4. NSW government research infrastructure

### 4.1. Premier and Cabinet Cluster

#### 3.1.1 Museum

Research Infrastructure	Location	Research capability	Description
<b>Art Gallery of NSW</b>	Sydney	Art and social science	<p>The Art Gallery of NSW is recognised for its collections, exhibitions and lecture and has a leading scientific role in identifying the provenance of works and conserving the collections. The Gallery's research function and services offer:</p> <ul style="list-style-type: none"> <li>- Access to artworks through online, reproduced images and borrow at the Gallery.</li> <li>- National Art Archive including artists' archives and papers and the records of commercial galleries, art societies and individuals as well as the Gallery's own administrative records</li> <li>- Edmund and Joanna Capon Research Library with collections of fine art publications, rare books and manuscripts in Australia</li> <li>- Research tools that links to Australian libraries and archives, international art libraries, art museum collections online and websites for biographical, image and art auction research.</li> </ul>
<b>State Library of NSW</b>	Sydney	Information and computing sciences	<p>The State Library of NSW is a world-leading library and centre of digital excellence specialising in Australian history, culture and literature, spanning social and applied sciences, Aboriginal studies, Antarctic exploration, family history, biography, business, law and health. The Library collects and preserves contemporary and heritage print and digital works, including manuscripts, maps, pictures, photographs, newspapers, prints and recordings. Collections include specialist and rare books, and reference libraries.</p>
<b>Powerhouse Museum</b>	Sydney	Physical science	<p>A new powerhouse facility, Powerhouse Parramatta, is under construction at Western Sydney and will deliver dynamic exhibition, education and community programs.</p>
<b>Sydney Observatory</b>	Sydney	Physical science	<p>Sydney Observatory is home to Australia's most accessible telescope domes, with modern and historic instruments to safely view the Sun and other stars, planets and astronomical objects. Other features include the Sydney Planetarium and 3D Space Theatre immersive astronomy experiences, and the new East Dome, which has a ground-level accessible telescope.</p>

<b>Australian Museum Research Institute</b>	Sydney	Biological Sciences, Agricultural and Veterinary Sciences	The Australian Museum Research Institute focuses on some of today's major challenges: climate change impacts on biodiversity; the detection and biology of pest species; understanding what constitutes and influences effective biodiversity conservation. The natural history collections underpin the research and are essential for biodiversity research. The Institute holds 20 million objects in the natural history collections and the research is underpinned by significant scientific infrastructure including the Australian Centre for Wildlife Genomics, the Scanning Electron Microscopy and Microanalytical Unit, the Australian Museum Research Library and the Lizard Island Research Station, situated on Australia's Great Barrier Reef.
---	--------	---	--

### 3.1.2 Zoos and botanic gardens

Research Infrastructure	Location	Research capability	Description
<b>Taronga Conservation Society Australia</b>	Taronga Zoo Sydney, Mosman Taronga Western Plains Zoo Dubbo, Dubbo.	Ecology, biodiversity conservation, wildlife health, behaviour and nutrition	<p>The Sydney and Dubbo zoos play an international role in the care and conservation of native and exotic species, including breeding programs and research. Scientific projects include population dynamics, wildlife health, marine science, and terrestrial and behavioural ecology.</p> <p>A newly opened Taronga Institute located in Taronga Sydney Zoo is a purpose-built research and education centre that. The Institute houses:</p> <ul style="list-style-type: none"> <li>- two multi-disciplinary labs, a behavioural ecology lab, wildlife health lab, Cryodiversity Bank lab and enrichment development centre.</li> <li>- higher education programs in partnership with university and TAFE. The institute has three immersive habitat classrooms of rainforest, desert and woodlands for education and STEM programs.</li> </ul> <p>The two zoos house two Wildlife Hospitals that are responsible for maintaining the health of the animals. The expertise comprising of professionals with decades of experience in their fields and the only full-time Zoo Veterinary Pathologist and Zoo Nutritionist. The hospitals' wildlife conservation and health teams have taken the science of animal medicine and husbandry.</p>

<b>The Australian Botanic Garden Mount Annan</b>	Mount Annan	Environmental Sciences, Biological Sciences	<p>The Australian Botanic Garden Mount Annan is the native plant garden of the Royal Botanic Gardens &amp; Domain Trust. It covers 416 hectares, making it the largest botanic garden in Australia. The plantings are designed to display the diversity of the Australian flora and will eventually include many of Australia's 25,000 known plant species.</p> <p>Research facilities located at Mount Annan include:</p> <ul style="list-style-type: none"> <li>- The Australian PlantBank. The Plantbank houses seedbank and research laboratories that specialise in horticultural research and conservation of Australian native plant species, particularly those from New South Wales.</li> <li>- A new National Herbarium of NSW. The Herbarium facility will conduct botanical research, advancing fundamental knowledge of flora and driving effective conservation solutions to ensure the survival of plants, and all life that depends on them.</li> </ul>
<b>The Blue Mountains Botanic Gardens Mount Tomah</b>	Mount Tomah	Environmental Sciences, Biological Sciences	<p>The Blue Mountains Botanic Garden is the cool-climate garden of the Royal Botanic Gardens &amp; Domain Trust. It covers 28 hectares on the summit of a basalt-capped peak 1000 metres above sea level in the world heritage listed Greater Blue Mountains. The theme of this Garden emphasises cool-climate plants from around the world, especially those from the southern hemisphere. The Botanic Garden houses research capabilities of evolutionary ecology, germplasm conservation &amp; horticulture, natural areas management, plant diversity and pathology.</p>
<b>The Royal Botanic Gardens Sydney</b>	Sydney	Environmental Sciences, Biological Sciences	<p>The Royal Botanic Gardens Sydney houses research capabilities of evolutionary ecology, germplasm conservation &amp; horticulture, natural areas management, plant diversity and pathology, collections management of specimens, climate change, bushfire recovery and botanical illustration. The PlantClinic houses the Plant Pathology and Mycology research program and the Plant Disease Diagnostic Unit.</p>

## 4.2. Planning, Industry and Environment Cluster

## 4.2.1. Environmental, Energy and Science

Research Infrastructure	Location	Research capabilities	Description
<b>Air quality monitoring network</b>	Multiple locations, network side locations are available on EES website	Air quality	The former Office of Environment and Heritage (OEH) operates a comprehensive air quality monitoring network, with 45 automated air analysis laboratories across NSW, to provide the community with accurate and up-to-date information about air quality. The network is NATA-accredited. OEH also delivers complex and integrated climate and atmospheric science research programs focussing on air quality, atmospheric chemistry, and airshed modelling; and researching and modelling the past, present and future climate of NSW and the impacts of climate on the state's communities and environment. The facility at Lidcombe houses: the maintenance and fabrication facilities for the air quality monitoring network; a Calibration Reference Laboratory that includes a range of primary standards and reference material, including the only Standard Reference Photometer in Australia; and high-end computing facilities for airshed and climate modelling.
<b>Lidcombe Laboratories</b>	Lidcombe	Chemistry, environmental forensics and testing	The Lidcombe scientific laboratories include two facilities that provide scientific services in the areas of analytical chemistry, chemical fingerprinting, environmental forensics, ecotoxicology, toxicity testing, environmental contaminants, the environmental effects of pollution and expert testimony in court proceedings. The Environmental Forensics laboratory is accredited by the National Association of Testing Authorities, Australia (NATA) for the range of services it provides (chemical, biological and forensics). It conducts over 30,000 tests a year.
<b>Silverwater data storage</b>	Silverwater	Data storage and analysis	The infrastructure provides a dedicated scientific computing and data storage facility. It also includes high-speed networks between Silverwater and former OEH offices at Hurstville, Lidcombe, Dubbo, and Grafton. The central data-storage capacity has been increased to over 10 Petabytes (a Petabyte is equivalent to 223,000 DVDs). The facility is being used for the storage and analysis of large quantities of environmental data. Key datasets include SPOT imagery of NSW since 2007, Landsat images of NSW

Research Infrastructure	Location	Research capabilities	Description
			since the 1980s, historic aerial photos back to the 1930s and high resolution climate modelling outputs.
<b>Soil Health and Archive Laboratory</b>	Yanco	Soil health and testing	The Soil Health and Archive (SHA) Laboratory provides specialist services in soil analysis, monitoring and soil health. The facility is located at the Yanco Agricultural Institute co-located with DPI. SHA is a world class soil health facility, both in terms of the expertise of its staff and the quality of its facilities. The laboratory is currently working on a range of soil health projects processing and analysing in excess of 8000 samples per year (equating to approx 32,000 tests per year). Also located at Yanco is the NSW Soil Archive. Managed by SHA it is a collection of >70,000 representative soil samples primarily from the NSW Soil Landscape Mapping Program (NSW SLMP) and Monitoring and Evaluation Program (MER) The collection is linked with the CSIRO National Soils Archive and serves as a benchmark for NSW soil conditions at time of sampling and is therefore a timeless and irreplaceable resource. Individuals, businesses or research institutions wanting advice about collaborations or services should contact the laboratory on 02 6951 2782. (Sourced from: OEH)

### 4.3. NSW Health Cluster

#### 4.3.1. Sydney local health districts

Health districts	Description	Research institute (infrastructure, research partner and key equipment)
<b>Central Coast Local Health District (CCLHD)</b>	CCLHD provides public health services to the communities of the Central Coast. The region is served by two acute hospitals - Gosford and Wyong, two sub-acute facilities and eight community health centres in addition to other community based services.	- Central Coast Clinical School and Research Institute (CCCSRI) which is a \$72.5 million research facility in a partnership between CCLHD and the University of Newcastle, is currently under construction.
<b>Illawarra Shoalhaven Local</b>	ISLHD services a population of more than 400,000 residents with eight hospital sites and	- Research Central is ISLHD's internal research support team. They assist ISLHD clinicians with research processes and provide individual project support.

Health districts	Description	Research institute (infrastructure, research partner and key equipment)
<b>Health District (ISLHD)</b>	community health services with an annual budget of more than \$900 million.	<ul style="list-style-type: none"> <li>- Nursing &amp; Midwifery Research Unit is an external unit that focuses on 'working with' clinicians to develop person-centred, evidence-based approaches to care.</li> <li>- Sponsors, collaborators and partners: Illawarra Health and Medical Research Institute, Centre for Health Research Illawarra Shoalhaven Population, Centre for Oncology Education &amp; Research Translation (CONCERT)</li> </ul>
<b>Nepean Blue Mountains Local Health District (NBMLHD)</b>	NBMLHD is responsible for providing community health and hospital care for people living in the Blue Mountains, Hawkesbury, Lithgow and Penrith Local Government Areas (LGAs) and tertiary care to residents of the Greater Western Region.	<ul style="list-style-type: none"> <li>- The Department of Anaesthetics conducts research such as clinical trials and collaborates with Australian and overseas researchers. Staff are affiliated with The University of Sydney School of Medicine and are involved in the training of medical students.</li> <li>- NBMLHD has a well-established national and international research program. The Research Office aims to foster innovation in research and teaching and to provide support to researchers, clinical staff and students.</li> </ul>
<b>Northern Sydney Local Health District (NSLHD)</b>	NSLHD emphasises local decision making and is led by a professional Health District Board and LHD Chief Executive. Its vision is for NSLHD to be "leaders in healthcare, partners in wellbeing".	<ul style="list-style-type: none"> <li>- NSLHD's research covers the whole spectrum of health and medical fields and is undertaken across every campus across the district. On average, 1,300 peer reviewed publications are published annually. Have been frequently successful in obtaining major grants from the National Health and Medical Research Council (NHMRC), Australian Research Council (ARC), Medical Research Futures Fund (MRFF) and the NSW Health Office for Health and Medical Research (OHMR).</li> <li>- My Research Hub provides support services to researchers on navigating the research process.</li> <li>- Research partners include the University of Sydney, Macquarie University, University of Technology Sydney, NSW Health, Sydney Health Partners, Sydney North Healthcare Network, and many others. Engagement with other partners include medical research institutes, public</li> </ul>

Health districts	Description	Research institute (infrastructure, research partner and key equipment)
		<p>health organisations, industry, non-government organisations and philanthropic organisations.</p> <ul style="list-style-type: none"> <li>- E.g. The Kolling Institute has been at the forefront of research for 100 years, turning scientific discoveries into medical realities. Joint venture of NSLHD and the University of Sydney.</li> <li>- E.g. The Allied Health Network includes research within, across, and beyond NSLHD, focussing on the role of allied health professionals in patient care. They provide support for researchers via the Allied Health Kickstarter Research Grants. The NSLHD Allied Health research team has important partnerships with Sydney MSK, University of Sydney, CSIRO, Sydney Health Partners, the Kolling Institute and the Agency for Clinical Innovation.</li> <li>- For more networks, <a href="https://www.nsw.gov.au/research-domains">Research domains - Research domains - Northern Sydney Local Health District (nsw.gov.au)</a></li> </ul>
<b>South Eastern Sydney Local Health District (SESLHD)</b>	<p>SESLHD covers the seven Local Government Areas from Sydney's Central Business District in the north to the Royal National Park in the south. Services provided include in-hospital care, outpatient services, population health programs and services, primary health care, community health/home based services, imaging and pathology and more.</p> <p>Its vision for the next three years is 'exceptional care, healthier lives'.</p>	<ul style="list-style-type: none"> <li>- Has various research groups in Sydney, Kogarah, Randwick and Sutherland</li> <li>- E.g. The Sydney/Sydney Eye Hospital collaborates with the University of Sydney (Save Sight Institute) on the campus of Sydney/Sydney Eye Hospital to undertake clinical trials and clinical studies in eye diseases.</li> <li>- E.g. The Fertility and Research Centre is a joint initiative between UNSW and the Royal Hospital for Women (RHW). It is a multidisciplinary centre for research and clinical excellence in reproductive medicine and fertility, based at the RHW.</li> </ul>
<b>South Western Sydney Local Health District (SWSLHD)</b>	<p>SWSLHD looks after all public hospitals and healthcare facilities in south western Sydney from Bankstown to Bowral.</p>	<ul style="list-style-type: none"> <li>- Over the last eight years, SWSLHD has invested significantly in the development of research, resulting in significant achievements around delivering an Academic Unit program, expanding clinical trials capability, growing research partnerships and strengthening research capacity</li> </ul>

Health districts	Description	Research institute (infrastructure, research partner and key equipment)
	SWSLHD operates 14 major community health centres, with its vision being “leading care, healthier communities.”	<p>and capability in our staff and students. This includes fields such as oncology, brain injury, respiratory disease, neurology, critical care, aged care and surgery.</p> <ul style="list-style-type: none"> <li>- The Research Directorate is responsible for providing research support.</li> <li>- Partners: Ingham Institute for Applied Medical Research, South West Sydney Research</li> </ul>
<b>Sydney Local Health District (SLHD)</b>	SLHD is responsible for providing health care services to more than 700,000 people living in the centre and inner west of Sydney and beyond.	<ul style="list-style-type: none"> <li>- The Sydney Local Health District Clinical Research Centre is responsible for assisting SLHD researchers.</li> <li>- The Sydney Local Health District directly undertakes, hosts, sponsors and supports world-leading biomedical, clinical, health services and public and population health research across the Royal Prince Alfred Hospital and Concord Repatriation General Hospital as well as several highly eminent medical research institutes.</li> <li>- 600+ clinical trials are currently underway, with over 1870 publications produced in 2019.</li> </ul>
<b>Western Sydney Local Health District (WSLHD)</b>	WSLHD is responsible for providing primary and secondary health care for people living in the Auburn, Blacktown, The Hills Shire, Holroyd and Parramatta Local Government Areas (LGAs) and tertiary care to residents of the Greater Western Region. It is one of the state’s fastest growing areas.	<ul style="list-style-type: none"> <li>- The Western Sydney Local Health District Research and Education Network (REN) enjoys a national and international reputation.</li> <li>- Facilities: libraries across the different hospitals, the Westmead Education and Conference Centre (an education partnership between WSLHD and the University of Sydney, it is a key facility for education, training and research at Westmead)</li> <li>- Research topics include laboratory, drug and device trials, epidemiological studies and more.</li> <li>- E.g. Centre for Research into Adolescents’ Health (CRASH) aims to promote the health of young Australians through clinical and public health research, informed policy, promoting better clinical practice, educating professionals and informing health consumers.</li> </ul>

## 4.3.2. Rural and regional NSW health districts

Health districts	Description	Research institute (infrastructure, research partner and key equipment)
<b>Far West Local Health District (FWLHD)</b>	FWLHD covers 194,949 square kilometres in remote NSW. It is the most sparsely populated local health district in NSW, with 62% of its approximately 30,000 inhabitants living in Broken Hill. The remainder of the population live in agricultural towns along the Murray River, in small remote communities of 80-800 people or on stations throughout the District. It has the highest proportion of Aboriginal residents (12%). The population is decreasing, ageing and experiencing significant morbidity related to lifestyle factors and chronic illness. Its vision is “Excellence in Rural and Remote Health.”	
<b>Hunter New England Local Health District (HNELHD)</b>	HNELHD covers a region of 131,785 square kilometres, encompassing a major metropolitan centre, regional communities, and a small percentage of people located in remote communities. Overall, the population is experiencing rapid growth and ageing, although several local areas are experiencing depopulation.	<ul style="list-style-type: none"> <li>- The HNE Research Office is responsible for the oversight of all research involving humans that is undertaken in the HHNELHD. This includes providing Secretariat support to the Hunter New England Human Research Ethics Committee and ensuring all governance requirements have been met for research conducted in the Hunter New England Local Health District.</li> </ul>
<b>Mid North Coast Local Health District (MNCLHD)</b>	MNCLHD covers an area of 11,335 square kilometres. It has an estimated population of more than 211,000 people, with 21% of residents over the age of 65 compared to 15% for NSW. It has one of the fastest growing and ageing populations within NSW. Its vision is Quality and Excellence in Regional Healthcare.	<ul style="list-style-type: none"> <li>- The Research and Knowledge Translation Unit provides a central point of contact to develop and support research and knowledge translation within the MNCLHD.</li> <li>- MNCLHD is a member of the NSW Regional Health Partners, an initiative of the National Health and Medical Research Council and which is supported by the NSW Ministry of Health Hub Strategy. The</li> </ul>

Health districts	Description	Research institute (infrastructure, research partner and key equipment)
		<p>partners include HNELHD, CCLHD, Hunter New England and Central Coast Primary Health Network, Calvary Mater Newcastle. Hunter Medical Research Institute, University of Newcastle and University of New England.</p> <ul style="list-style-type: none"> <li>- The Mid North Coast Research and Knowledge Translation Unit also unit works in collaboration with a range of local organisations, including Charles Sturt University, Durri Aboriginal Corporation Medical Service, Galambila Aboriginal Health Service, North Coast Primary Health Network, Rural Clinical School, University of NSW,</li> <li>- Southern Cross University, University of Newcastle and Werin Aboriginal Corporation.</li> </ul>
<b>Murrumbidgee Local Health District (MLHD)</b>	MLHD is located in southern NSW across 125,242 square kilometres. Most of the district is considered inner regional and outer regional, with one remote area.	
<b>Northern NSW Local Health District (NNSWLHD)</b>	NNSWLHD covers an area in north eastern NSW extending from Tweed Heads in the north to Tabulam and Urbenville in the west and to Nymboida and Grafton in the south. The District delivers a broad range of health services in state-of-the-art facilities, with access to general and specialist services. Its vision is "A healthy community through quality care".	
<b>Southern NSW Local Health District (SNSWLHD)</b>	SNSWLHD provides health services for about 200,000 residents and additional visitors in the South East of NSW. It is continuing to improve the quality and access to health services, including continued development of capital upgrades, extension of population health activities and community engagement.	

Health districts	Description	Research institute (infrastructure, research partner and key equipment)
<b>Western NSW Local Health District (WNSWLHD)</b>	WNSWLHD covers around 250,000 square kilometres, encompassing cities, inner regional, outer regional and remote communities. It has introduced many innovative approaches and programs to improve health services and health outcomes for people living in the district.	<ul style="list-style-type: none"> <li>- The Research Office should be the first point of contact for researchers seeking advice and ethics approval for health-related research projects being conducted in Western NSW, including clinical trials.</li> <li>- Partners include the Western NSW Health Research Network, which is the peak body for health research in Western NSW and has over 250 members. The Network is a collaboration between four universities, Western NSW Local Health District, Western NSW Primary Health Network, Hospitals, community managed organisations and Aboriginal Community Controlled Health Organisations.</li> </ul>

#### 4.4. Regional NSW

##### 4.4.1. NSW Primary Industry

Research Infrastructure	Location	Industry	Description	Facilities, major equipment, and services	Research capability
<b>Australian Cotton Research Institute</b>	Narrabri	Cotton	The research centre is owned by NSW DPI with over 100 staff from both DPI and CSIRO with a diverse mix of researchers, technicians, farm operational and administrative support employees.	<ul style="list-style-type: none"> <li>- 277ha farm</li> <li>- Laboratories</li> <li>- Glasshouses</li> <li>- Cotton ginning facilities</li> <li>- Controlled environment growth rooms</li> <li>- Insectaries</li> </ul>	Cotton pathology and integrated disease management, insecticide resistance management, cotton agronomy, environmental stewardship, cotton weeds and herbicide resistance, soil and water management and summer pulse agronomy.

Research Infrastructure	Location	Industry	Description	Facilities, major equipment, and services	Research capability
<b>Armidale Livestock Industries Centre</b>	Armidale, on UNE campus	Livestock	The centre focuses on improving productivity, profitability and sustainability of livestock industries and is the hub for beef and sheep industry research and development.	<ul style="list-style-type: none"> <li>- Access to UNE facilities (Laboratories, Animal houses Sheep and beef feedlot, CT scanner, Methane chambers Pasture intake and grazing efficiency measurement facilities)</li> <li>- Access to nearby facilities including CSIRO Chiswick FD McMaster Laboratory and UNE SMART farms</li> </ul>	Livestock genetics, ruminant nutrition and behaviour, greenhouse gas accounting, livestock methane mitigation, meat quality, animal physiology, animal welfare, and technology development and implementation.
<b>Central Coast Primary Industries Centre</b>	Central Coast (Ourimbah campus of UoN)	Greenhouse horticulture	The centre is DPI's Centre of Excellence for Market Access and Greenhouse Horticulture and has been in the service for over 100 years. The centre is supported with purpose-built laboratories and a greenhouses complex which support R&D of NSW Agriculture and Biosecurity & Food Safety.	<ul style="list-style-type: none"> <li>- 15 individually controlled greenhouse structures covering a total area of 700 m2. The greenhouses are equipped with a fully integrated fertigation and environmental control system</li> <li>- 18 Controlled environment rooms (CER) for postharvest, market access and food safety research</li> </ul>	Research is focused on four major themes- protected cropping, market access & postharvest, food safety and plant biosecurity.

Research Infrastructure	Location	Industry	Description	Facilities, major equipment, and services	Research capability
				<ul style="list-style-type: none"> <li>- Laboratories of plant pathology, entomology, postharvest, fruit fly rearing and infestation, food safety.</li> <li>- Somersby field station (78ha)</li> </ul>	
<b>Condobolin Agricultural Research and Advisory Station</b>	Condobolin	Dryland cropping and livestock	Leading dryland research facility to increase efficiency, productivity and profitability of low rainfall zone farming.	<ul style="list-style-type: none"> <li>- Laboratories are resourced for plant, soil and seed sample, processing, quality testing and storage.</li> <li>- Greenhouses on site for controlled environment experiments.</li> <li>- 1722ha of land of mixed cropping and livestock.</li> </ul>	Dryland cropping, farming systems, variety trials, pastures, livestock, glasshouse, shadehouse and supplementary watering capabilities.
<b>Cowra Agricultural Research and Advisory Station</b>	Cowra	Red meat and sheep	Leading research centre for Red Meat and Sheep Development with a long and impressive research record in the improvement of the Australian sheep meat industry. Recent activities have focussed on developing improvements in	<ul style="list-style-type: none"> <li>- Meat science laboratory that can conduct variety of tests to determine meat quality, sensory characteristics, shelf-life and preservative capacities and validate objective on-chain technologies.</li> <li>- 390ha of farming land</li> </ul>	Four research teams working on: <ul style="list-style-type: none"> <li>○ Pastures</li> <li>○ Agronomy/cropping</li> <li>○ Extensive livestock</li> <li>○ Meat science</li> </ul>

Research Infrastructure	Location	Industry	Description	Facilities, major equipment, and services	Research capability
			genetics, meat quality, nutrition, reproduction, lamb survival and market development.		
<b>Dareton Primary Industries Institute</b>	Dareton	Citrus production	The Institute is the site of the National Citrus Arboretum Collection and a source of high health status propagating material for the Australian citrus nursery industry. Research at the Institute is primarily directed at improving the sustainability of citrus production.	<ul style="list-style-type: none"> <li>- Research laboratories</li> <li>- 243ha of farming land</li> <li>- Variety evaluations</li> <li>- Seed bank</li> <li>- Rootstock evaluations</li> </ul>	Citrus research, permission, pistachios, hazelnuts, grapevine propagation and national germplasm collection.
<b>Ebor Dutton Trout Hatchery</b>	Ebor	Fish	The hatchery is one of two NSW Government facilities for breeding and rearing Rainbow Trout and Brown Trout. They are bred for release into public waterways in the New England and Central Tablelands and Southern Highlands. 2 million fish are bred annually.	<ul style="list-style-type: none"> <li>- Hatchery recirculation shed for adult broodstock</li> <li>- 2 cottages</li> <li>- Machinery sheds</li> <li>- 5 earthen ponds</li> <li>- 50 megalitre water storage dam</li> <li>- 4 recirculation systems</li> <li>- 20 concrete holding ponds</li> <li>- 4 concrete raceways</li> </ul>	Trout tagging program, trout stocking

Research Infrastructure	Location	Industry	Description	Facilities, major equipment, and services	Research capability
<p><b>Elizabeth Macarthur Agricultural Institute, Menangle</b></p>	<p>Menangle</p>	<p>Animal health, plant health</p>	<p>A world renowned, biosecurity facility that enhances food and fibre production and helps protect the environment.</p>	<ul style="list-style-type: none"> <li>- Laboratories are NATA/ISO 17025 accredited:                             <ul style="list-style-type: none"> <li>o Veterinary laboratories provide specialist research and diagnosis in the fields of animal pathology, virology, genetics, microbiology, immunology, and parasitology</li> <li>o Plant health laboratories provide pest and disease diagnosis and research for the early detection, reduction, on-going management or eradication of harmful plant pests and diseases</li> </ul> </li> <li>- Greenhouses</li> <li>- Biocontainment facilities</li> </ul>	<p>Animal biosecurity (diagnosis and surveillance of viral diseases of animals and aquatic species), microbiology and parasitology (diagnosis and control of bacterial diseases and parasites of terrestrial and aquatic species), biotechnology (genetics and genomics of inherited and infectious diseases impacting agriculture)</p>

Research Infrastructure	Location	Industry	Description	Facilities, major equipment, and services	Research capability
<b>Glen Innes Agricultural Research and Advisory Station</b>	Glen Innes	Livestock and pastures	The research and development base for the Northern Tablelands of NSW. Activities and research target the improvement of pastures and livestock.	<ul style="list-style-type: none"> <li>- 1600ha of land</li> <li>- Glasshouses</li> <li>- Shearing school</li> <li>- 450ha of land</li> <li>- Cattle Yards</li> <li>- Shearing Shed</li> <li>- Sheep Shed</li> <li>- Rotation</li> </ul>	Cattle research, sheep research, pasture research
<b>Grafton Primary Industries Institute</b>	Trenayr	Agriculture, biosecurity, fisheries and forestry	The Institute has been involved in the evaluation of many enterprises to assist primary producers to respond to changing needs. Many types of crops have been evaluated on the property. Livestock enterprises have included beef and dairy cattle, pigs, poultry and aquaculture. Research and advisory work are directed at the control and eradication of various terrestrial and aquatic weeds. The Institute also houses the Grafton Fisheries Centre that has pioneered aquaculture of freshwater species and	<ul style="list-style-type: none"> <li>- Laboratories</li> <li>- Glasshouses including a weed biocontrol facility</li> <li>- Crop research facilities</li> <li>- Animal and fish research facilities</li> <li>- 830ha of land</li> <li>- Water storage and irrigation infrastructure</li> <li>- Cattle yards</li> <li>- Seed cleaning and storage equipment</li> <li>- Tree nursery</li> </ul>	Northern cropping systems, fisheries, weeds, invasive plants and animals, beef, agriculture land use planning, biosecurity and food safety compliance, forestry

Research Infrastructure	Location	Industry	Description	Facilities, major equipment, and services	Research capability
			now retains populations of several threatened wild species for breeding and restocking purposes. The Forestry Corporation of NSW also operates from the site and conducts a wide range of programs supporting the timber industry.		
<b>Jindabyne Gaden Trout Hatchery</b>	Jindabyne	Fish	Run by NSW DPI Fisheries, the Hatchery produces quality salmonid fry, fingerlings and adult fish to stock NSW waterways for recreational fishing. Over 1 million fish are grown in this facility annually.	<ul style="list-style-type: none"> <li>- 4ha of land</li> <li>- Five earthen ponds</li> <li>- Hatching room</li> <li>- 25 grow out tanks</li> </ul>	Trout Tagging program, Trout stocking
<b>Narrandera Fisheries Centre</b>	Narrandera	Fish	A world-class fisheries research and aquaculture facility that support native fish breeding, conservation, environmental surveys, NSW rivers management and community education. It can produce millions of	<ul style="list-style-type: none"> <li>- 40ha of land</li> <li>- 47 ponds with surface area of 7.5ha</li> <li>- Specialist laboratories, including updated, modern wet and dry laboratories</li> <li>- Innovative fish-sampling equipment</li> </ul>	Fish management (focused on 3 priority areas: restoration and recovery, ecology and environment, recreation & culture), health of native fish species, drought recovery, future drought risk to aquatic biota, genetic research, effectiveness of stocking, threatened species, pest species management, fish age and growth

Research Infrastructure	Location	Industry	Description	Facilities, major equipment, and services	Research capability
			fingerlings per year, including Murray cod, trout cod, golden perch and silver perch, which are stocked into NSW waterways to maintain and enhance populations of key native freshwater fish for recreational and conservation outcomes.	<ul style="list-style-type: none"> <li>- Modern aquaculture facilities</li> <li>- Microscopy rooms</li> <li>- A molecular laboratory with genetics and environmental DNA facilities</li> <li>- A temperature-controlled aquaria tank room</li> <li>- Hatchery</li> <li>- Sample-processing facilities</li> </ul>	from ear bones, fish movements in rivers, improving fish passage
<b>Orange Agricultural Institute</b>	Orange	Agriculture and biosecurity	The institute works across a range of agricultural and biosecurity fields, developing practical solutions, and providing vital services to support livestock, crops and the environment. Also home to co-located entities such as NSW Department of Primary Industries, Central Tablelands Local Land Services, & Soil Conservation Services, Lands and Water, Water	<ul style="list-style-type: none"> <li>- 183ha of land which supports 5 hectares of irrigated orchards with over 5000 fruit and nut trees, grapevines</li> <li>- A long-term grazing trial with over 700 sheep</li> <li>- Research laboratories</li> <li>- Training centre that is available for hire</li> <li>- Storage dam for irrigation and livestock with 174 megalitre capacity</li> </ul>	Biosecurity collections, Vertebrate Pest Research Unit, Weed Research Unit, horticulture, viticulture, climate, pastures, livestock, soils and water, Global Ag-Tech Ecosystem (GATE is an initiative of the NSW government to increase connections between public research and private sector innovation in creating new products and services)

Research Infrastructure	Location	Industry	Description	Facilities, major equipment, and services	Research capability
			NSW and the Global Agri-Tech Ecosystem.	<ul style="list-style-type: none"> <li>- Controlled environment growth chambers</li> <li>- Greenhouses</li> </ul>	
<b>Port Stephens Fisheries Institute</b>	Taylors Beach	Fish	The Institute is one of the largest specialised aquaculture research facilities in the country, driving excellence for NSW.	<ul style="list-style-type: none"> <li>- Laboratories</li> <li>- Outdoor ponds</li> <li>- Broodstock tanks</li> <li>- Marine fish nursery facilities &amp; grow-out tanks</li> <li>- Nutrition barn</li> <li>- Aquatic research aquarium &amp; laboratory</li> <li>- Aquatic ecosystem shed &amp; laboratory</li> <li>- Barotrauma Laboratory</li> <li>- Library Services</li> <li>- Oyster leases</li> <li>- Hatcheries</li> </ul>	Aquaculture (oysters, marine fish, nutrition, diet development), freshwater ecosystem, marine ecosystem, aquatic biosecurity, aquatic environment protection and management
<b>Tamworth Agricultural Institute</b>	Calala	Pathology, cereal (durum) and pulses (chickpea, faba bean, field pea and lupin), soil chemistry	The Department's principal research institute for the cropping zone of northern inland NSW, it is dedicated to helping ensure agricultural industries and rural communities remain economically viable and sustainable	<ul style="list-style-type: none"> <li>- ISO9001 certified laboratories</li> <li>- 332ha of land</li> </ul>	Durum Breeding Australia (DBA), grain pathology, cereal chemistry, pasture agronomy, weeds management, Pulse Breeding Australia (PBA) Chickpea Breeding Program, Tamworth Winter Cereal Quarantine Facility, invasive species, Weed Biological Control (WBCU), soil research, water management research

Research Infrastructure	Location	Industry	Description	Facilities, major equipment, and services	Research capability
<b>Tocal Agricultural Institute</b>	Paterson	Livestock, insects	The institute's farm staff operate a commercial beef herd, stock horse breeding, dairy and free-range egg production as well as a demonstration sheep flock and bee hives used in training.	<ul style="list-style-type: none"> <li>- 2200ha of land</li> <li>- Tocal College (Paterson campus, Yanco campus, Tocal farms and the Tocal Homestead heritage precinct)</li> </ul>	Cattle, bee (National Honey Bee Genetic Improvement Program)
<b>Trangie Agricultural Research Centre</b>	Trangie	Livestock, technology development	Provides services to agricultural and pastoral industries, especially those in western NSW. Conducts agricultural research, including horticulture and agronomy. The Centre has ISO 14001 accreditation for environmental management.	<ul style="list-style-type: none"> <li>- 3900ha of land, consisting of 2790ha of native pasture, 500ha for dry land cropping in rotation with lucerne pastures, 320ha developed for flood irrigation, 290ha of roads, buildings etc.</li> <li>- Livestock carrying capacity of 12,000 dry sheep equivalents</li> <li>- Availability of high security irrigation water</li> <li>- Paddocks, yards and associated infrastructure, including 72 x 4ha paddocks that are used for joining and lambing of ewes in</li> </ul>	Rangeland management/ecology, merino and beef cattle genetics, development of conservation farming technology, soil research

Research Infrastructure	Location	Industry	Description	Facilities, major equipment, and services	Research capability
				<ul style="list-style-type: none"> <li>single sire mating groups</li> <li>- Extensive infrastructure such as offices, workshops, and library and seminar facilities</li> </ul>	
<b>Wagga Wagga Agricultural Institute</b>	Wagga Wagga	Agriculture	Aims to improve the profitability and competitiveness of mixed farming systems in southern NSW in ways that protect the natural resource base and assist growers adapt to climate change and variability.	<ul style="list-style-type: none"> <li>- Laboratories</li> <li>- Greenhouses</li> <li>- Irrigators</li> <li>- Rain out shelters</li> <li>- Growth chambers</li> <li>- 893ha of land</li> <li>- Training centre</li> <li>- Conference facilities</li> </ul>	Farming practices and agronomy, crop germplasm development and variety evaluation, crop protection, pastures, beef production animal nutrition, weed science, entomology, vine management, natural resource management, land use planning, Feedlab testing services, cereal science, oil science
<b>Wollongbar Primary Industries Institute</b>	Wollongbar	Soils, horticulture, food safety and animal health	The Institute supports the local community and sustainable and profitable agriculture, horticulture, forestry and fisheries. It comprises of 4 main sites: Wollongbar, Alstonville, Pearces Creek and Duck Creek.	<ul style="list-style-type: none"> <li>- Laboratories (testing facility is ISO 17025 (NATA) accredited, ASPAC and WaterCheck certified)</li> <li>- Library services</li> <li>- Conference room</li> <li>- Over 500ha of land</li> </ul>	Horticulture and agriculture (macadamia, blueberries and banana), soil and water research, biosecurity and food safety research, forestry, fisheries, agriculture
<b>Yanco Agricultural Institute</b>	Yanco	Agriculture	Provides targeted research, development and education to support the sustainability and	<ul style="list-style-type: none"> <li>- Over 813ha of dryland farming country and mixed irrigation</li> <li>- Laboratories</li> </ul>	Citrus and entomology trials, rice breeding and agronomy, cotton trials and crop rotation experiments, hazelnuts, drought tolerance in wheat, irrigated

Research Infrastructure	Location	Industry	Description	Facilities, major equipment, and services	Research capability
			profitability of crop production, including rice, cotton, citrus, cereals, canola, soybean and pulses, in southern New South Wales.	<ul style="list-style-type: none"> <li>- Greenhouses</li> <li>- Field sites with irrigation (channel delivery and lateral move)</li> <li>- Rainout shelters</li> <li>- 242ha at Leeton Field Station</li> <li>- Phytosanitary inspections</li> <li>- Plant pest and disease identification</li> </ul>	cereals, oilseeds, pulses and horticultural crops, canola, soybeans

#### 4.4.2. Geological Survey NSW

Research Infrastructure	Location	Industry	Description	Facilities, major equipment, and services	Research capability
<b>National Virtual Core Library (NSW Node)</b>	W B Clarke Geoscience Centre, Londonderry.	Mining	The National Virtual Core Library (NVCL) is a collaborative infrastructure project with AuScope, an institution that promotes the use of innovative infrastructure to produce and deliver geoscientific data. The purpose of the NVCL is to improve our understanding of the geology of the uppermost 2 km of the continent's crust.	The NVCL project uses the CSIRO-developed HyLogger™ drillcore scanning system for imaging and acquiring spectral information about rock, ore and alteration minerals in drillcore, chips and pulps. The images and data are archived within the NVCL so that mineral explorers and researchers can view and download them via the internet. The node has its own portable X-ray diffraction and X-ray fluorescence instruments for supporting	Drillcore research and documentary

Research Infrastructure	Location	Industry	Description	Facilities, major equipment, and services	Research capability
				NVCL projects and validating HyLogging data.	
<b>MinEx CRC</b>	University of Newcastle (NSW Node)	Mining	The MinEx Cooperative Research Centre (MinEx CRC) is the world's largest mineral exploration collaboration, bringing together industry, government, research organisations and universities to further our understanding of geology, mineral deposits and groundwater resources in areas where rocks aren't exposed at Earth's surface.		geological mapping, airborne electromagnetic and other geophysical surveys, hydrogeochemistry, biogeochemistry, and drilling.

#### 4.5. Stronger Communities Cluster

Research Infrastructure	Location	Industry	Description	Research capability
<b>Family and Community Services Insights Analysis and Research (FACSIAR)</b>	Ashfield	Human Services	FACSIAR is a government agency that works on various projects, data linkage activities and research and evaluation activities. They have partnered with other government agencies, universities, national reporting bodies, industry peak bodies, not for profit	Child protection, domestic and family violence, out-of-home care, social housing, homelessness, disability, ageing

Research Infrastructure	Location	Industry	Description	Research capability
			organisations, service providers and research organisations.	
<b>NSW Bureau of Crime Statistics and Research (BOCSAR)</b>	Sydney	Criminal justice	A statistical and research agency on crime and criminal justice in NSW, BOCSAR develops and maintains statistical databases, monitors trends, provides information and advice and conducts research.	Crime and criminal justice issues and problems
<b>Corrections Research Evaluation and Statistics (CRES)</b>	Sydney	Corrective services	As the research and statistics branch of Corrective Services NSW, CRES is responsible for undertaking research, reporting, analysis and evaluation of correctional programs and interventions.	Research around people who are in prison or are supervised in the community
<b>Youth Justice NSW Research and Information Unit</b>	Sydney	Youth Justice	The unit coordinates internal and external research activities and projects in its community and custodial centres. It is involved with research and evaluation into juvenile offending, translating research findings into policy and practice and the presentation of these findings.	Evidence-based interventions for young people involved in the criminal justice system
<b>Office of the Senior Practitioner Practice Research</b>	Sydney	Child protection and out-of-home care	The Office of the Senior Practitioner's practice research team is focused on using evidence from research to improve child protection and out-of-home care practice. They conduct research and evaluation and synthesise a wide range of qualitative/quantitative published/unpublished research. Their 'Research to Practice' events connect practitioners with researchers, policy makers and practice experts within Australia and from around the world.	The lived experience of children, young people and families

Research Infrastructure	Location	Industry	Description	Research capability
<b>Women NSW, Ageing and Carers Research, Performance and Evaluation Unit</b>	Sydney	Social policy	The Research, Performance and Evaluation Unit within Women NSW, Ageing and Carers leads the development and implementation of ongoing social policy research. This includes research reports on gender equity priorities as well as on domestic and family violence priorities.	Gender equity, domestic violence and other social research

## 4.6. Other clusters

Cluster	Research Infrastructure	Location	Industry	Description
<b>Customer Services</b>	Customer Experience Unit	Sydney	Customer service	The Customer Experience Unit works with NSW Government departments and agencies to ensure the customer is at the centre of policy, service delivery, funding and evaluation. Case studies such as 'Real-time apps making trip planning a breeze' and 'Getting kids from the couch to campsite' showcase key initiatives that have been delivered by the NSW government.
<b>Transport for NSW</b>	Smart Innovation Centre	Sydney	Transport (Autonomous Vehicle)	The Smart Innovation Centre is NSW's hub for collaborative research and development of safe and efficient emerging transport technology. The Centre is partnering with industry to conduct trials of transport technologies such as automated vehicle.
<b>Education</b>	Centre for Education Statistics and Evaluation (CESE)	Sydney	Education	The CESE develops rigorous evidence and actionable advice for the NSW Department of Education, to improve learning outcomes across the education sector. They conduct research and publish evidence to share 'what works', produce practical resources for educators to engage with data and evidence, evaluate education programs and strategies and collect, analyse and report on essential education data and information.

## Reference

OCSE (2020). Funding – R&D, NCRIS. <https://www.chiefscientist.nsw.gov.au/funding/research-and-development/national-collaborative-research-infrastructure-strategy>

OCSE (2020). Funding – R&D, ARC ITPR. <https://www.chiefscientist.nsw.gov.au/funding/research-and-development/arc-industrial-transformation-research-program>

OCSE (2020). Funding – R&D, ARC CoE. <https://www.chiefscientist.nsw.gov.au/funding/research-and-development/arc-centres-of-excellence>

OCSE (2020). Funding – R&D, ARC CRC. <https://www.chiefscientist.nsw.gov.au/funding/research-and-development/cooperative-research-centres>

ANSTO. Research Facilities. <https://www.ansto.gov.au/our-facilities>

CSIRO. Research and Infrastructure. <https://www.csiro.au/en/research>

OCSE. Internal document of co-investments on NCRIS, ARC CoE, CRC and ITRP.

OCSE. Internal document of NSW Research Map Database.

NSW DPI. Research and Development. <https://www.dpi.nsw.gov.au/about-us/research-development>

Geological Survey NSW. <https://resourcesandgeoscience.nsw.gov.au/miners-and-explorers/geoscience-information/services/drill-core-libraries/national-virtual-core-library>

NSW Government. Art Galley Research. <http://www.artgallery.nsw.gov.au/research>

Australian Museum. Australia Museum Research Institute. <https://australian.museum/get-involved/amri/>

NSW Government. Powerhouse Parramatta. <https://maas.museum/new-powerhouse/>

Taronga Zoo. Taronga Wildlife Hospitals. <https://taronga.org.au/conservation-and-science/taronga-wildlife-hospitals>

Taronga Zoo. Taronga Institute of Science & Learning. <https://taronga.org.au/education/taronga-institute-of-science-and-learning#laboratories>

The Royal Botanic Garden. Plant Bank. [http://www.rbgsyd.nsw.gov.au/annan/Australian\\_plantbank](http://www.rbgsyd.nsw.gov.au/annan/Australian_plantbank)

Australian Botanic Garden. Major projects. <https://www.australianbotanicgarden.com.au/About-us/Major-Projects/Building-a-new-Herbarium-1>

Blue Mountain Botanic Garden. Science and Research. <https://www.bluemountainsbotanicgarden.com.au/Science/Our-work-discoveries>

NSW Government. Environment, Energy and Science, Our Science and Research. <https://www.environment.nsw.gov.au/research-and-publications/our-science-and-research>

NSW Primary Industry. Research and Development. <https://www.dpi.nsw.gov.au/about-us/research-development>

NSW Health. Local health districts. <https://www.health.nsw.gov.au/lhd/Pages/default.aspx>

Geological Survey NSW. Services. <https://resourcesandgeoscience.nsw.gov.au/miners-and-explorers/geoscience-information/services>

NSW Government. Clusters. <https://www.nsw.gov.au/departments-and-agencies>

## NSW Startups Communities and Supporting Services Mapping

This mapping exercise was conducted for NSW Accelerating Research and Development in NSW Advisory Council (ARDAC)'s Action Plan Priority Action 5 of establishing an R&D platform. This stocktake provides information about supporting services provided to NSW startups by government and private sectors as well as those scaling up services hosted by NSW universities.

### Role, Definition and Terminology

This mapping adopts the definition and terminology of startups communities as below:

- Startups. Based on company values, startups typically are referred as Unicorn (\$1 billion), Decacorn (\$10 billion) and hectocorn (\$100 billion).
- SME. SMEs are defined as small and medium enterprises from NSW, other states and territories of Australia and New Zealand, with up to 200 full-time equivalent employees.
- Startups vs SME. The main differences are in their rate of growth, finance and end goal
  - o Startups aims to scale up the business quickly, rely on external funding to accelerate their growth and they expect to disrupt the market with new technologies, services and business models at global scale.
  - o SMEs have relatively slow growth, self-funded and provide traditional products or services targeting customers within their geographic locations.
- Accelerator. A hub that admins a small group of startups (batches) and helping startups building their businesses and develop products within a set period of time. Accelerator offers mentorship, networking, seed funding, some office space (limited and not anchored) and other resources in preparing startups for the demo day.
- Incubator. Similar support to accelerator but often offer dedicated office space, some research equipment and even wet lab for deep tech startups. Most startup incubators and accelerators operate in-house venture funds and make modest equity investments similar to a standard angel investment (e.g. \$20,000-\$150,000).
- Angel investor. High net worth individuals who invest in startups as individuals or groups. Angel investors are accredited investors that have liquid assets over \$1 million or income over \$200,000 p.a.
- Angel syndicate. A group of angel investors that make investment on startups as a group. Angle syndicate typically focus on a concentrated geographic region and industry sector. They derisk their investment and have larger bargaining power compare to individual angel investors.
- Venture capital (VC). Fund management organisations that raise money from various sources and invest the collective capitals into startups.

Startup Supporting Services by Private Sector<sup>1</sup>

## Idea Stage

Startup Media	Events and Networking	Education and Best Practice	Training	Team Formation	First Product
<ul style="list-style-type: none"> <li>- <a href="#">Anthill Magazine</a></li> <li>- <a href="#">AFR Entrepreneur (previously BRW)</a></li> <li>- <a href="#">Internet Dealbook</a></li> <li>- <a href="#">iPitch</a></li> <li>- <a href="#">Startup88</a></li> <li>- <a href="#">Startup Daily</a></li> <li>- <a href="#">Startup Digest Sydney</a></li> <li>- <a href="#">StartupSmart</a></li> <li>- <a href="#">StartupAUS</a></li> <li>- <a href="#">Technology Spectator</a></li> <li>- <a href="#">Tech.Co Sydney</a></li> <li>- <a href="#">TWISTa</a></li> <li>- <a href="#">InnovationAus</a></li> </ul>	<ul style="list-style-type: none"> <li>- <a href="#">Entrepreneurs in Sydney</a></li> <li>- <a href="#">Fishburners Meetup</a></li> <li>- <a href="#">Geek Girl</a></li> <li>- <a href="#">Innovation Ba</a></li> <li>- <a href="#">Launch Festival Sydney</a></li> <li>- <a href="#">Manly Entrepreneurs</a></li> <li>- <a href="#">North Shore Startups</a></li> <li>- <a href="#">Port80 Sydney</a></li> <li>- <a href="#">Product Hunt Sydney</a></li> <li>- <a href="#">Silicon Beach</a></li> <li>- <a href="#">Startup Grind Sydney</a></li> <li>- <a href="#">Startup Weekend Sydney</a></li> <li>- <a href="#">Sydney FinTech Startups Meetup</a></li> <li>- <a href="#">Startup Founder 101 Sydney</a></li> <li>- <a href="#">Sydney Startup Community</a></li> <li>- <a href="#">Sydney Startups</a></li> <li>- <a href="#">Sydney Startups Friday Drinks</a></li> <li>- <a href="#">Sydney Tech Startup Meetup</a></li> <li>- <a href="#">Sydney Women Entrepreneurs Meetup: Rare Birds</a></li> <li>- <a href="#">SydStart</a></li> <li>- <a href="#">Tech23</a></li> </ul>	<ul style="list-style-type: none"> <li>- <a href="#">Disruptive Startups Sydney</a></li> <li>- <a href="#">Money Making Entrepreneurs</a></li> <li>- <a href="#">Startup Founder 101 Sydney</a></li> <li>- <a href="#">StartupSchool Sydney</a></li> <li>- <a href="#">Sydney Online Business Owners</a></li> <li>- <a href="#">The Digital Marketing Connection</a></li> <li>- <a href="#">The Startup Institute</a></li> <li>- <a href="#">Women's Business Lab</a></li> </ul>	<ul style="list-style-type: none"> <li>- <a href="#">99 to Launch</a></li> <li>- <a href="#">Coder Factory</a></li> <li>- <a href="#">Elevacao</a></li> <li>- <a href="#">FireBootCamp</a></li> <li>- <a href="#">Founder Institute</a></li> <li>- <a href="#">General Assembly</a></li> <li>- <a href="#">HealthTech Sydney</a></li> <li>- <a href="#">Innovation Bootcamp</a></li> <li>- <a href="#">Lean Startup Sydney Meetup</a></li> <li>- <a href="#">Pivotal Product Office Hour</a></li> <li>- <a href="#">ProductTank Sydney</a></li> <li>- <a href="#">Sydney Dev Camp</a></li> <li>- <a href="#">Sydney School of Entrepreneurship</a></li> <li>- <a href="#">Start Your Food Business</a></li> </ul>	<ul style="list-style-type: none"> <li>- <a href="#">CoFoundersLab</a></li> <li>- <a href="#">Founder2be</a></li> <li>- <a href="#">FounderDating</a></li> <li>- <a href="#">IDEASVOICE</a></li> <li>- <a href="#">KickStart Small Business Network</a></li> <li>- <a href="#">The Seniorpreneurs Network</a></li> <li>- <a href="#">Upstarters Network</a></li> </ul>	<ul style="list-style-type: none"> <li>- <a href="#">AWSHine Hack</a></li> <li>- <a href="#">AngelHack Sydney</a></li> <li>- <a href="#">Create-a-thon</a></li> <li>- <a href="#">EcoHack</a></li> <li>- <a href="#">FashHack</a></li> <li>- <a href="#">GovHack</a></li> <li>- <a href="#">Hackagong</a></li> <li>- <a href="#">HackerNest Sydney Tech Socials</a></li> <li>- <a href="#">HealthHack</a></li> <li>- <a href="#">MasterCard Masters of Code Competition</a></li> <li>- <a href="#">Qantas Hackathon</a></li> <li>- <a href="#">Random Hacks of Kindness</a></li> <li>- <a href="#">Startup Social</a></li> <li>- <a href="#">Sw/tch Festival</a></li> <li>- <a href="#">UTS Project Pitch</a></li> <li>- <a href="#">Unearthed Sydney</a></li> <li>- <a href="#">Start Your Food Business</a></li> </ul>

<sup>1</sup> Based on Sydney Startup Ecosystem Canvas (live document) by the Founder Institute Sydney and public available information

Startup Media	Events and Networking	Education and Best Practice	Training	Team Formation	First Product
	<ul style="list-style-type: none"> <li>- <a href="#">The Pulse Sydney</a></li> <li>- <a href="#">The Sunrise</a></li> <li>- <a href="#">TiE Sydney</a></li> <li>- <a href="#">Vivid Ideas</a></li> <li>- <a href="#">Women Entrepreneurs Meetup</a></li> <li>- <a href="#">Young Entrepreneurs Sydney</a></li> <li>- <a href="#">Spark Festival</a></li> <li>- <a href="#">NorthSydney Innovation Meet UP</a></li> <li>- <a href="#">Startcon</a></li> </ul>				

## Launch Stage

Legal and Financial Services	Workplace	Accounting, HR and Early Scaling up Advice	Pre-seed Incubators and Mentorship	Seed Accelerators	Pitch and Demo
<ul style="list-style-type: none"> <li>- <a href="#">Adroit Lawyers</a></li> <li>- <a href="#">Arnotts Technology Lawyers</a></li> <li>- <a href="#">Caputo Lawyers</a></li> <li>- <a href="#">Easy Companies</a></li> <li>- <a href="#">General Standards Startup Lawyers</a></li> <li>- <a href="#">Goodsell Lawyers</a></li> <li>- <a href="#">Green &amp; Associates</a></li> <li>- <a href="#">KMI Legal</a></li> <li>- <a href="#">KWS Legal</a></li> <li>- <a href="#">Kalde &amp; Associates</a></li> <li>- <a href="#">LawPath</a></li> <li>- <a href="#">LegalVision</a></li> <li>- <a href="#">Marque Lawyers</a></li> <li>- <a href="#">Navado Legal &amp; Financial Group</a></li> </ul>	<ul style="list-style-type: none"> <li>- <a href="#">Aura Creative</a></li> <li>- <a href="#">CoSydney</a></li> <li>- <a href="#">Common Room Sydney</a></li> <li>- <a href="#">Commune</a></li> <li>- <a href="#">Desk X Space</a></li> <li>- <a href="#">EngineRoom</a></li> <li>- <a href="#">Fishburners</a></li> <li>- <a href="#">Haymarket HQ</a></li> <li>- <a href="#">Hub Sydney</a></li> <li>- <a href="#">Stone and Chalk</a></li> <li>- <a href="#">Tank Stream Labs</a></li> <li>- <a href="#">The Ventura</a></li> <li>- <a href="#">The Workbench</a></li> <li>- <a href="#">Tyro FinTechHub</a></li> <li>- <a href="#">WOTSO WorkSpace</a></li> <li>- <a href="#">WeCo Sydney</a></li> <li>- <a href="#">Work Club</a></li> </ul>	<ul style="list-style-type: none"> <li>- <a href="#">4mation Technologies</a></li> <li>- <a href="#">Akascia</a></li> <li>- <a href="#">Ambion</a></li> <li>- <a href="#">Australian Accounting Advisory</a></li> <li>- <a href="#">Appster</a></li> <li>- <a href="#">Binary Studio</a></li> <li>- <a href="#">City Tax Accountants</a></li> <li>- <a href="#">Code Studio</a></li> <li>- <a href="#">Createur</a></li> <li>- <a href="#">Creatio</a></li> <li>- <a href="#">Crowe Horwarth</a></li> <li>- <a href="#">Cruz &amp; Co.</a></li> <li>- <a href="#">EB Pearls</a></li> <li>- <a href="#">Empirical Works</a></li> <li>- <a href="#">Fletcher Tax</a></li> </ul>	<ul style="list-style-type: none"> <li>- <a href="#">25Fifteen</a></li> <li>- <a href="#">ATP Innovations</a></li> <li>- <a href="#">Black Citrus</a></li> <li>- <a href="#">Bluechilli</a></li> <li>- <a href="#">Capital Pitch</a></li> <li>- <a href="#">Incubate</a></li> <li>- <a href="#">The Entourage</a></li> <li>- <a href="#">The Grid</a></li> </ul>	<ul style="list-style-type: none"> <li>- <a href="#">Antler</a></li> <li>- <a href="#">delta-V Space Accelerator</a></li> <li>- <a href="#">H2 Fintech Accelerator</a></li> <li>- <a href="#">iAccelerate Wollongong</a></li> <li>- <a href="#">Ignition Labs</a></li> <li>- <a href="#">muru-D</a></li> <li>- <a href="#">Remarkable</a></li> <li>- <a href="#">Slingshot Accelerator</a></li> <li>- <a href="#">Startmate</a></li> <li>- <a href="#">VentureTech Enterprise Accelerator</a></li> <li>- <a href="#">UQ SPIN Lab</a></li> </ul>	<ul style="list-style-type: none"> <li>- <a href="#">CeBIT Startup</a></li> <li>- <a href="#">Echelon</a></li> <li>- <a href="#">Product Hunt Product Demos and Mixer</a></li> <li>- <a href="#">Seedstars Sydney</a></li> <li>- <a href="#">Springboard Enterprises Australia Accelerator Program</a></li> <li>- <a href="#">Startup Bootcamp Sydney Pitch Day</a></li> <li>- <a href="#">Startcon</a></li> </ul>

Legal and Financial Services	Workplace	Accounting, HR and Early Scaling up Advice	Pre-seed Incubators and Mentorship	Seed Accelerators	Pitch and Demo
<ul style="list-style-type: none"> <li>- <a href="#">Newhouse &amp; Arnold</a></li> <li>- <a href="#">Rouse Lawyers</a></li> <li>- <a href="#">sprintlaw</a></li> <li>- <a href="#">UX Law</a></li> <li>- <a href="#">Voet &amp; Associates Lawyers</a></li> <li>- <a href="#">Swaab Attorneys</a></li> </ul>	<ul style="list-style-type: none"> <li>- <a href="#">Your Desk</a></li> </ul>	<ul style="list-style-type: none"> <li>- <a href="#">Accountants</a></li> <li>- <a href="#">gube Recruit</a></li> <li>- <a href="#">Green Accounting</a></li> <li>- <a href="#">Hall Chadwick</a></li> <li>- <a href="#">Interactive Accounting</a></li> <li>- <a href="#">Mitchell Lake Recruitment</a></li> <li>- <a href="#">Nudge Accounting</a></li> <li>- <a href="#">Recruit Shop</a></li> <li>- <a href="#">RecruitLoop</a></li> <li>- <a href="#">Sentia</a></li> <li>- <a href="#">Standard Ledger</a></li> <li>- <a href="#">Step Change Marketing</a></li> <li>- <a href="#">Tax Effective</a></li> <li>- <a href="#">Taximise</a></li> <li>- <a href="#">William Digital Agency</a></li> <li>- <a href="#">Xenero</a></li> <li>- <a href="#">YML Group</a></li> <li>- <a href="#">PwC Immigration</a></li> </ul>			

## Growth Stage

Investor Networks	Angel Investors and Micro-VCs	Venture Capitals	Office, HR and Business Insurance	Growth Accelerators and Consultants
<ul style="list-style-type: none"> <li>- <a href="#">Australian Investment Network</a></li> <li>- <a href="#">Next Investment Wave Sydney</a></li> <li>- <a href="#">Scale Investors</a></li> <li>- <a href="#">Sydney Investor Forum</a></li> <li>- <a href="#">Sydney Investor Meetup</a></li> <li>- <a href="#">Sydney Investors Opportunities &amp; Social Group</a></li> </ul>	<ul style="list-style-type: none"> <li>- <a href="#">Aaron Bertinetti</a></li> <li>- <a href="#">Adrian Bunter</a></li> <li>- <a href="#">Adrian Vanzyl</a></li> <li>- <a href="#">Alex de Aboitiz</a></li> <li>- <a href="#">Andrey Shirben</a></li> <li>- <a href="#">Ari Klinger</a></li> <li>- <a href="#">Benjamin Chong</a></li> <li>- <a href="#">Bill Bartee</a></li> <li>- <a href="#">Brett Mason</a></li> </ul>	<ul style="list-style-type: none"> <li>- <a href="#">Alchemy Equities</a></li> <li>- <a href="#">Arowana Capital</a></li> <li>- <a href="#">Artesian</a></li> <li>- <a href="#">AirTree Ventures</a></li> <li>- <a href="#">Blackbird Ventures</a></li> <li>- <a href="#">Brandon Capital Partners</a></li> <li>- <a href="#">Innovation Capital</a></li> <li>- <a href="#">M.H. Carnegie &amp; Co.</a></li> <li>- <a href="#">OneVentures</a></li> </ul>	<ul style="list-style-type: none"> <li>- <a href="#">BAC Insurance Brokers</a></li> <li>- <a href="#">Commercial Property Guide</a></li> <li>- <a href="#">Commercial View</a></li> <li>- <a href="#">EBM Insurance</a></li> <li>- <a href="#">Instant Offices</a></li> <li>- <a href="#">Morgan Consulting</a></li> <li>- <a href="#">Ray White</a></li> <li>- <a href="#">Real Commercial</a></li> <li>- <a href="#">Regus</a></li> </ul>	<ul style="list-style-type: none"> <li>- <a href="#">Bain &amp; Company</a></li> <li>- <a href="#">Boston Consulting Group</a></li> <li>- <a href="#">Halkin Group</a></li> <li>- <a href="#">KPMG Upstarts</a></li> <li>- <a href="#">L.E.K. Consulting</a></li> <li>- <a href="#">MGI Sydney</a></li> <li>- <a href="#">Marketing Eye</a></li> <li>- <a href="#">McKinsey &amp; Company</a></li> <li>- <a href="#">Nexia</a></li> </ul>

- <a href="#">Sydney Startup Investing</a>	- <a href="#">Casper Urhammer</a>	- <a href="#">Raven Capital</a>	- <a href="#">Steadfast</a>	- <a href="#">Nous Group</a>
- <a href="#">Sydney Value Investors</a>	- <a href="#">Chris Plough</a>	- <a href="#">Right Click Capital</a>	- <a href="#">Sydney Insurance Brokers</a>	- <a href="#">PwC</a>
- <a href="#">Sydney Angels</a>	- <a href="#">Chris Sang</a>	- <a href="#">Square Peg Capital</a>	- <a href="#">TGC</a>	- <a href="#">Polyglot Group</a>
	- <a href="#">David Kowalski</a>	- <a href="#">Tank Stream Ventures</a>	- <a href="#">Tandem Partners</a>	- <a href="#">PwC Immigration</a>
	- <a href="#">Dean McEvoy</a>	- <a href="#">VentureCrowd</a>	- <a href="#">Whitbread Insurance Brokers</a>	
	- <a href="#">Eddie Geller</a>			
	- <a href="#">Garry Visontay</a>			
	- <a href="#">Jeremy Colless</a>			
	- <a href="#">Justin Sullivan</a>			
	- <a href="#">Mark Greig</a>			
	- <a href="#">Martin Dalgleish</a>			
	- <a href="#">Matthew Browne</a>			
	- <a href="#">Nathan Creswell</a>			
	- <a href="#">Neill Miller</a>			
	- <a href="#">Pete Cooper</a>			
	- <a href="#">Rayn Ong</a>			
	- <a href="#">Romain Bonjean</a>			
	- <a href="#">Tony Faure</a>			
	- <a href="#">Tony Surtees</a>			
	- <a href="#">Trevor Folsom</a>			

## Startup Supporting Services by NSW Government

### Funding Program and Grants<sup>2</sup>

Program	Description	Funding available and requirement
<b>Minimum Viable Product grants</b>	Minimum Viable Product (MVP) grants are designed for pre-revenue technology startups to help them engage with a potential business customer, or channel to market, to achieve market validation and first sale.	<ul style="list-style-type: none"> <li>- Maximum up to \$25,000</li> <li>- Matched funding grant up to 50% of approved project costs,</li> <li>- Successful grant applicants will receive 35% of the funding up-front and 65% after completion and validation of the MVP.</li> </ul>
<b>Building Partnership grants</b>	Building Partnerships grants help revenue-generating startups and small to medium	<ul style="list-style-type: none"> <li>- Maximum up to \$100,000</li> <li>- Funding to cover project costs of further developing a product/solution, progressing early</li> </ul>

<sup>2</sup> NSW Government. [Support for Startups](#).

Program	Description	Funding available and requirement
	enterprises (SMEs) scale or grow by acquiring a key customer or channel to market.	stage commercialisation and acquiring and retaining talent
<b>Boosting Business Innovation Program</b>	\$18 million program gives small businesses access to research organisations to build strong local business communities and stimulate economic growth in metropolitan and regional NSW.	
<b>TechVouchers</b>	TechVouchers encourages research collaboration between NSW small-to-medium enterprises (SMEs) and Boosting Business Innovation Program (BBIP) delivery partners.	<ul style="list-style-type: none"> <li>- Maximum up to \$15,000</li> <li>- Matched fund and valid for use with any delivery partner</li> </ul>
<b>Regional Startups</b>	Regional recipients of the Minimum Viable Product grant have access to stipend to help with travel costs for innovation-related purpose.	<ul style="list-style-type: none"> <li>- Maximum up to \$2,000</li> <li>- Recipients of MVP grants and regional locations</li> </ul>
<b>Western Sydney Investment Attraction Fund</b>	The Western Sydney Investment Attraction Fund aims to support businesses to grow in Western Sydney City Deal, including areas of Blue Mountains, Camden, Campbelltown, Fairfield, Hawkesbury, Liverpool, Penrith and Wollondilly.	
<b>Local Innovation Network</b>	The Local Innovation Network (LIN) is a \$2.1 million commitment by the NSW Government to develop regional entrepreneurship and support startups and small to medium enterprises (SMEs) across the state.	

## Major Startup Hubs, Accelerators/Incubators and Training Facilities

Organisation	Category	Status	Description
<b>Sydney Startup Hub</b> <sup>3</sup>	Accelerators	Operating	<ul style="list-style-type: none"> <li>- Innovation centre supported by \$35 million investment from NSW Government</li> <li>- Hosting startups, incubators and accelerators</li> <li>- Offering community facilities and running innovation programs</li> </ul>
<b>Cicada Innovation</b>	Incubator (deep tech)	Operating	<ul style="list-style-type: none"> <li>- University shareholders (UNSW, ANU, UTS and USYD) provide specialist deep tech research infrastructure</li> <li>- Programs cover all phases of deep tech development from concept to commercialisation</li> </ul>
<b>Sydney Entrepreneur School</b>	Entrepreneur training	Operating	<ul style="list-style-type: none"> <li>- Modelled based on the Stockholm School of Entrepreneurship in Sweden and established in 2016 with investment by NSW Government</li> <li>- Collaboration between 11 NSW universities and TAFE NSW in providing entrepreneurship training and education services to individuals and organisations</li> </ul>
<b>Sydney Tech Central</b> <sup>4</sup>	Incubator/accelerator	Under development	<ul style="list-style-type: none"> <li>- Major urban planning and development as Sydney's new innovation and technology precinct to host startups, universities and research.</li> <li>- NSW Government committed an initial funding package of \$48.2 million for the Central's development and the backing of Atlassian as anchor tenant. Other confirmed tenants include NSW Space Hub and Sydney Quantum Academy.</li> </ul>
<b>Western Sydney Startup Hub</b> <sup>5</sup>	Incubator/accelerator	Under development	<ul style="list-style-type: none"> <li>- 1,500 sqm site located in the Parramatta North Heritage Core building on the success of Sydney Startup Hub to attract Western Sydney startups, scaleups and business</li> </ul>
<b>Sydney Science Park</b>	Incubator/accelerator	Under development	<ul style="list-style-type: none"> <li>- A \$5 billion private-led project with 280 hectare food science, energy and health precinct with industry, CSIRO and education providers</li> <li>- NSW Government is coordinating the infrastructure development for the Park including transport, water and energy.</li> </ul>

<sup>3</sup> [Sydney Startup Hub](#).

<sup>4</sup> NSW Government. [Tech Central](#).

<sup>5</sup> NSW Government. [Western Sydney Startup Hub](#).

### University in-house Startup Supporting Services<sup>6</sup>

NSW universities are providing entrepreneurship support and startup scaling up services:

- Targeting customers from their current students, researchers, alumni and possible external customers with charge
- Offering co-working space, deep tech labs and training courses.
- Running mentors program, networking events, demo days and other facilitation and coordination services
- Providing seed funding supported by angle investors, angle syndicates and university alumni

Name	Hosting University	Category	Description	Startup community
<b>UNSW Founders Program</b>	UNSW	Accelerator/incubator and industry specific accelerator (Health X10)	A few programs have been rolled into the Founders Program, including MCIC Foundations, Global Founders, Founders Start, 10X accelerator and FounderLab	Supports 400 startups and projects every year. Featured startups on their website include 'Contactile', 'Docterio', 'HEO Robotics'
<b>Macquarie University Incubator</b>	MQU	Incubator	The incubator is used by students, researchers, staff and the broader startup and intrapreneur community to explore, develop and scale their ideas. Supported by the NSW Treasury's Boosting Business Innovation Program and donors.	30 startups are featured on their website.
<b>INCUBATE</b>	USYD	Incubator	Funds students, alumni and researchers to launch startups, support student entrepreneurs through community activities	Supported the creation of more than 125 startups across 15 different sectors (media-tech, ag-tech, mobile etc.) that are now worth over \$67m, have a

<sup>6</sup> Based on public available information from universities

Name	Hosting University	Category	Description	Startup community
				community of more than 100 mentors
<b>Sydney Genesis</b>	USYD	Incubator program	Provides expert mentoring, media exposure assistance and \$25,000 to one startup every year. Other types of assistances are also provided to applicants, with the number of assistances provided depending on their startup's ranking.	As at the start of 2020, approximately 200 startups were actively engaged in Sydney Genesis.
<b>Sydney Knowledge Hub</b>	USYD	Co-working space/incubator	A coworking space for startups, non-profits and companies collaborating with University of Sydney researchers and students	Supports the following industries: Advanced Manufacturing, Agtech, Artificial Intelligence, Biotech, Edtech, Medtech, Nanotech, Quantum
<b>UTS Startups</b>	UTS	Accelerator	Provides individuals with collaboration spaces, mentors, exclusive opportunities, news and events, inspirational talks and masterclasses, profile-building opportunities, industry events and offers, community-building activities and regular pitch nights	

Name	Hosting University	Category	Description	Startup community
<b>Deep Green Biotech Hub</b>	UTS	Incubator (industry specific)	Aims to bring together researchers, SMEs, industry, start-ups, students and other stakeholders to push NSW as the leader of algae-based biotechnology innovation in Australia. Runs the Green Light Accelerator Program. Supported by the NSW Treasury's Boosting Business Innovation Program.	Focused solely on biotechnology-based businesses.
<b>iAccelerate</b>	UoW	Accelerator/incubator	Startups, scaleups, social enterprises and intrapreneurs are supported in the form of education, mentoring and seed funding.	227 companies supported so far with 41 products launched in 2020.
<b>Launch Pads</b>	WSU	Incubator/accelerator	There are currently three Launch Pads planned across Western Sydney University campus at Werrington, Parramatta and Liverpool.	Focused on startups and scaleups in Western Sydney.
<b>Integrated Innovation Network (I2N)</b>	UoN	Incubator	Connects innovators and entrepreneurs with the community, customers, coaching and capital.	71 businesses accelerated and incubated so far, have a community of 4440 entrepreneurs
<b>SMART Region Incubator</b>	UNE	Incubator	To connect regional startups with academic business research, business mentors, corporate and community partners. Supported by the NSW Treasury's Boost Business Innovation Program.	Focus on startups that are commercialising solutions to agriculture, health, environmental services and creative industries.
<b>Enterprise Lab</b>	SCU		Encourage collaboration between entrepreneurs, researchers, students and mentors from the	3 startups are featured; Lamina (sustainable surfboard), Uplift

Name	Hosting University	Category	Description	Startup community
			Northern Rivers region by providing resources, knowledge, talent and spaces	(mastectomy swimwear), Flo Gardens (aquaponics system)
<b>AgriTech Incubator Hub (Wagga)</b>	CSU	Incubator	Supporting regional NSW university and high school students, the Hub provides incubator programs, founder events, innovation and entrepreneurship programs. Supported by the NSW Treasury's Boosting Business Innovation Program.	
<b>Digital Showcase and Start Up Hub (Bathurst)</b>	CSU		In development	
<b>Indigenous Entrepreneurship Pop Up Innovation Hub (Albury, Dubbo, Lismore, Port Macquarie)</b>	CSU		In development	

## NSW Government R&D Policies and Funding Mapping

This document was prepared for the NSW R&D Platform, a priority action under the Accelerating R&D NSW Action Plan. This map provides information about NSW Government's existing strategies, policies, grants and funding programs that supporting R&D.

### R&D Strategies and Polies Mapping

Whilst not mean to be definitive as technology and innovation are playing important role in many aspects of public policies across industries, this stocktake provides an overview of NSW Government's commitment and priority in R&D.

*Table 1 Recent Strategies announced since June 2019*

Strategy	Lead agency	Released Date	High level summary
<b>Accelerating NSW R&amp;D Advisory Council Action Plan</b>	DPC, led by Parliamentary Secretary to the Primer)	January 2020	NSW Government's Action Plan to accelerate R&D and transfer innovation into economic benefits and job growth. The Action Plan has five priority actions and supporting actions to support a strong, vibrant and high quality research and innovation ecosystem in NSW.
<b>NSW Economic Blueprint</b>	Treasury, led by NSW Chief Economist	2019/2020	The Blueprint identifies challenges and risks and highlighted many opportunities NSW has to grow industries, innovate and improve our economy. It sets directions to 2040 for our continued success in a changing world and expanding global economy. The Blueprint identified seven NSW Government policy levers to improve economic performance <sup>3</sup> , including innovation and industry development.
<b>NSW Net Zero Plan</b>	DPIE	2019/2020	NSW Government's climate change action plan that has a principle of developing and investing in clean technologies to ensure economic prosperity from decarbonisation. In supporting this principle, the NSW Government has announced the \$750 million New Industry and Innovation Program for the development and uptake of clean technologies.
<b>20 Year Economic Vision for Regional NSW (2020 update)</b>	Regional NSW	2020	The 20 Year Economic Vision for Regional NSW sets out NSW Government's priorities and plans to achieve long term social and economic success for regional communities. The 2018 Vision has been updated in 2020, Vision Refresh, outlines new trends and emerging sectors industries with their innovation and technology requirement.

Strategy	Lead agency	Released Date	High level summary
<b>Global NSW</b>	Treasury	2019/2020	The Global NSW Strategy is NSW's government-wide plan to grow and build on prosperity. The Strategy aims to position Sydney and NSW as Australia's global by growing industry and innovation, trade and investment, and precinct development. Technology advancements have been identified by the strategy as a key enabler for new industries leading to investment attraction and prosperity.

Table 2 Strategies and Policies Before June 2019

Strategy	Lead agency	Release Data	Industry Sector	Description
<b>State Plan and Overarch Strategy</b>				
<b>Greater Sydney Region Plan – A Metropolis of Three Cities</b>	Greater Sydney Commission	March 2018	Greater Sydney Integrated government land use and infrastructure decision making	The Plan sets a vision to 2056 and establishes a 20 year plan to manage growth and change for Greater Sydney on social, economic and environmental matters. It informs district and local plans and assists infrastructure plans to achieve place-based outcomes.
<b>State Infrastructure Strategy 2018-2038</b>	Infrastructure NSW	March 2018	Greater Sydney Integrated government land use and infrastructure decision making	The new 20 year plan switches the focus from developing an infrastructure project pipeline to achieving sustainable growth in NSW population, and economy aligning investment in infrastructure with community building and innovation in service delivery. The Strategy sets six cross-sectoral strategic directors: <ol style="list-style-type: none"> <li>1. Continuously improve the integration of land and infrastructure planning</li> <li>2. Plan, prioritise and deliver an infrastructure program that represents the best possible investment and use of public funds</li> <li>3. Optimise the management, performance and use of the State's assets</li> <li>4. Ensure existing and future infrastructure is resilient to natural hazards and human-related threats</li> </ol>

Strategy	Lead agency	Release Data	Industry Sector	Description
				<p>5. Improve statewide connectivity and realise the benefits of technology, ensuring that NSW becomes a leader in the adoption and use of digital technology</p> <p>6. Drive high quality consumer-centric services and expand innovative service delivery models in infrastructure sectors by being innovative in buying services and delivering new assets.</p>
<b>Future Transport Strategy 2056</b>	Transport NSW	March 2018	Greater Sydney Integrated government land use and infrastructure decision making	The Strategy is an update to the 2012 Long Term Transport Master Plan for NSW. It's an overarching strategy which sets the 40 year vision, directions and outcomes framework for customer mobility in NSW. The delivery of the strategy will be supported by a suite of plans such as the Greater Sydney and Regional NSW Services and Infrastructure Plans and other more detailed issues-based or place-based plans.
<b>NSW Climate Change Policy Framework</b>	Formerly OEH	November 2016		The Framework outlines long-term objectives to achieve aspirational net-zero emissions by 2050 and to make NSW more resilient to a changing climate. It defines the NSW Government's role in reducing emissions and adapting to the impacts of climate change and set policy directories to guide implementation.
<b>Jobs for the Future, Adding 1 million rewarding jobs in NSW by 2036</b>	Formerly Jobs for NSW	August 2016	Jobs	Four long-term strategies in responding to challenges, two strategies help build demand for jobs by nurturing high quality jobs in global competitive tradeable segments and building stronger entrepreneurial ecosystem; two act on supporting the supply of suitably skilled workers by skilling up for the knowledge economy and removing employment barriers for people over 65, women with children and regional youth. The future plan includes enduring, 20-year priorities for each of these strategies, and an initial agenda for action.
<b>NSW International Education and Research Industry Action Plan</b>	Department of Education	September 2012	Education, R&D	The plan, developed by the sector-led International Education and Research Taskforce, outlined a vision and strategy for the NSW international education and research sector over the next decade. The Taskforce's vision was for NSW education to deliver cutting edge, industry-relevant education, providing one of the best life and career decisions for international students. The focus of NSW universities and research sector were strong links with global industry and research networks. The plan addresses four key areas:

Strategy	Lead agency	Release Date	Industry Sector	Description
				<ol style="list-style-type: none"> <li>1. Quality of teaching, courses and research and further enhancing the good reputation of New South Wales education and research institutions.</li> <li>2. Quality of total international student experience in New South Wales. Coordinated promotion of NSW's education and research strengths.</li> <li>3. Establishment of Study NSW as a dedicated unit to develop policies, deliver and evaluate strategic programs, identify and facilitate international market opportunities.</li> </ol>
<b>A 20 Year Economic Vision for Regional NSW</b>	Department of Regional NSW	July 2018	Regional development	The strategy maps regional NSW into smaller economies which are metro satellite, growth centre, coastal, inland and remote. It identifies megatrends: the rise of Asia, rapid urbanisation, demographic & social change and digital disruption and their impacts to regional NSW. The strategy identifies 'engine industries' that will drive regional economies with seven established sectors and three emerging sectors which are advanced manufacturing, renewable energy and tech-enabled primary industries. It provides key principles to guide decisions on regional economic development on infrastructure, skills, advocacy and promotion and business environment
<b>Making it Happen in the Regions – Regional Development Framework</b>	DPIE	June 2017	Regional development	The framework provides an overall vision across Government for regional development in NSW and will act as a point of reference for future work. The framework helps identifying regional development opportunities and three major programs of investment: quality service and infrastructure, grow regional centres and activating economic potentials.
<b>Bringing Big Ideas to Life – NSW Innovation Strategy</b>	NSW Government	2015	Multisector	The purpose of the strategy was to create a framework to boost innovation in NSW to stimulate economic activities and be better equipped to tackle complex economic, environmental and social challenges. It introduced government's key initiatives under four themes: Government as an innovation leader, fostering and leveraging R&D, skills for the future and a home for entrepreneurs. List of achievement and current activities from the strategy is at <a href="https://www.innovation.nsw.gov.au/nsw-innovation-strategy">https://www.innovation.nsw.gov.au/nsw-innovation-strategy</a>

Strategy	Lead agency	Release Date	Industry Sector	Description
<b>Digital NSW - Designing our Digital Future (NSW Digital Government Strategy)</b>	DCS	May 2017	Multisector (Digitalisation)	The Strategy represents a vision for ICT reform within NSW Government aiming to develop a data informed and agile public service. The Strategy outlines three priorities of customer experience, data and digital on the insider. It sets out four enablers to support digital innovation across government which are technology, cyber security, and legislation and delivery capability.
<b>Great Sydney Services and Infrastructure Plan</b>	Transport NSW	March 2018	Transport	Building on the state-wide transport outcomes identified in the Future Transport Strategy 2056, the Plan establishes the specific outcomes transport customers in Greater Sydney (as a metropolis of three cities) can expect and identifies the policy, service and infrastructure initiatives to achieve these. The focus is enabling safe, efficient and reliable transport around Greater Sydney with access to the nearest centre within 30 minutes by public transport.
<b>Regional NSW Services and Infrastructure Plan</b>	Transport NSW	March 2018	Transport	A stand alone regional vision with a 'hub and spoke' planning model that connects between regional cities and centres and to global markets.
<b>Industry sector strategy</b>				
<b>Future Transport Technology Roadmap</b>	Transport for NSW	2016	Transport	A study with extensive industry input that uncovers the next generation of technology development and applies it to transform service delivery, better connect communities and enhance the customer experience. 12 emerging and developing fields of technology have been identified that will transform transport as they mature. These technologies span across customer interface, data and insight, infrastructure and vehicle technologies. The Roadmap sets out five technology enabled strategies that will be implemented to capture the potential benefits of these technologies.
<b>NSW Government Defence and</b>	Treasury	February 2017	Defence	The Strategy is built around sustaining and enhancing existing defence industry investment, and seeking new investment to better position NSW's defence industries in areas with untapped capability. It aims to engage the state's substantial research and development (R&D)

Strategy	Lead agency	Release Date	Industry Sector	Description
<b>Industry Strategy 2017</b>				<p>capacity, focusing on emerging areas crucial to Australia's Defence (Defence) needs. The strategy aims to assist Defence in the delivery of its ambitious acquisition targets and to maximise the economic opportunities for NSW businesses and communities. The Strategy identified five state wide key areas:</p> <ol style="list-style-type: none"> <li>1. Foster stronger relationships with Defence and across the NSW defence industry at a state and regional level</li> <li>2. Leverage NSW's strengths in critical capability areas to grow existing work and create new Defence and defence industry activity</li> <li>3. Provide Defence and industry with their future workforce</li> <li>4. Sustain and grow existing and new Defence and defence industry activity across regional NSW</li> <li>5. Increase opportunities for innovation, commercialisation and research within Defence and defence industry</li> </ol> <p>The Strategy puts forward a hub and spoke delivery approach that involves central coordination of state priority initiatives delivered with dedicated resources and specialised expertise in each region.</p>
<b>NSW Advanced Manufacturing Industry Development Strategy</b>	Treasury	May 2018	Advanced Manufacturing	<p>The Strategy realigns the theoretical concepts guiding decision makers in NSW manufacturing with the sector's changed reality. It aims to provide a better understanding of the metrics that define global manufacturing success in an advanced economy such as NSW. It also sets out targeted, practical initiatives to grow the sector, build the capability of businesses and continue to foster a supportive external business environment in the state. The Strategy identified four key themes with objectives, challenges and initiatives for each:</p> <ol style="list-style-type: none"> <li>1. Facilitate the development of advanced knowledge to foster collaboration and research within the industry and with research institutions</li> <li>2. Drive the adoption of advanced process to support and facilitate skills development in NSW manufacturing industry</li> </ol>

Strategy	Lead agency	Release Date	Industry Sector	Description
				<ol style="list-style-type: none"> <li>3. Support the implementation of advanced business models that lead to high-value manufacturing solutions and create products that fulfil previously unmet needs</li> <li>4. Grow exports and attract investment into NSW</li> </ol>
<b>NSW Food and Beverage Manufacturing Industry Development Strategy 2019</b>	Department of Primary Industry	2019	Advanced Manufacturing (food and beverage)	<p>Built on the advanced manufacturing industry strategy, this strategy aims to pursue the opportunities food and beverage manufacturing presents in NSW. The strategy is designed to:</p> <ol style="list-style-type: none"> <li>1. support collaboration between industry, government, researchers, and education and training institutions to support innovation and unlock growth</li> <li>2. create a fit-for-purpose workforce by attracting employees with the right skills</li> <li>3. advocate for the industry by providing a supportive business environment and promoting the strengths of the industry to investors and consumers</li> <li>4. accelerate growth in niche and emerging markets by assisting SMEs to access and become established in new domestic and export markets</li> <li>5. help attract investment by making international investors aware of the local sector and enabling businesses to access international markets.</li> </ol>
<b>Agriculture Industry Action Plan</b>	Department of Primary Industry	Nov 2014	Agriculture	<p>The Strategy is co-designed by NSW Government and Industry and it targets new partnerships and supply chain models to capitalise on market and export opportunities for the NSW primary industries sector. A range of recommendations to be implemented by both government and industry based on six key themes.</p>
<b>NSW Medical Technology Industry Development Strategy</b>	Health	October 2018	Health	<p>The strategy consists of a set of five key strategy areas underpinned by initiatives to promote further growth and innovation in the industry. The strategy aims to:</p> <ol style="list-style-type: none"> <li>1. support industry in commercialising research and development</li> <li>2. grow exports and attract investment into the NSW medical technology sector</li> </ol>

Strategy	Lead agency	Release Date	Industry Sector	Description
				<ol style="list-style-type: none"> <li>3. support skills development</li> <li>4. improve connectivity and collaboration within the NSW medical technology industry</li> <li>5. improve the business environment.</li> </ol>
<b>NSW Cyber Security Industry Development Strategy</b>	DCS	November 2018	Cyber	<p>The strategy has identified four strategic themes to support the sustainable growth of the cyber industry which are</p> <ol style="list-style-type: none"> <li>1. support innovation and collaboration to drive commercial outcomes in cyber security</li> <li>2. support startups and small-to-medium enterprises (SMEs) to increase investment in and commercialisation of intellectual property</li> <li>3. grow exports and attract investment in the NSW cyber security sector</li> <li>4. close the cyber security workforce skills gap.</li> </ol>
<b>NSW Minerals Industry Action Plan</b>	Regional NSW	February 2015	Mining and resources	<p>The Strategy was prepared by the industry-led NSW Minerals Taskforce in responding to challenges faced by the minerals industry such as declining investment in coal and other mineral resources. The Taskforce's vision sees NSW as a globally competitive mining state benefiting local communities and the people of NSW. As part of the long-term strategy, the taskforce made 12 recommendations across three priority areas</p> <ol style="list-style-type: none"> <li>1. A transparent process and integrated policy that provides certainty for mining companies investing in NSW</li> <li>2. Providing fiscal certainty. It will not change the royalty regime and it will consolidate fees and charges and work to reduce these in real terms over time.</li> <li>3. Developing skills and providing supporting infrastructure to foster a vibrant mining sector.</li> </ol>
<b>NSW Minerals Strategy</b>	Regional NSW	February 2019	Mining and resources	<p>The NSW Minerals Strategy builds on this government's response to the <a href="#">2015 Minerals Industry Action Plan</a>. It aims to unlock the state's</p>

Strategy	Lead agency	Release Data	Industry Sector	Description
				metals potential and attract investment through better data, improved communication, supporting a skilled workforce and an effective and efficient regulation and services. Actions are identified in six key themes to support the sustainable growth of minerals industry. The strategy is accompanied a NSW high tech metals map that highlights areas of production or potential to produce in NSW.
<b>Targeted Technologies</b>				
<b>Connected and Automated Vehicles (CAV) Plan</b>	Transport for NSW	January 2019	Transport	The Plan outlines NSW's strategic directories and actions to progress CVA over the next five years. It focuses on the opportunity for NSW to lead the way in encouraging the use of CAVs on NSW. It puts actions in place to embrace the technology as well as address potential challenges, such as cybersecurity and ensuring safe interactions between automated vehicles and other road users.
<b>NSW Electric and Hybrid Vehicle Plan</b>	Transport for NSW	January 2019	Transport	The Plan reflects the growing focus on future mobility and technology innovations which will modernise transport for the community and businesses across NSW. Actions are identified for the next five years with three focussed key priorities on vehicle availability, charging points and customer information. The Plan will be updated to keep pace with changing fuel technologies, markets and services.
<b>Others – International engagement, trade and investment</b>				
<b>India Strategy – NSW International Engagement Strategy</b>	Treasury (ITI)	Updated June 2017		The NSW Government will focus its efforts to grow its relationship with India across trade, investment, education and tourism. Exporting NSW capabilities to deliver smart cities in Indian and facilitating the exchange of agtech and expertise are two of the eight key areas.
<b>China Strategy – NSW International Engagement Strategy</b>	Treasury (ITI)	Updated June 2017		The NSW Government will focus its efforts to grow relationship with China across trade, investment, education and tourism. One of the eight key areas is to grow export of NSW innovation to China.

## R&D Funding Programs Mapping

This stocktake presents information of NSW Government's funding programs and grants in supporting R&D and commercialisation. Completed or closed programs are not included.

Program	Lead Agency	Industry/Technology	Budget	Status	Description
<b>New Industry and Innovation Program</b>	DPIE, EES	Decarbonisation and Clean Technology	\$750 million	ROI closed in April 2021	The NSW Government released the <a href="#">Net Zero Industry and Innovation Program</a> (the Program) in March 2021 which aims to ensure NSW is ready and able to expand the economy, significantly reduce emissions to 2050. The Program is part of the NSW Government's <a href="#">Net Zero Plan Stage 1: 2020-2030</a> to reduce emissions by 35 percent by 2030 and achieve net zero by 2050. To boost local innovation and position NSW as a global leader in the export of low emissions products, technologies and services, the Program will focus on the three areas of clean technology innovation, new low carbon industry foundation and high emitting industries.
<b>Research Attraction and Acceleration Program</b>	OCSE	Various	\$16.2 million	Ongoing	The Research Attraction and Acceleration Program (RAAP) supports innovation and investment in the state's research and development capacity. RAAP funding is primarily allocated through competitive grants rounds using a rigorous selection process and used to leverage funds from national and international bodies. Facilities, programs and events supported by the RAAP include: <ul style="list-style-type: none"> <li>• prestigious ARC Centres of Excellence and critical research infrastructure for our state's universities</li> <li>• the NSW Research Networks – the NSW Smart Sensing Network (NSSN), the NSW Defence Innovation Network (DIN) and NSW Circular</li> </ul>

Program	Lead Agency	Industry/Technology	Budget	Status	Description
					<ul style="list-style-type: none"> <li>science engagement and outreach activities in NSW</li> <li>the NSW Premier's Prizes for Science &amp; Engineering and the NSW Science &amp; Research Breakfast Seminar Series</li> </ul>
<b>Innovation Districts Challenges</b>	Treasury	Health, industry recovery	\$1.5 million	Challenges 1 and 2 closed, challenge 3 yet to open	The Innovation Districts Challenges are designed to accelerate the commercialisation of research products that address the impacts of COVID-19 by businesses in partnership with universities and CSIRO in NSW.
<b>Medical Devices Fund</b>	Health	Health	\$60 million+ (\$8.2 million per annum)	First round was in 2013. Applications for round 9 are now open	The Medical Devices Fund aims to provide support to individuals, companies, public and private hospitals, medical research institutes, universities and the medical devices industry, to take local innovation to market. The fund invests in the development and commercialisation of medical devices and related technologies in NSW.
<b>Minimum Viable Product Grants</b>	Treasury	Various	Maximum of \$25,000 per grant	Applications are open all year round	Minimum Viable Product grants support promising pre-revenue startup businesses across all industry sectors to progress from Proof of Concept to a Minimum Viable Product stage of development.
<b>Regional startups travel stipend</b>	Treasury	Regional startups	Maximum of \$2000 stipend	Must be a regional recipients of the Minimum Viable Product grant	The stipend will help with travel costs for an innovation-related purpose. It removes cost barriers that would otherwise prevent an early-stage startup from participating in innovation-related meetings, programs or events at the Sydney Startup Hub or run through the Local Innovation Network. This helps to ensure regional entrepreneurs can access the full benefits of the NSW Government's investment in creating sustainable innovation communities.
<b>Western Sydney Investment</b>	Treasury	Western Sydney jobs	Yet to be announced	Details on the fund are	The Western Sydney Investment Attraction Fund will assist innovative businesses unlocking new jobs in Western Sydney.

Program	Lead Agency	Industry/Technology	Budget	Status	Description
<b>Attraction Fund</b>				currently being finalised	
<b>Agency for Clinical Innovation Research Grant Scheme</b>	Health	Health	Varies each round	Opens in June	The NSW Agency for Clinical Innovation provides funding for selected research grants every year. The purpose of the scheme is to undertake and source relevant, high quality research that aligns with the agency's mandate, functions, strategic plan and research priorities.
<b>NSW Environmental Trust Grants</b>	DPIE	Environment	Various	Various	The NSW Environmental Trust provides funding through a range of grant programs and strategic investments to various stakeholders to deliver projects that conserve, protect and rehabilitate the NSW environment, or that promote environmental education and sustainability.  E.g. Environmental Research grant: grants of up to \$200,000 for collaborations undertaking applied research in priority environmental themes.
<b>NSW Climate Change Fund programs</b>	DPIE	Environment	\$1.4 billion	Various	The Fund has several key programs including: <ul style="list-style-type: none"> <li>• Delivering energy savings and reducing emissions by providing energy bill relief for households and businesses</li> <li>• Delivering reliable, clean and affordable energy by providing funding for programs that will help households, businesses and communities benefit from clean energy</li> <li>• Increasing resilience to a changing climate</li> </ul>
<b>Regional Job Creation Fund</b>	Regional NSW	Regional businesses	\$100 million	Preliminary applications closing in May 2021, detailed	The A\$100 million Regional Job Creation Fund supports existing businesses in regional NSW to grow and encourages interstate or overseas businesses to invest in regional NSW.

Program	Lead Agency	Industry/Technology	Budget	Status	Description
				applications closing in June 2021	<p>The Regional Job Creation Fund supports regional investment and job creation by offering up to \$10 million in co-funding to activate or bring forward regional projects in engine, enabling or emerging engine industries.</p> <p>The Regional Job Creation Fund's focus is to co-fund projects creating at least five sustainable regional jobs. Applicants must provide a minimum 50% cash co-contribution to the project and the NSW Government contribution will be no more than \$20,000 per new job created through the project.</p>
<b>Justice Innovation Fund</b>	Communities and Justice	Justice	Total value of \$1 million over 4 years (2019/2020-2022/2023)	Round for 2020/2021 will open soon	<p>The Justice Innovation Fund aims to encourage innovative ideas that will help increase access to justice in NSW. Projects could include those that aim to:</p> <ul style="list-style-type: none"> <li>• explore new approaches to the delivery of legal assistance services and the resolution of legal problems;</li> <li>• help people to navigate and access the justice system;</li> <li>• promote collaborative approaches to reducing barriers to justice; and/or</li> <li>• demonstrate how technology can improve access to and user experience of the justice system</li> </ul> <p>For example, the 2019/20 grant was awarded to Marrickville Legal Centre, which launched its online chatbot NALA (New Age Legal Assistant) on 30 November 2020.</p>
<b>NSW Sheep Industry Fund</b>	DPI	Sheep	Not stated on website	Applications open	All projects must deliver a potential benefit to the NSW sheep industry and this must be detailed in the application.

## NSW Priority Industry and R&D Capability Mapping

This document is prepared for the NSW R&D Platform which is an initiative under the Accelerating R&D NSW Action Plan. This mapping provides information and assessment around NSW’s priority industry and R&D capability of key technology group for priority industry.

### Priority Industry

To identify priority industries and technology groups for NSW, a range of recent strategic planning and policies by the NSW Government have been considered for this mapping. These strategies cover the perspective of investment attraction, economic planning, regional development and technological solutions requires for global challenges. Venn diagram in Figure 1 shows the five priority industries and two technology enablers that have been identified for this assessment. These industries and technologies have the most significant opportunities with multi-dimensional benefits in social, environmental and economic outcome for NSW.

Figure 1 Venn diagram of priority industries and their technological enablers



NSW Government state-wide strategies and policies assessed for this mapping include:

1. Investment attraction perspective: The Global NSW Strategy<sup>1</sup> is NSW's government-wide plan to grow and build on prosperity. The Strategy aims to position Sydney and NSW as Australia's global by growing industry and innovation, trade and investment, and precinct development. Eight priority sectors were identified by the Strategy which are Defence & Aerospace, AgTech & Food, EdTech & international education, Cyber security, Environmental Goods & Services, Construction & Smart Cities, Resources, Fintech, Clean energy, MedTech and Health, Transport, Tourism. In addition, advanced manufacturing was identified as one enabler for those priority sectors.
2. Economic development perspective: The NSW 2040 Economic Blueprint<sup>2</sup> sets out the long-term plan for NSW Government as financial manager of the state to ensure the NSW economy grows in coming decades. The Blueprint identifies challenges and risks and highlights major opportunities for the NSW Government to grow industries, innovate and improve our economy. The Blueprint identified industries of the future for NSW and framed in three categories:
  - Building on our strengths: finance & fintech, mining, education, tourism, arts and creative industries
  - Serving our domestic needs: digital and cybersecurity, medtech and biomedical science, waste management
  - Looking to a vibrant future: advanced manufacturing, agtech and food, aerospace and defence, space and hydrogen
3. Regional development perspective: The 20 Year Economic Vision for Regional NSW<sup>3</sup> sets out NSW Government's priorities and plans to achieve long term social and economic success for regional communities. The 2018 Vision has been updated in 2020, Vision Refresh, outlines new trends and emerging sectors:
  - Established: agribusiness and forestry, resources and mining, tourism and hospitality, tertiary education and skills, health and residential care, freight and logistics, and defence
  - Emerging sectors: advanced manufacturing, renewable energy and gas, and technology-enabled primary industries
  - Future industries: Critical minerals, ecotourism, recycling and waste management and high-quality food products
  - New investment areas: visitor economy infrastructure and affordable and accessible energy
4. Technological solutions for global crisis and challenges:
  - Climate change: Australia has committed to the Paris Agreement as a global response to climate change and NSW has committed to a net zero emission target in 2050. Technology solutions such as green hydrogen, electric vehicle and low carbon materials are the

---

<sup>1</sup> NSW Government (2019). [Global NSW](#).

<sup>2</sup> NSW Treasury (2019). [NSW 2040 Economic Blueprint: Investing in the state's future](#).

<sup>3</sup> NSW Government (2020). [20-Year Economic Vision for Regional NSW: Vision Refresh](#).

keys to reduce emissions. One priority area set by NSW's climate change action plan, NSW Net Zero Plan<sup>4</sup>, is developing and investing in clean technologies to ensure economic prosperity from decarbonisation. In supporting this principle, the NSW Government has announced the \$750 million New Industry and Innovation Program<sup>5</sup> for the development and uptake of clean technologies.

- COVID-19: The COVID pandemic has changed the way of work, education and life at global scale. Remote working and studying, telehealth, contact tracing are made possible by digital technologies and digitalisation. Medical research, MedTech and advanced manufacturing are the critical capabilities in research and manufacturing vaccine, medical devices and personal protection equipment in combating COVID. NSW Government's COVID Recovery Plan<sup>6</sup> priorities digitalisation and advance manufacturing to repair economy and be more resilient.

---

<sup>4</sup> NSW Government (2019). [NSW Net Zero Plan: Stage 1 2020-2030.](#)

<sup>5</sup> NSW Government (2021). [NSW Net Zero Industry and Innovation.](#)

<sup>6</sup> NSW Government (2020). [NSW COVID-19 Recovery Plan.](#)

## R&D Capability Mapping

NSW's 11 universities, research centres and institutions have strong R&D capabilities across sectors. In supporting NSW government's industry strategies and programs, OCSE have delivered R&D capability maps for a range of priority industries and sub-sectors and this document summaries those capabilities of selected areas. These R&D capability mapping are developed with desktop research supported with qualitative assessment and stakeholder consultations. These maps are not conclusive due to evolving R&D capabilities and should be considered as live documents.

### *Decarbonisation and ClimateTech (Hydrogen)*

**Industry Overview:** Decarbonisation industry aims to reduce carbon emissions and build new clean industries. Decarbonisation is broad and across-sectorial where hydrogen is emerging as a major economic opportunity for Australia to lead in the global transition to low emission sources of energy. Australia has the potential to become a major hydrogen supplier and build a hydrogen export industry worth \$1.7 billion annually with over 2,800 employment opportunities by 2030.<sup>7</sup>

### Capability Summary Table

Hydrogen value chain and technologies		UNSW	MQU	USYD	UTS	UoN	WSU	UoW
<b>Production</b> including electrolysis, photochemical/catalytic, biological, fossil fuel, thermal splitting and hydrogen carrier		●	●	●	●	●	●	●
<b>Storage</b> including compression, liquefaction and chemical storage		●		●	●	●		●
<b>Utilisation</b> including export, gas blending, transport, electricity, industrial process and heat storage		●		●	●	●		●
<b>Cross-cutting technologies</b> including environmental, policy, regulation, modelling, social and others		●	●	●	●	●		●
Capability indication	Significant capability and national leader	Some level of capability and regional impacts			Limited capability in selected areas			
	●	●			●			

**Detailed Capability Mapping:** The NSW Hydrogen R&D Capability Mapping was conducted by OCSE in 2019 to support Australia's National Hydrogen Strategy and updated in 2020 for NSW Hydrogen Strategy which is now under development. Detail map is in Appendix A.

<sup>7</sup> NSW Treasury (2020). [NSW 2040 Economic Blueprint](#).

*Defence and Space Industry*

**Industry Overview:** NSW is home to over 80 military facilities including 21 major defence bases and training areas with over 25,000 military and civilian defence personnel. NSW's defence expenditure exceeds \$9 billion a year and the industry employees over 36,000 people. Multinational defence primes are based in NSW such as Lockheed Martin, Northrop Grumman, and BAE Systems.<sup>8</sup> Australia aims to build a \$12 billion space industry by 2030. NSW space industry generates \$1.8 billion to \$2.8 billion, representing 50% export revenue for Australia.<sup>9</sup>

**Summary Table**

Defence and Space priority technologies	UNSW	MQU	USYD	UTS	UoN	WSU	UoW
Advanced sensors and intelligence	●	●	●	●	●	●	●
Autonomous systems	●	●	●	●	●	●	●
Communications, electronics and digital	●	●	●	●	●	●	●
Cyber and IT Security	●	●	●	●	●	●	●
Enhanced human performance and protection	●	●	●	●	●	●	●
Hypersonics	●		●				
Material sciences and manufacturing	●	●	●	●	●	●	●
Quantum and telecommunication	●	●	●	●			●
Space technologies	●	●	●		●	●	
Astronomy	●	●	●			●	
Capability indication	Significant capability and national leader		Some level of capability and regional impacts			Limited capability in selected areas	
	●		●			●	

**Capability Mapping:** The NSW Defence R&D Capability Mapping was conducted by OCSE to support the development of NSW Defence Industry Strategy and NSW Defence Innovation Network. The NSW Space R&D Capability Mapping was conducted for internal use. Detailed map of Defence and Space are in Appendix B and C respectively.

<sup>8</sup> NSW Government. [Invest NSW: Defence.](#)

<sup>9</sup> NSW Government. [Invest NSW: Aerospace.](#)

*Financial Services and FinTech (Anti-money Laundering)*

**Industry Overview:** NSW contributes 45% of Australia’s total financial service output and 69% of national financial services export. Financial services generate over \$66 billion per year, representing 13% of NSW’s GSP. NSW is home to almost 60% of Australia’s FinTech startups.<sup>10</sup>

**Summary Table**

Anti-money laundering technologies and capabilities		UNSW	MQU	USYD	UTS	UoN	WSU	UoW
<b>Security and cyber</b> including financial security and integrity, cybersecurity and quantum.		●	●	●	●	●	●	●
<b>Finance and accounting</b> including financial crimes and fraud, forensic accounting and finance.		●	●	●	●			
<b>Artificial Intelligence and machine learning</b> including communications, digital, sensing, autonomous and AI		●	●	●	●	●	●	●
<b>Human behaviour</b>		●	●	●	●	●	●	●
Capability indication	Significant capability and national leader	Some level of capability and regional impacts			Limited capability in selected areas			
	●	●			●			

**Capability Mapping:** The NSW Anti-money Laundering R&D Capability Mapping was conducted by OCSE in 2019 and updated in 2021 to support foreign companies that have interest to establish their operation in NSW. Detailed map is in Appendix D.

<sup>10</sup> NSW Government. [Invest NSW: Financial and Professional Services.](#)

*Primary Industries and AgTech*

**Industry Overview:** AgTech is estimated to be worth as much as US\$189 billion between 2013 and 2022 globally and is expected to be Australia’s next \$100 billion industry by 2030. The growing demand for local-grown sustainable food in domestic market and expanding agriculture export market in Asia Pacific is driving the AgTech development in NSW. <sup>11</sup>

**Summary Table**

AgTech Priority Technology	UNSW	MQU	USYD	UTS	UoN	WSU	UoW	CSU	UNE	SCU
Finance and capital markets								●	●	
Agriculture research, farm management and decision support tools			●					●		
Food safety, traceability and packaging		●							●	
Biotech and novel crops			●							●
Other enabling technologies	●	●	●	●	●	●	●			
Capability indication	Significant capability and national leader			Some level of capability and regional impacts				Limited capability in selected areas		
Overall	●			●				●		

**Capability Mapping:** The NSW AgTech R&D Capability Mapping is a working draft which is under development by OCSE. Draft map is in Appendix E.

<sup>11</sup> NSW Government. [Invest NSW: AgTech.](#)

*Advanced Manufacturing*

**Industry Overview:** NSW’s manufacturing industries and business are increasingly using new technology and advanced business models aiming for higher productivity and profits in competing with other regions. NSW is Australia’s largest manufacturing sector represents 30% of national output. There are over 26,000 manufacturing businesses in NSW employing around 253,000 people. NSW’s manufacturing industry generates \$20.3 billion a year with a stable growth rate of 7.5% a year.<sup>12</sup>

**Summary Table**

Advanced manufacturing technologies	UNSW	MQU	USYD	UTS	UoN	WSU	UoW	CSU	UNE
Advanced sensors and data analytics	●	●	●	●	●	●	●	●	●
Smart robotics and automation	●	●	●	●	●	●	●	●	●
Augmented and virtual reality	●	●	●	●	●	●	●		
Advanced materials	●	●	●	●	●	●	●		●
Additive, precision, sustainable manufacturing and processing	●	●	●	●	●	●	●		
Quantum technologies	●	●	●	●			●		
Capability indication	Significant capability and national leader			Some level of capability and regional impacts			Limited capability in selected areas		
Overall	●			●			●		

**Capability Mapping:** The NSW Advanced manufacturing R&D Capability Mapping was conducted by OCSE in 2019 to support NSW Advanced Manufacturing Strategy. Detailed map is in Appendix F.

<sup>12</sup> NSW Government. [Invest NSW: Advanced Manufacturing.](#)

*Digitalisation*

**Industry Overview:** Digital innovation can deliver \$315 billion economic value to Australia by 2030. There are opportunities of developing and deploying digitalised technology and digital-enable technologies in precision healthcare, digital agriculture, data-driven urban management, cyber-physical security, supply chain integrity, proactive government, legal informatics and smart exploration and production.<sup>13</sup>

**Summary Table**

Digitalisation Technology	UNSW	MQU	USYD	UTS	UoN	WSU	UoW
Machine learning, AI, IoT and autonomous systems	●	●	●	●	●	●	●
Communication, computer science and software engineering	●	●	●	●	●	●	●
Quantum technologies	●	●	●	●			●
Capability indication	Significant capability and national leader		Some level of capability and regional impacts			Limited capability in selected areas	
Overall	●		●			●	

**Capability Mapping:** The NSW Digitalisation R&D Capability Mapping is a working draft which is under development by OCSE. Draft map is in Appendix G.

<sup>13</sup> CSIRO (2018). [Digital Innovation: Australia’s \\$315b opportunity.](#)

[Appendix List](#)

Appendix A – NSW R&D Capability Mapping in Hydrogen

Appendix B – NSW R&D Capability Mapping in Defence

Appendix C – NSW R&D Capability Mapping in Space

Appendix D – NSW R&D Capability Mapping in Anti-Money Laundering

Appendix E – NSW R&D Capability Mapping in AgTech (Working Draft)

Appendix F – NSW R&D Capability Mapping in Advanced Manufacturing

Appendix G – NSW R&D Capability Mapping in Digitalisation Technology (Working Draft)

## NSW Hydrogen R&D Capabilities

### Level 1 - NSW University

	University of New South Wales (UNSW)	Macquarie University (MQ)	University of Sydney (USYD)	University of Technology Sydney (UTS)	University of Newcastle (UoN)	Western Sydney University (WSU)	University of Wollongong (UoW)	CSIRO (Newcastle Energy)	Charles Sturt University (CSU)	University of New England (UNE)
<b>Overall Capability</b>	15	4	9	8	13	2	1	1		
<b>Hydrogen Value Chain and Technology</b>										
<b>Production</b>	4	2	2	1	4	2	1	1		
Biological hydrogen production										
Electrolysis										
Photochemical and photocatalytic process										
Biomass and waste conversion										
Fossil fuel conversion										
Thermal water splitting										
Direct hydrogen carrier production										
<b>Storage</b>	2		2	1	2					
Compression and liquefaction										
Chemical										
<b>Utilisation</b>	6		3	1	4			1		
Export										
Gas blending										
Transport										
Electricity										
Industrial process										
Heat storage										
<b>Cross-cutting RD&amp;D</b>	3	2	2	5	3					
Environmental										
Policy and regulation										
Social licence, safety and standards										
Modelling										
Ancillary technology and services										

Capability indication	Significant capability and national leader	Some level of capability and regional impacts	Limited capability in selected areas
Overall			

## Level 2 - Research Institution

<b>UNSW</b>	<p><b>Research institutions and facilities:</b></p> <p>Materials Energy Research Laboratory in nanoscale (MERLin), Particle and Catalysis Group, School of Chemical Engineering, ARC Research Hub for Integrated Energy Storage Solutions, ARC Training Centre for the Global Hydrogen Economy, Engine Research Laboratory, Centre for Energy and Environmental Markets (CEEM) and School of Mechanical and Manufacturing Engineering, School of Materials Science and Engineering, and School of Photovoltaic and Renewable Energy Engineering</p> <p><b>Research capabilities:</b></p> <p>Production: Alkaline electrolysis, PEM electrolysis, water splitting (photocatalytic water, photoelectrochemical and solar thermochemical), SMR and CO<sub>2</sub> reforming.</p> <p>Storage: hydrides (metal, chemical and complex), cryogenic tanks, ammonia, methanol.</p> <p>Utilisation: export demo, appliance testing for gas blending, internal combustion engine, gas turbine, fuel cells, thermal batteries.</p> <p>Cross-cutting: environmental and combustion modelling.</p>
<b>MQ</b>	<p><b>Research institutions and facilities:</b></p> <p>Biomolecular Discovery and Design Research Centre.</p> <p><b>Research capabilities:</b></p> <p>Production: dark fermentation, water splitting (photoelectrochemical) and biogas reforming</p> <p>Cross-cutting: general safety and standards and technical/simulation modelling.</p>
<b>USYD</b>	<p><b>Research institutions and facilities:</b></p> <p>School of Chemical and Biomolecular Engineering, Laboratory for Catalysis Engineering and Laboratory of Advanced Catalysis for Sustainability.</p> <p><b>Research capabilities:</b></p> <p>Production: hydrothermal liquefaction, SMR and CO<sub>2</sub> reforming</p> <p>Storage: cryogenic tanks, ammonia, methanol, chemical hydrides</p> <p>Utilisation: steel embrittlement, PEMFC for transport, aviation and UAVs, gas turbine, combustion and synthetic fuels</p> <p>Cross-cutting: safety and standards, modellings</p>
<b>UTS</b>	<p><b>Research institutions and facilities:</b></p> <p>Hydrogen Research Program (under the Centre for Green Technology), Centre for Green Technology and Centre for Clean Energy Technology</p> <p><b>Research capabilities:</b></p> <p>Production: direct carrier production,</p> <p>Storage: MOFs, ammonia, synthetic methane, complex and metal hydrides, proton batteries</p> <p>Utilisation: synthetic fuel</p> <p>Cross-cutting: environmental, policy and regulation, social licence, safety, modelling, sensors, monitoring devices.</p>
<b>UoN</b>	<p><b>Research institutions and facilities:</b></p> <p>Priority Research Centre for Frontier Energy Technologies and Utilisation (PREC FETU), Newcastle Institute of Energy and Resources (NIER), International Collaborative Centre for Carbon Futures (ICCCF) and the Global innovation Centre for Advanced Nanomaterials (GICAN).</p> <p><b>Research capabilities:</b></p> <p>Production: carbon and hydrocarbon-assisted water electrolysis, water splitting (photocatalytic and photoelectrochemical), biomass and waste conversion and fossil fuel conversion.</p> <p>Storage: ammonia, liquefaction and compression in gas network, LOHC, complex hydrides</p> <p>Utilisation: export demo, hydrogen gas separation, fuel cells for electricity, steel processing and synthetic fuel.</p> <p>Cross-cutting: safety, social licence and modellings, technology integration and process improvement.</p>
<b>WSU</b>	<p><b>Research institutions and facilities:</b></p> <p>Solar Energy Technologies Research Group</p> <p><b>Research capabilities:</b></p> <p>Production: carbon and hydrocarbon-assisted water electrolysis, photochemical and photocatalytic water splitting</p>
<b>UoW</b>	<p><b>Research institutions and facilities:</b></p>

---

Institute for Superconducting and Electronic Materials, Australian Institute for Innovation Materials (AIMIM), Future Fuels CRC (FFCRC) (NSW node) and ARC Centre of Excellence for Electromaterials Science (ACES) and Intelligent Polymer Research Institute (IPRI).

**Research capabilities:**

Production: electrocatalytic process, electrochemical water splitting

**CSIRO**

**Research institutions and facilities:**

Energy expertise and facilities (e.g. two solar thermal towers, wind turbines, batteries and energy management systems) in supporting CSIRO's Future Science Platform

**Research capabilities:**

Production: solar thermal water splitting

Utilisation: synthetic fuel

## NSW Defence Sector R&D Capabilities

Summary of relative R&D strengths across all NSW universities<sup>2</sup>

Defence priority technologies	Macquarie Uni. (MQ)	Uni. Of NSW (UNSW)	Uni. Of Newcastle (UoN)	Uni. Of Sydney (USYD)	Uni. Of Tech. Sydney (UTS)	Uni. Of Wollongong (UoW)	Western Sydney Uni. (WSU)
Advanced sensors and intelligence	..	...	..	...	..	..	..
Autonomous systems	.	...	..	...	...	..	..
Communications, electronics and digital technology	..	...	.	...	..	.	.
Cyber and IT security	..	...	..	...	...	..	.
Enhanced human performance and protection	..	...	.	...	...	..	..
Hypersonics		...		..			
Material sciences and manufacturing	.	...	.	...	..	...	..
Quantum technologies	..	...		...	..	.	
Space technologies	..	...	.	...			..

Capability:     · Some        ·· Developed        ... Highly developed

<sup>1</sup> ABS, Research and Experimental Development, Higher Education Organisations, Australia, 2016.

<sup>2</sup> Table excludes Australian Catholic University, Southern Cross University and University of New England as defence relevant capability was assessed as limited. Assessed with reference to ERA Report 2015, ARC Grants Database, State of Research in Australian Universities Report (Barlow, 2015), League of Scholars Research Database, NSW Defence Innovation Network capability database, NSW Cyber Security Network capability map, NSW Smart Sensing Network capability database, independent research.

## Detailed breakdown of NSW research and development expertise

**Advanced sensors and intelligence**

<b>Strength</b>	Biosensors, photonics, nanophotonics, wireless sensors, chemical and electric sensor networks, antennas, sensors for autonomous vehicles, space sensors, remote sensing, sonars, eye tracking, signal and image processing, ultrafast optical and non-linear signal processing, data mining and analytics, machine learning, AI, neural networks
<b>Centres</b>	<p><b>USYD:</b> Nano Institute, Australian Centre for Field Robotics (ACFR), UBTECH AI Centre</p> <p><b>UNSW:</b> Biosensors and Biointerfaces Group</p> <p><b>UoW:</b> Intelligent Polymer Research Institute (IPRI), Centre for Big Data Analytics and Intelligent Systems</p> <p><b>UTS:</b> Advanced Analytics Institute (AAi), Global Big Data Technologies Centre, and Centre for Advanced Modelling and GIS</p> <p><b>MQ:</b> Photonics Research Centre and Biomedical Imaging and Sensing Group</p> <p><b>WSU:</b> the MARCS Institute</p> <p><b>Other:</b> Data to Decisions CRC, NSSN</p>

**Autonomous systems**

<b>Strength</b>	Systems, lean manufacturing automation, control, navigation, path planning, precision guidance, cooperation, swarms, sensors, computer vision, signal and image processing, data fusion, AI, machine learning, human-machine interface, social robotics, fabrication and assembly, testing, ethics and law, governance
<b>Centres</b>	<p><b>USYD:</b> ACFR, Centre for Robotics and Intelligent Systems and UBTECH</p> <p><b>UNSW:</b> Robotics and Autonomous Systems and Trusted Autonomy groups, and Autonomous Systems Lab</p> <p><b>UTS:</b> Centre for Autonomous Systems, Centre for Artificial Intelligence (CAI), AAi</p> <p><b>UoW:</b> Defence Materials Technology Centre (DMTC), Facility for Intelligent Fabrication (FIF) and Decision Systems Lab</p> <p><b>UoN:</b> Newcastle Robotics Laboratory, Priority Research Centre for Complex Dynamic Systems and Control, and Precision Mechatronics Laboratory</p> <p><b>WSU:</b> Robotics, Vision and Signal Processing (RVSP) and AI (AIRG) research groups</p> <p><b>Other:</b> Trusted Autonomous Systems Defence CRC</p>

## Communications, electronics and digital technologies

<b>Strength</b>	Reliable electronics, nano and micro systems, organic electronics, antennas, reconfigurable electronics and antennas, ultra-wideband and super-wideband planar antennas, wireless communications, photonics, photonic crystals, optically controlled phased arrays, photonics signal processing, self-assembly photonics, low-power design, wireless-powered communications, IoT, biomedical wireless devices, cognitive radio networks, photovoltaics, high-speed data communication, micro and millimetre waves, terahertz radiation
<b>Centres</b>	<p><b>UNSW:</b> Wireless Communications Lab, Telecommunications Research Group and Nano/Micro Systems Research Group</p> <p><b>USYD:</b> Centre for IoT and Telecommunications, Fibre-optics and photonics engineering research group, and Nano Institute</p> <p><b>UTS:</b> Wireless Communications and Networking lab, Photonics Laboratories, Centre for Electrical Machines and Power Electronics (CEMPE), Centre for Real-time Information Networks (CRIN) and Institute of Biomedical Materials and Devices</p> <p><b>MQ:</b> Wireless Communications Research Team, Centre for Electromagnetic and Antenna Engineering, Future Wireless Networks Research Group, Reconfigurable Electronics and Antennas Research Group, and Photonics Research Centre</p> <p><b>UoN:</b> Telecommunications Networks Research Group, Signal Processing Microelectronics Research Centre, Centre for Secure and Reliable Communications, and Priority Research Centre for Organic Electronics</p> <p><b>UoW:</b> Signals, Information and Communications Research Institute</p>

## Cyber and IT security

<b>Strength</b>	Network security, application security, software-defined networking, IoT, blockchain, cyber-physical systems, cryptography, model checking, network intelligence, analytics, biometric authentication, machine learning, AI, governance and regulation
<b>Centres</b>	<p><b>USYD:</b> Sydney Cyber Security Network</p> <p><b>UNSW:</b> UNSW Cyber, Cyber Security CRC</p> <p><b>UoW:</b> Institute of Cybersecurity and Cryptology (iC2)</p> <p><b>MQ:</b> Optus-MQ Cyber Security Hub</p> <p><b>UoN:</b> Advanced Cyber Security Research Centre</p> <p><b>WSU:</b> Networking, Security and Cloud Research Group (NSCR)</p> <p><b>Other:</b> Cyber Security CRC, NSW CSN</p>

## Enhanced human performance and protection

<b>Strength</b>	Bionics, wearable and implanted technologies, smart materials, magnetorheological body armour, biomaterials, nanomedicine, nanomaterials and devices, tissue engineering, biodefence, molecular sensing, infectious diseases, human performance monitoring and augmentation, thermal physiology, injury prevention, cognitive psychology, VR, AR, human-machine interactions
-----------------	--

<b>Centres</b>	<p><b>UNSW:</b> Biodefence Collaboration, Australian Centre for Nanomedicine, Kirby Institute</p> <p><b>USYD:</b> Institute of Biomedical Engineering and Technology, Marie Bashir Institute</p> <p><b>UTS:</b> Centre for Health Technologies, Institute for Biomedical Materials and Devices (IBMD), and Computational Intelligence and Brain-Computer Interface Centre</p> <p><b>MQ:</b> WiMed Research Centre, Synthetic Biology Consortium, ARC CoE for Nanoscale Biophotonics</p> <p><b>UoN:</b> Centre for Medical Engineering Research and i3 Lab</p> <p><b>WSU:</b> MARCS Institute and Bioelectronics Neuroscience (BENS) Group</p> <p><b>Other:</b> ARC T.C. for Innovative Bioengineering (USYD/UTS), HEARing CRC (WSU/MQ)</p>
----------------	--

## Hypersonics

<b>Strength</b>	Hypersonic aerodynamics, control, structures, sensors
-----------------	---

<b>Centres</b>	<p><b>UNSW:</b> Hypersonics and High-Speed Flows Group Hypersonics Research Group</p> <p><b>USYD:</b> Aeronautical Engineering research group</p>
----------------	---

## Material sciences and manufacturing

<b>Strength</b>	Metallurgy, polymers, biomaterials, composites, nanomaterials, nanocomposites, nanostructured fluids, smart materials, superconducting materials, organic conductors, precision and nano processing, high-speed fabrication, additive manufacturing, high-speed metal printing, lean automation, welding, sustainable manufacturing, characterisation, modelling and simulation, failure mechanics, testing, corrosion, materials and condensed matter physics
<b>Centres</b>	<p><b>UoW:</b> DMTC, Australian Institute of Innovative Materials, IPRI and FIF, Engineering Materials Research Centre (EMRC), National Facility for Physical Blast Simulation</p> <p><b>UNSW:</b> ANFF, Materials Science and Engineering Research Group, Manufacturing Engineering Research Group, Centre for Sustainable Materials Research and Technology (SMaRT), ARC T.C. for Automated Manufacture of Advanced Composites</p> <p><b>USYD:</b> Nano Institute, Centre for Advanced Materials Technology, Institute for Biomedical Engineering and Technology, and ARC T.C for Innovative Bioengineering</p> <p><b>UTS:</b> ProtoSpace for Additive Manufacturing, IBMD, Institute for Nanoscale Technology</p> <p><b>UoN:</b> Global Innovative Centre for Advanced Nanomaterials</p> <p><b>WSU:</b> Advanced Materials and Smart Structures (AMSS) research group, and Advanced Materials Characterisation Facility (ACMF)</p> <p><b>Other:</b> Innovative Manufacturing CRC (UNSW/USYD/UTS) and Advanced Manufacturing Growth Centre (UNSW/USYD/UoW/WSU/UoN/MQ)</p>

## Quantum technologies

<b>Strength</b>	Silicon quantum computing, topological quantum architecture, spin qubits, trapped ions, quantum software and information processing, quantum simulations and theory, nano-diamonds, quantum sensing, quantum sensing with organic materials
<b>Centres</b>	<p><b>UNSW:</b> Silicon Quantum Computing</p> <p><b>USYD:</b> Sydney Nanoscience Hub, Quantum Nanoscience, Quantum Control Labs</p> <p><b>UTS:</b> Centre for Quantum Software and Information</p> <p><b>MQ:</b> Research Centre in Quantum Science and Technology (QSCITECH)</p> <p><b>Other:</b> Centre for Quantum Computation and Communication Technology (CQC2T) (UNSW/UTS) and ARC CoE for Engineered Quantum Systems (EQUS) (USYD/MQ)</p>

## Space technologies

<b>Strength</b>	Spacecraft design, build, testing, operations, missions, instrumentation, remote sensing, astrophotonics, GNSS, navigation, positioning and control, space situational awareness, space solar cells, rovers and UAVs, astrophysics
<b>Centres</b>	<p><b>UNSW:</b> Australian Centre for Space Engineering Research (ACSER), Satellite Navigation and Positioning (SNAP) Lab, Australian Centre for Astrobiology (ACA)</p> <p><b>USYD:</b> Sydney SpaceNET and ACFR</p> <p><b>MQ:</b> Research Centre for Astronomy, Astrophysics &amp; Astrophotonics</p> <p><b>Other:</b> ARC Training Centre for Cubesats, UAVs and applications (USYD/UNSW/MQ)</p>

## NSW Space Capability Map

Advanced Sensors & Intelligence	
UNSW	<p><b>Strengths:</b> antennas, sensors for autonomous vehicles, biosensors, eye tracking, gas sensors, signal and image processing, lasers, optics, photonics, smart plasmonic sensors, remote sensing, spectroscopy, wireless sensors, distributed network sensors, space sensors, optical fibre sensors, immunosensors, porous silicon sensors, optical towed-array sonars (partnering with Thales, Zeddef); ferroelectric crystals for sonar (partnering with USN ONR), ground penetrating probes (partnering with NASA JPL), underground positioning systems, big data integration, space mining</p> <p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <i>Australian Centre for Space Engineering Research (ACSER):</i> space sensors, space systems, satellite operator, Satellite subsystems and components, Space Enabled Services and Applications, Position, navigation and timing, Remote sensing and Earth observation</li> <li>○ <i>School of Minerals and Energy Resources Engineering:</i> CO<sub>2</sub> sequestration; improving efficiencies through digital rock analysis; generating clean energy through geothermal engineering; and research into space mining</li> </ul>
USYD	<p><b>Strengths:</b> air quality, photonics, quantum integrated photonics, nanophotonics, sensors for autonomous vehicles, sensors for agriculture, environmental monitoring, medical and health monitoring sensors, optical sensing, ultrafast optical and non-linear signal processing, remote sensing, spectroscopy, sensors for food quality and safety, space sensors, biosensors, electromedical sensors, ground penetrating radar, image processing, data mining and analytics</p> <p><b>Capabilities:</b> <i>Faculty of Engineering (Mechatronic Engineering):</i> control, mechatronic systems development, programming, digital systems and specialist electives in computer vision, robotics, machine learning, sensors and intelligent systems</p>
UTS	<p><b>Strengths:</b> air quality, biosensors, environmental monitoring, nanophotonics, signal and image processing, remote sensing, laser scanning systems, computer vision, large-scale surveillance, water quality, wireless sensor networks, information processing, machine learning, human behaviour recognition, AI, big data analytics.</p> <p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <i>Computational Intelligence and Brain Computer Interface Centre:</i> mobile sensing technology, translational neuroscience and machine intelligent systems, robots</li> <li>○ <i>Centre for Advanced Modelling and Geospatial Information Systems (CAMGIS):</i> remote sensing, digital image processing, laser scanning systems; optical, IR, thermal, hyper-spectral sensors</li> </ul>
MQ	<p><b>Strengths:</b> antennas, air quality, biomedical sensors, photonics, astrophotonics, gas sensing, fibre sensing, lasers, environmental monitoring, water quality, health monitoring, small scale medical body-area communications, IR, remote sensing capacitive sensors, chemical sensors, electrochemical sensors, gesture recognition, motion sensing, natural language processing, computation linguistics, signal and image processing, AI</p>

	<b>Capabilities:</b> <i>School of Engineering:</i> antennas, bandwidth, ultra-wideband, sensors, microstrip antennas, ground systems, space enabled services and applications
UoW	<b>Strengths:</b> chemical and electrical sensing networks, intelligent polymers and nanostructures, organic conductors, air quality, environmental monitoring, signal processing, IoT, wireless sensor networks, distributed AI
UoN	<b>Strengths:</b> remote sensing, environmental monitoring, health monitoring <b>Capabilities:</b> <i>School of Mathematical and Physical Sciences (Physics) / Centre for Space Physics:</i> remote sensing near-earth space, electromagnetic wave monitoring, space systems, ground systems, space enabled services and applications
WSU	<b>Strengths:</b> neuromorphic cognition and event-based sensors, health monitoring, neural network architectures for sensors <b>Capabilities:</b> <i>International Centre for Neuromorphic Systems:</i> energy-efficient sensors and processors, autonomous applications, space situational awareness
<b>Autonomous Systems</b>	
UNSW	<b>Strengths:</b> advanced control systems, perception, sensors, data fusion, precision guidance, testing, simulation, artificial intelligence, human-robot interface, swarms, robotics <b>Capabilities:</b> <i>School of Mechanical and Manufacturing Engineering - Robotics and Autonomous Systems:</i> design and analysis of robotic systems, including space robotics, medical robotics, field robotics, precision robotics, agricultural robotics and combining core knowledge from control engineering, electrical engineering, mechanical engineering and computer science
USYD	<b>Strengths:</b> robotics principles and systems, sensors and fusion, machine learning and adapting, perception and path planning, navigation, fabrication and assembly, test facilities, multidisciplinary approach, ethics, law and regulation, AI, social robotics <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <i>Australian Centre for Field Robotics:</i> sensors for autonomous vehicles, implemented in air, land and sea environments; robotics principles and systems; fusion and perception; movement, control and decisions; modelling, system identification, learning and adapting; architectures, cooperation, intelligent systems; perception and path planning; sensing, navigation, imaging; dynamic walking robots; electronics fabrication and assembly, anechoic test facility, environmental test chamber, flight-vehicle fabrication laboratory, remote aviation test facility (partnering with DST, South Korea Agency of Defence Development), space enabled services and applications, position, navigation and timing, scientific and engineering support</li> <li>○ <i>Centre for Robotics and Intelligent Systems:</i> space systems, suppliers of material and components, advancements in robotics and intelligent systems</li> </ul>
UTS	<b>Strengths:</b> AI, machine learning, brain-computer interface, computation intelligence, human behaviour recognition, social robotics, prototypes, proof-of-concept systems <b>Capabilities:</b> <i>Faculty of Engineering and Information Technology:</i> autonomous systems, artificial intelligence, space systems, ground systems
MQ	<b>Strengths:</b> language technology, language processing, machine learning, computer-human interface

UoW	<b>Strengths:</b> autonomous jiggling and welding, lean manufacturing automation, application in defence, autonomous vehicles, complex systems, operations research.
UoN	<b>Strengths:</b> robotics, automated manufacturing systems, AI, image processing, machine learning, dynamic systems, optimisation, precision mechatronics
WSU	<b>Strengths:</b> signal and image processing, computer vision, knowledge representation and reasoning, blockchain, intelligent agents, machine learning, information security
<b>Space Technologies</b>	
UNSW	<b>Strengths:</b> spacecraft design, build and launch, missions, navigation, positioning and control, space situational awareness (SSA), space solar cells, structures and rapid prototyping, Earth observation <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <i>BlueSat Team:</i> space systems, satellite operator, satellite subsystems and components, ground systems, ground segment systems and equipment, support services, engineering consulting services</li> <li>○ <i>Canberra/ADFA - Australian National Concurrent Design Facility:</i> develop space missions from start to finish, accelerate and improve mission concept definition by having a team of experts collaborate concurrently and collocated</li> </ul>
USYD	<b>Strengths:</b> spacecraft design, build and launch, instrumentation and systems, numerical and computational tools, planetary rovers and UAVs, space data integration and Earth observation <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <i>School of Aerospace, Mechanical and Mechatronic Engineering:</i> space systems, ground systems. Home to research institutes and centres in the fields of aerospace, mechanical and mechatronic engineering including the: <ul style="list-style-type: none"> <li>-Sydney Institute for Robotics and Intelligent Systems (SIRIS)</li> <li>-Australian Centre for Field Robotics (ACFR), and</li> <li>-Centre for Advanced Materials and Technology (CAMT).</li> </ul> </li> <li>○ <i>CubeSats, Unmanned Aerial Vehicles and Their Applications (CUAVA):</i> develop instruments and technology to solve crucial problems, and develop a world-class Australian industry in CubeSats, UAVs, and related products</li> <li>○ <i>SpaceNet:</i> earth observations from space (EOS), space research, strong foundation to develop into a future Australia Space Research Network</li> <li>○ <i>Centre for Advanced Materials and Technology:</i> space systems, suppliers of material and components, fundamental and applied research for space systems</li> </ul>
MQ	<b>Strengths:</b> astronomy, astrophysics, astrophotonics, remote sensing, instrumentation <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <i>Australian Astronomical Optics:</i> development of innovative telescope instrumentation for astronomical surveys of the night skies</li> </ul>
UoN	<b>Strengths:</b> space weather, satellite resilience <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <i>Centre for Space physics:</i> data are sourced from ground-based and spacecraft platforms, examining space weather</li> </ul>

WSU	<p><b>Strengths:</b> space situational awareness, event-based sensors, space law, neuromorphic space imaging</p> <p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <i>Biomedical Engineering and Neuromorphic Systems (BENS) research program:</i> brain science, biomedical &amp; human technologies</li> </ul>
CSU	<p><b>Strengths:</b> remote sensing and GIS</p> <p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <i>Spatial Data Analysis Network:</i> geographic information systems, remote sensing and image analysis, spatial statistics and spatial analysis, questionnaire design and survey implementation, simulation and modelling, provision of spatial and analytical software, access to scientific instrumentation and other hardware, spatial data sourcing and supply</li> </ul>
<b>Quantum and Telecommunication</b>	
UNSW	<p><b>Strengths:</b> silicon quantum computing, quantum sensing using organic materials.</p> <p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <i>ARC CoE for Quantum Computation &amp; Communication Technology (CQC2T):</i> global quantum computing information network, encompassing ultra- fast quantum computation, absolutely secure quantum communication and distributed quantum information processing</li> </ul>
USYD	<p><b>Strengths:</b> Internet of Things, 5G wireless cellular communications, industry internet, wireless sensor networks and quantum coding, wireless engineering.</p> <p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <i>Centre for IoT and Telecommunications:</i> space enabled services and applications, Internet of Things, mobile satellite communications, remote sensing and earth observation</li> </ul>
UTS	<p><b>Strengths:</b> forensic science, mathematical sciences, physics and chemistry</p> <p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <i>School of Mathematical and Physical Sciences:</i> quantum physics, advanced mathematics and physics, imaging science, computational physics</li> <li>○ <i>Faculty of Engineering and Information Technology:</i> quantum software and Information</li> </ul>
<b>Astronomy</b>	
UNSW	<p><b>Strengths:</b> Antarctic astronomy, astrobiology, exoplanetary science, star formation, chemistry and dynamics of the interstellar medium, varying fundamental constants, cosmology, physics of the early universe and galactic archaeology, antarctic astronomy</p> <p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <i>Department of Astrophysics:</i> astronomy, fundamental and applied research for space systems</li> <li>○ <i>The Australian Centre for Astrobiology (ACA):</i> astronomy</li> <li>○ <i>Joint Australian Centre for Astrophysical Research in Antarctica (JACARA):</i> scientific potential of the Antarctic Plateau for astronomy</li> </ul>
USYD	<p><b>Strengths:</b> stellar astrophysics, plasma astrophysics, cataclysmic variables, black-hole binaries, masers, pulsars, supernovae, and their remnants, the interstellar medium, and the galactic centre, normal galaxies, the magellanic clouds, clusters of galaxies, active galaxies &amp; quasars, gravitational lensing, and cosmology.</p> <p><b>Capabilities:</b> <i>Sydney Institute for Astronomy (SIfA):</i> astronomy</p>

MQ	<p><b>Strengths:</b> planetary evolution, and downstream applications in engineering and technology development, including the intersection of engineering and remote sensing/geophysical instrumentation and in Earth monitoring, geodynamics, geochemistry and petrology, astronomy, astrophysics and astrophotonics, lasers, photonics and quantum science.</p> <p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <i>Planetary Research Centre:</i> astronomy</li> <li>○ <i>Department of Earth and Planetary Sciences (EPS):</i> planetary dynamics meteorite studies, and experimental planetology</li> <li>○ <i>Department of Physics and Astronomy:</i> ground systems</li> </ul>
WSU	<p><b>Strengths:</b> fundamental and generic astrophysical observational research</p> <p><b>Capabilities:</b> <i>Astrophysical eScience Laboratory (AeSciL):</i> radio, optical, IR, x-ray</p>
ANU	<p><b>Strengths:</b> black hole phenomena, galactic archaeology, instrumentation, stellar and planetary astronomy and the structure and evolution of the cosmos.</p> <p><b>Capabilities:</b> <i>Research School of Astronomy &amp; Astrophysics (RSSA):</i> ranging from planetary science to cosmology, instrumentation to theory</p>

## NSW R&D Capabilities in anti-Money Laundering

Summary of R&D capabilities and facilities – NSW universities & research organisations

Updated March 2021

### A. SECURITY AND CYBER TOPICS

Financial security and integrity	
RoZetta Institute	<p>Research covers global financial, energy, health and real estate markets along with developing markets such as digital finance and crypto currency. Institute includes two research centres:</p> <ul style="list-style-type: none"> <li>• Finance Research Centre</li> <li>• Derivatives Markets Research Centre</li> </ul> <p>Affiliated with RoZetta Ventures, which targets start-up and emerging growth venture investments in businesses focussed on the development of financial and health technologies, or related fields. RoZetta Ventures also commercialise research from within RoZetta Institute</p>
University of Wollongong	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> Post-quantum cryptography</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Institute of Cybersecurity and Cryptology (iC2):</b> post-quantum cryptography, quantum-proof encryption algorithms (partnering with US National Institute of Standards and Technology (NIST)).</li> </ul> </li> </ul>
Data61/CSIRO Capabilities	<ul style="list-style-type: none"> <li>• <b>Artificial Intelligence and Machine Learning:</b> advanced analytics, smart data acquisition and analytics, data preparation for machine learning and analytics.</li> <li>• <b>Cybersecurity:</b> capabilities in research and stakeholder analysis to understand human behaviours, vulnerabilities of cyber attack and cyber security management.</li> <li>• <b>Distributed ledger technology (blockchain):</b> software systems design with blockchain as a component, analysing and improving trustworthiness of blockchain, human behaviour research and patterns of use and misuse of blockchain,</li> <li>•</li> </ul>
NSW Cyber Security Innovation Node	<ul style="list-style-type: none"> <li>• <b>NSW Cyber Security Innovation Node</b> part of AustCyber (The Australian Cyber Security Growth Network and works with industry on cyber innovation and grow the local cybersecurity workforce in NSW.</li> </ul>
Stone & Chalk	<ul style="list-style-type: none"> <li>• <b>FinTech incubator:</b> Start-up and scale up communities of FinTech, Cyber, Data analytics and insights, AIs and IoTs.</li> </ul>
Cyber & IT Security	
University of New South Wales	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> Security assurance, application security, workforce development, artificial intelligence, machine learning, network security, software defined networking</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Model checking knowledge</b> in distributed and multi-agent systems (partnering with Defence R&amp;D Canada, USAF)</li> <li>○ <b>IoT systems:</b> wireless communications, blockchain, security protocols, biometric and authentication (partnering with DST, NEC, Google)</li> <li>○ <b>Real time analytics</b> for IoT and embedded systems</li> <li>○ <b>UNSW Institute for Cyber Security (IFCYBER):</b> (formerly UNSW Canberra Cyber) and spans both the UNSW Canberra and Sydney and an active online community with 60 members in cyber security research, education, innovation and commercialisation.</li> <li>○ <b>Cyber Security CRC:</b> critical infrastructure protection; and cyber security solution as a service to governments and businesses (partnering with DST, Data61, Commonwealth Bank)</li> </ul> </li> </ul>
University of Sydney	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> Empirical security, network intelligence, network security, blockchain, analytics, artificial intelligence</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Sydney Cyber Security Network:</b> research capabilities in social media, censorship and security; data privacy and surveillance, international conflict and cooperation</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ <a href="#">UBTECH Sydney Artificial Intelligence Centre</a>: have capabilities in artificial intelligence for image capture and processing, data mining and analytics, and advanced probabilistic methods and in partnership with UBTECH (world leading robotic firm)</li> <li>○ <a href="#">Centre for Distributed and High Performance Computing</a>: algorithmics and analytics; clouds, green computing and virtualisation; internetworking and IoT, and service computing</li> <li>○ <a href="#">Concurrent Systems Research Group</a>: distributed computing, blockchain, security and fault tolerance</li> </ul>
University of Technology Sydney	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> Machine learning, big data processing and analytics, IoT and blockchain</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">Global Big Data Technologies Centre</a>: high data-rate wireless communications; mission critical ad-hoc networks (e.g. high capacity, low latency passive sensor networks); communication networks for UAVs; meta-material based antennas and arrays; underwater object recognition; computational intelligence and brain computer interfaces</li> <li>○ <a href="#">Advanced Analytics Institute (AAi)</a>: big data, data sciences and analytics with focuses on large-scale deep neural networks for analytical solutions, image classification and decision making</li> </ul> </li> </ul>
University of Wollongong	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> cryptography and post quantum research</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">Institute of Cybersecurity and Cryptology (iC<sup>2</sup>)</a>: cryptography, post-quantum cryptography, anonymity and accountability; machine learning, pattern recognition and computer vision; data fusion and network security; data visualisation, visual authentication and virtual reality systems (partnering with Australian Signals Directorate (ASD), DST, Data 61)</li> </ul> </li> </ul>
Macquarie University	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> Multidisciplinary approach – privacy, secure and reliable systems, human-centric security, cyber physical systems, risk modelling, governance and regulation</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">Optus Macquarie University Cyber Security Hub</a>: Information Security and Privacy Research (systems, protocols, information theory, applied cryptography and cryptanalysis, machine learning, data mining). Centre for Elite Performance, Expertise and Training (CEPET): acquisition, maintenance and loss of cyber expertise. Programming Languages and Verification Group (PLV): programming theory, design and implementation and verification.</li> </ul> </li> </ul>
University of Newcastle	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> Large scale data systems, IoT and cyber-physical systems, cloud services</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">Advanced Cyber Security Research Centre (ACSRC)</a>: (formerly ACSRC at MQU) cloud security, secure virtualization, IoT security, big data security, trusted computing, software defined networks security, malware and security attacks, data analytics for malware analysis, secure systems design, peer to peer applications, formal security techniques and applied cryptography</li> </ul> </li> </ul>
Western Sydney University	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> Trust, governance, psychology, regulation, policy and standards, networks, cloud</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">Networking, Security and Cloud Research (NSCR) Group</a>: Wireless and mobile networks, ad hoc networks, sensor networks, performance modelling and analysis, and application of AI in networked systems, IoT, network security, and secure cloud</li> </ul> </li> </ul>
<b>Quantum Technologies</b>	
<a href="#">Sydney Quantum Academy</a>	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> industry development, quantum ecosystem, education and training. Partnership between USYD, UNSW, UTS and Macquarie University (see following)</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Industry training and courses</b></li> <li>○ <b>Post graduate degrees</b></li> <li>○ <b>Undergraduate degrees</b></li> <li>○ <b>Education</b></li> <li>○ <b>Entrepreneurship</b></li> </ul> </li> </ul>
University of New South Wales	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> Silicon quantum computing, quantum sensing using organic materials</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">Centre for Quantum Computation and Communication Technology (CQC2T)</a>: quantum communication for secure information capture, processing, storage and transmission; optical quantum computation; silicon quantum computation; quantum communication, distributed quantum computation, quantum sources, detectors and memory, architectures and control (partnering with NASA, Lockheed Martin, DSTG, IBM)</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ <a href="#">Silicon Quantum Computing</a>: commercialisation of silicon quantum electronics, building a prototype 10-qubit silicon quantum computer (partnering with Australian and NSW Governments, Commonwealth Bank, Telstra)</li> </ul>
University of Sydney	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> topological quantum architecture, spin qubits, trapped ions, quantum theory</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">Sydney Nanoscience Hub – Quantum Nanoscience Lab and Quantum Control Lab</a>: advanced quantum measurement and instrumentation capabilities, quantum control and metrology (partnering with Microsoft via the global Station Q network)</li> <li>○ <a href="#">ARC CoE for Engineered Quantum Systems (EQuS)</a>: USYD node - cross-disciplinary research in quantum physics, nanotechnology, quantum materials, quantum enabled diagnostics and imaging, quantum engines and instruments</li> <li>○ <a href="#">Q-CTRL</a>: spin-out startup focused on control techniques to stabilise quantum bits for quantum computers, quantum sensors and related technology (partnering with IBM)</li> </ul> </li> </ul>
University of Technology Sydney	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> quantum software and information processing</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">Centre for Quantum Software and Information</a>: quantum algorithms and complexity, AI applications of quantum computing, intermediate quantum computing and architectures, quantum programming and verification, quantum information theory and security</li> </ul> </li> </ul>
Macquarie University	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> quantum simulations and theory, nano-diamonds, quantum sensing</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">Macquarie University Research Centre in Quantum Science and Technology (QSCITECH)</a>: quantum simulations and algorithms; quantum sensing applications, nano-diamonds for applications in quantum science and biology; quantum optics and photonics; hybrid quantum systems for sensing, communications and computing</li> <li>○ <a href="#">ARC CoE for Engineered Quantum Systems (EQuS)</a>: nano-diamonds for quantum-based applications including quantum information technology and sensing</li> </ul> </li> </ul>
University of Wollongong	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> Post-quantum cryptography</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">Institute of Cybersecurity and Cryptology (iC2)</a>: UoW Node - post-quantum cryptography, quantum-proof encryption algorithms (partnering with US National Institute of Standards and Technology (NIST)).</li> </ul> </li> </ul>

## B. FINANCE and ACCOUNTING TOPICS

Financial crimes and fraud	
University of New South Wales	<a href="#">Fraud Research Group</a> : post-fraud management, research around nature of fraudulent opportunities, rationalisation, motivation of whistle-blowers, accountant fraud and decision to co-offend in fraud.
University of Sydney	<a href="#">Business School</a> : research capability in financial crimes and money laundering. Links with large accounting firms and top tier law firms
University of Technology Sydney	<a href="#">Centre for Forensic Science</a> : forensic science and intelligence, criminalistics and crime investigation and criminology.
Finance and forensic accounting	
University of Macquarie	<a href="#">Centre for Applied Finance Research</a> : experimental and behavioural finance, investment management and applied financial research. <a href="#">Finance Decision Lab</a> : in partnership with Factset and Refinitiv in providing real-time financial data, financial decision making, business intelligence, financial markets simulation.

## C. ARTIFICIAL INTELLIGENCE, MACHINE LEARNING TOPICS

### Communications, Electronics & Digital Technologies

University of New South Wales	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> Reliable electronics, nanoscale devices, nano and micro optical electrical and mechanical systems, wireless communications, data network, signal processing, photonics, microwave and millimetre waves, terahertz radiation</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">Wireless Communications Lab</a>: design and test facilities, M2M communication transceivers technologies and protocols, IoT, 5G, wireless powered communication networks, cross-layer coding, delayed bit interleaved coded modulation</li> <li>○ <a href="#">Telecommunications Research Group</a>: multiuser information theory, processing and iterative receiver design, wireless network coding, cooperative communications, cognitive radio, dedicated short range communications, wireless sensor networks, security and trust, telepresence systems, quantum coding for communications, speech processing, cognitive load measurement, signal processing, compression, image enhancement, polymer and silica optical fibres, photonic fibre device and sensors, diamond-based optical circuitry, self-assembly photonic materials (partnering with DST, Thales)</li> <li>○ <a href="#">Nano/Micro Systems Research Group</a>: microwave and millimetre-wave systems, MEMS/CMOS fabrication and circuits, bio-medical microelectronics, cryogenic environments, micro-actuators, nanofabrication, solid state devices, ultra-low power CMOS. The research team contributes significantly to the <a href="#">Australian Centre of Excellence for Quantum Computation and Communication Technology (CQC2T)</a>.</li> <li>○ <a href="#">Systems and Control Research Group</a>: automated signal processing and interpretation, power system control, guidance, hybrid dynamical systems, networked control systems, neural coding, real-time control and controller implementation, reconfigurable computing, signal processing, stochastic systems and control, system identification</li> <li>○ <a href="#">Australian National Fabrication Facility (ANFF) NSW node</a>: advanced semiconductor manufacturing, nanofabrication</li> </ul> </li> </ul>
University of Sydney	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> IoT, photonic signal processing, microwave photonics, wireless engineering, millimetre wave communications, cooperative wireless heterogeneous systems, ultra-dense networks, wireless powered communications,</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">Centre for IoT and Telecommunications</a>: IoT connectivity, analytics and intelligence; passive and cognitive radios for IoT; wireless engineering, millimetre wave communications, wireless imaging, 5G, ultra-dense networks, energy harvesting techniques for the Internet of Things (IoT), wireless powered communications, network visualisation and software-defined networks, public safety communications and IoT security</li> </ul> </li> </ul>
University of Technology Sydney	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> electrical machines, power electronics, control electronics, power systems, smart grid, wireless communications, photonics, biomedical devices, AI, high-speed data communication</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">5G/6G Wireless Communications and IoT Networking Lab</a>: 5G communications networks, multiple-input multiple-output (MIMO) techniques, wireless sensing, Software Defined Networking (SDN), IoT, Blockchain applications, testing (partnering with Intel, NBN, NSW DPI)</li> <li>○ <a href="#">Interdisciplinary Photonics Laboratories (iPL)</a>: interdisciplinary research for novel materials, processes, optical fibres, devices and applications of photonic technologies for IoT</li> <li>○ <a href="#">The Australian Artificial Intelligence Institute</a>: (formerly Centre for Artificial Intelligence) AI, computer vision, machine learning, brain computer interface, social robotics, computational intelligence, Computation intelligence and Brain-Computer Interface (CIBCI) lab</li> <li>○ <a href="#">Global Big Data Technologies Centre</a>: high-speed data communications, reconfigurable and cognitive antennas and radio systems, super-sensitive receivers, low-latency data transfers, signal processing and software defined networks,</li> <li>○ <a href="#">Centre for Real-time Information Networks (CRIN)</a>: Intelligent transport systems: Applying sensing, information gathering and processing, telecommunications, data analytics to improve the performance of transportation systems. Security, Trust and Privacy Research Program: prevention, detection of attacks, preservation of information security and privacy, IoT security, cloud security. Wireless embedded networked sensing and localisation: embedding of detection, processing and communications technology, wireless embedded networked sensors and applications.</li> </ul> </li> </ul>

Macquarie University	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> wireless communications, antenna engineering, photonics, reconfigurable electronics and antennas, future wireless networks, 5G</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">Wireless Communications Research Team:</a></li> <li>○ electromagnetic and microwave engineering, nonlinear electronic circuits and systems, satellite communications, VLSI design and computer architecture, wireless communications, signal processing, compression and encryption, low-power design, interference mitigation, cognitive radio networks, underwater acoustic sensor networks, cloaking, ultra-wideband and super-wideband planar antenna, wireless localisation (partnering with DST, ADF, Gilat Network Systems, ONERA)</li> <li>○ <a href="#">Centre for Electromagnetic and Antenna Engineering:</a> antennas, cavity resonators, antenna arrays, microstrip antennas</li> <li>○ <a href="#">Macquarie University Photonics Research Centre:</a> photonic sources, laser applications, terahertz photonics, novel waveguide lasers, topological beams, unble UV lasers, natural and engineered optical materials, advanced semiconductor materials and applications, quantum photonics</li> </ul> </li> </ul>
University of Newcastle	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> wireless networks, smart grids, mesh/relay networks, secure communications, signal processing, organic electronics, photovoltaics, energy technologies, dynamic systems, optimisation, scheduling</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">Telecommunications Networks Research Groups:</a> self-configurable Field Area Networks (FAN)s, smart grid communications, cognitive wireless networks, protocols for AUV swarms, self-organising networks, power optimised mesh/relay networks, ad hoc wireless mesh networks, energy efficient wireless sensor networks</li> <li>○ <a href="#">Signal Processing Microelectronics Research Centre:</a> MIMO communications testing, model predictive control, future wireless, system identification, filtering and smoothing, variance quantification, network information theory,</li> <li>○ <a href="#">Centre for Secure and Reliable Communications:</a> data transmission in multi-terminal communication networks, near-capacity codes for communications channel conditions, information-theoretic security, optimising and managing 5G networks, quantum key distribution</li> <li>○ <a href="#">Priority Research Centre for Complex Dynamic Systems and Control:</a> mathematical modelling and analysis, dynamic systems, optimisation, scheduling, estimation, signal processing, communication systems, electrical machines, power electronics and drive</li> </ul> </li> </ul>
Western Sydney University	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> power electronics and drive systems, wireless and mobile networks</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">Intelligence and Sustainable Electrical Systems Research Group:</a> microelectrical devices, power quality issues, motors, actuators, power electronics, generators, renewable energy and conversion,</li> <li>○ <a href="#">Networking, Security and Cloud Research (NSCR) Group:</a> Wireless and mobile networks, ad hoc networks, sensor networks, performance modelling and analysis, and application of AI in networked systems, IoT, network security, and secure cloud</li> </ul> </li> </ul>
University of Wollongong	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> signal and information processing, wireless sensor networks</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">Signals, Information and Communications Research Centre:</a> signal and information processing, emerging networks and applications, communications research laboratory, wireless sensor networks, low power wireless communications, link schedulers for next-gen networks</li> </ul> </li> </ul>
<b>Advanced Sensors &amp; Intelligence</b>	
<a href="#">NSW Smart Sensing Network</a>	<p>Built Environment and Smart Cities; Data Analytics; Environment and Ag Tech; Manufacturing; MedTech; Resources and Energy; Space and Aviation.</p> <p>The NSSN brings together the world class research taking place in NSW universities with state government agencies and industry to develop innovative solutions to these key challenges and, at the same time, position NSW as a leader in sensing technology.</p>
University of New South Wales	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> antennas, sensors for autonomous vehicles, biosensors, eye tracking, signal and image processing, lasers, optics, photonics, smart plasmonic sensors, remote sensing, spectroscopy, wireless sensors, distributed network sensors, space sensors, optical fibre sensors, immunosensors, porous silicon sensors, optical towed-array sonars (partnering with Thales, Zeddef); ferroelectric crystals for sonar (partnering with USN ONR), ground penetrating probes (partnering with NASA JPL), underground positioning systems, big data integration</li> </ul>

	<ul style="list-style-type: none"> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">Australian Centre for Nanomedicine</a>: biosensors, immunosensors, electrochemical detection, porous silicon sensors, nanoparticle-based biosensors, smart plasmonic sensors</li> </ul> </li> </ul>
University of Sydney	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> photonics, quantum integrated photonics, nanophotonics, optical sensing, ultrafast optical and non-linear signal processing, remote sensing, spectroscopy, biosensors, electromedical sensors, image processing, data mining and analytics</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>UBTECH Sydney Artificial Intelligence Centre</b>: artificial intelligence for image capture and processing, data mining and analytics, and advanced probabilistic methods</li> </ul> </li> </ul>
University of Technology Sydney	<ul style="list-style-type: none"> <li>• <b>Strengths:</b>, nanophotonics, signal and image processing, remote sensing, laser scanning systems, computer vision, large-scale surveillance, , wireless sensor networks, information processing, machine learning, human behaviour recognition, AI, big data analytics,</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Advanced Analytics Institute (AAI)</b>: information processing, visualisation, machine learning, human behaviour recognition, adaptive intelligent software agents, cyber-physical systems</li> <li>○ <b>Global Big Data Technologies Centre</b>: high-speed data communications, reconfigurable and cognitive antennas and radio systems, super-sensitive receivers, low-latency data transfers, signal processing and software defined networks, spectrum sharing, 5G, security, surveillance, computer vision</li> </ul> </li> </ul>
Macquarie University	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> antennas, air quality, biomedical sensors, photonics, astrophotonics, gas sensing, fibre sensing, lasers, environmental monitoring, water quality, health monitoring, small scale medical body-area communications, IR, remote sensing capacitive sensors, chemical sensors, electrochemical sensors, gesture recognition, motion sensing, natural language processing, computation linguistics, signal and image processing, AI</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Macquarie University Photonics Research Centre</b>: photonic sources, laser applications, terahertz photonics, novel waveguide lasers, topological beams, unbleached UV lasers, natural and engineered optical materials,</li> <li>○ <b>Centre for Language Technology</b>: Natural language processing, computational linguistics and language technology, information extraction, text summarisation, machine learning, data science, controlled natural languages as high level specification languages, Processable English (PENG) and Situation Awareness by Inference and Logic (SAIL) (partnering with DST)</li> <li>○ <a href="#">Intelligent Systems Research Group</a>: data mining, machine learning, knowledge mining</li> </ul> </li> </ul>
University of Wollongong	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> chemical and electrical sensing networks, intelligent polymers and nanostructures, organic conductors, signal processing, IoT, wireless sensor networks, distributed AI</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>SMART Infrastructure Facility and SMART IoT hub</b>: prototyping; low-cost and low power water level, air quality, air pressure, pedestrian sensors</li> <li>○ <a href="#">Centre for Big Data Analytics and Intelligent Systems</a>: distributed AI, collective intelligence in social systems, big data analytics, decision-making and problem solving, multi-agent technology, smart city and smart grids, smart modelling and simulations in complex systems, data mining, machine learning, IoT</li> </ul> </li> </ul>
Western Sydney University	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> neuromorphic cognition and event-based sensors, neural network architectures for sensors</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <a href="#">The MARCS Institute for Brain, Behaviour and Development</a>: Neuromorphic systems (BENS); event-based sensors, neuromorphic cognition, microelectronic 3D imaging, neuromorphic recognition, human-machine interaction; multisensory communication; speech and language (partnering with Defence, NATO)</li> <li>○ <b>Biomedical Engineering and Neuromorphic Systems Research Program</b>: improved electronic signal processing systems applying neuromorphic engineering approaches</li> </ul> </li> </ul>
<b>Autonomous Systems and Machine Learning</b>	
University of New South Wales	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> advanced control, perception, sensors, data fusion, precision guidance, testing, simulation, artificial intelligence, human-robot interface, swarms</li> <li>• <b>Capabilities:</b></li> </ul>

	<ul style="list-style-type: none"> <li>○ <b>Robotics and Autonomous Systems Research Group:</b> advanced flight and ground control systems, perception, localisation, navigation, precision guidance, path tracking, sensors and fusion, vectored trust aerial vehicles, dynamic modelling and simulation, optimisation, cooperative control</li> <li>○ <b>Autonomous Systems Laboratory:</b> ground and aerial vehicle design, build and testing, sensor integration, sensing and data fusion, path planning, mapping and localization, precision navigation of unmanned ground vehicles, communications, control systems</li> <li>○ <b>Trusted Autonomy (UNSW Canberra):</b> AI, transparent and explainable AI, biometrics including multimodel biometrics, cognitive engineering, neuroengineering, intelligent control, game play, simulation, guidance including distributed guidance, human performance, human-autonomy teaming, human-swarm interaction, machine learning, multi-agent systems, swarm robotics, sensing and machine vision, skill-bootstrapping, computational motivation</li> </ul>
University of Sydney	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> robotics principles and systems, sensors and fusion, machine learning and adapting, perception and path planning, navigation, fabrication and assembly, test facilities, multidisciplinary approach, ethics, law and regulation, AI, social robotics</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Australian Centre for Field Robotics:</b> robotics principles and systems; sensors, fusion and perception; movement, control and decisions; modelling, system identification, learning and adapting; architectures, cooperation, intelligent systems; perception and path planning; sensing, navigation, imaging; dynamic walking robots; electronics fabrication and assembly, anechoic test facility, environmental test chamber, flight-vehicle fabrication laboratory, remote aviation test facility (partnering with DST, South Korea Agency of Defence Development)</li> <li>○ <b>Sydney Institute of Robotics and Intelligent Systems (SIRIS):</b> SIRIS incorporating the Australian Centre for Field robotics (ACFR) and is a multidisciplinary research centre across ethical, economic, legal, educational and employment implications of robotics and intelligence systems; machine perception and sensing, information modelling, data fusion, managing uncertainty; decision making and interaction; systems development (partnering with Thales, DST, Ford, Rio Tinto, Qantas, TfNSW)</li> <li>○ <b>UBTECH Sydney Artificial Intelligence Centre:</b> artificial intelligence for image capture and processing, data mining and analytics, and advanced probabilistic methods</li> <li>○ <b>Human-centred Technology Research Group:</b> emotional and affect sensors, social robotics, machine learning, data mining, personalisation, human-robot interfaces (natural language, visualisation, touch, movement)</li> </ul> </li> </ul>
University of Technology Sydney	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> AI, machine learning, brain-computer interface, computation intelligence, human behaviour recognition, social robotics, prototypes, proof-of-concept systems</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Centre for Artificial Intelligence (CAI):</b> AI, computer vision, machine learning, brain computer interface, social robotics, computational intelligence, Computation intelligence and Brain-Computer Interface (CIBCI) lab</li> <li>○ <b>Advanced Analytics Institute (AAI):</b> information processing, visualisation, machine learning, human behaviour recognition, adaptive intelligent software agents, cyber-physical systems</li> </ul> </li> </ul>
University of Newcastle	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> Robotics, automated manufacturing systems, AI, image processing, machine learning, dynamic systems, optimisation, precision mechatronics</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Newcastle Robotics Laboratory:</b> Adaptive control, artificial emotions, AI, classification and clustering, machine learning, companion robots, computational neuroscience, data mining, digital control, image processing, dimensionality reduction, evolutionary computation, extended Kalman filters, feedback control and regulation, manifold learning, motor control and legged locomotion, neural networks, reinforcement learning, robot programming, support vector machines, vision systems</li> <li>○ <b>Priority Research Centre for Complex Dynamic Systems and Control:</b> mathematical modelling and analysis, dynamic systems, optimisation, scheduling, estimation, signal processing, communication systems, electrical machines, power electronics and drive</li> <li>○ <b>Precision Mechatronics Laboratory:</b> piezo robotics, piezo actuators and amplifiers, biomedical devices, electroactive optics, nanopositioner design and control theory.</li> </ul> </li> </ul>
University of Wollongong	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> complex systems, operations research</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Decision Systems Lab:</b> applied A, autonomous vehicles, complex systems and decision making, and operations research (partnering with BAE)</li> </ul> </li> </ul>

Western Sydney University	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> signal and image processing, computer vision, knowledge representation and reasoning, blockchain, intelligent agents, machine learning, information security</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Robotics, Vision and Signal Processing (RVSP) Research Group:</b> signal and image processing, pattern recognition, computer vision and computational intelligence in robotic applications</li> <li>○ <b>Artificial Intelligence Research Group (AIRG):</b> Knowledge representation and reasoning; computational properties of existential rules; Answer Set Programming (ASP); Blockchain: data integrity verification, access control frameworks, data query; Intelligent agents: automated negotiation, reasoning strategies, trading agents; Machine learning: image processing, AI real time analysis and adaption; network security, secured cloud data access, rule-based control.</li> <li>○ <b>Intelligent &amp; Sustainable Systems Research Group:</b> power electronics and drive systems, actuators, induction and reluctance generators, power system protection, micro electromechanical devices, Fuzzy Logic Control Systems, Neuro-Fuzzy Applications</li> </ul> </li> </ul>
Macquarie University	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> language technology, language processing, machine learning, computer-human interface</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Centre for Language Technology:</b> Natural language processing, computational linguistics and language technology, information extraction, text summarisation, machine learning, data science, controlled natural languages as high level specification languages, Processable English (PENG) and Situation Awareness by Inference and Logic (SAIL) (partnering with DST)</li> </ul> </li> </ul>

## D. HUMAN BEHAVIOUR TOPICS

Neuroscience	
University of New South Wales	<p><b>NeuRA – Neuroscience Research Australia:</b> Ageing and neurodegeneration; Brain structure and function; mental illness; neural injury; sensation, movement, balance and falls</p>
University of Sydney	<p><b>Brain and Mind Centre:</b> Child neurodevelopment and mental health; Youth mental health and technology; Forefront Ageing and neurodegeneration; Computational Neuroscience; Multiple Sclerosis; Lambert Initiative for Cannabinoid Therapeutics; neuroimmunology; gambling harm minimisation; chemotherapy induced nerve damage; sleep and circadian biology; technology addiction.</p>
Enhanced Human Performance & Behavioural Science	
Macquarie University	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> psychology, wireless and sensing technologies for medical devices, neurological devices, molecular sensing, human performance</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>WiMed Research Centre:</b> wireless and sensing technologies for medical devices, implant radio platforms, biocompatible materials and sensors, neurological devices, medical imaging technologies, orthopaedic devices</li> <li>○ <b>Department of Cognitive Science:</b> non-invasive transcranial brain and electrical stimulation, eye tracking, language acquisition, behavioural cognition, body perception and control</li> <li>○ <b>Centre for Elite Performance, Expertise and Training:</b> human performance, machine-human interactions, creativity in movement-based expertise, VR and AR, eye tracking, emotional regulation</li> <li>○ <b>ARC CoE in Cognition and its Disorders:</b> cognitive sciences and disorders, belief formation, language, memory, person perception, reading</li> </ul> </li> </ul>
University of New South Wales	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> bionics, biomonitoring and modelling, biomaterials, biosynthetic polymers, tissue engineering, regenerative medicine, biodefence, , speech signal processing and analysis, human decision science, eye tracking, nanomedicine, neuro prosthetics and stimulation</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>UNSW Medicine Neuroscience, mental health and Addiction Theme:</b> The interface of regulation and emotion, executive function and decision-making, mind-machine</li> </ul> </li> </ul>

	<p>nexus, neural coding, neural therapeutics, neural prosthetics, neuromodulation and stimulation strategies</p> <ul style="list-style-type: none"> <li>○ <b>Human decision science:</b> human decision processes, computational modelling, cognition, emotion, eye tracking, physiological measurement, VR, machine learning</li> <li>○ <b>Speech signal processing:</b> automatic inference of emotion and mental state from speech and other biometrics, voice biometrics and anti-spoofing countermeasures, automatic language and pronunciation identification, behavioural and biomedical signal processing, automatic task analysis for wearable computing (partnering with US Army, ITC-Pacific)</li> </ul>
University of Sydney	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> biomechanics, biomaterials, tissue engineering, visualisation technologies, wearable and implanted technologies, biomaterials, sensor and telemetry technologies, nanomaterials, data fusion</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>ARC Training Centre for Innovative Bioengineering:</b> diagnostic therapeutic wearable and implanted technologies; materials, design and fabrication technologies; sensor and telemetry technologies: continuous assessment and optimisation for refinement of future implants</li> </ul> </li> </ul>
University of Technology Sydney	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> biomedical materials and devices, nanomaterials and devices, biosensing surfaces, nanophotonics, human performance augmentation, cognition neuroscience, wearable neuroimaging devices, VR</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Centre for Health Technologies (CHT):</b> interdisciplinary centre, medical devices, non-invasive instrumentation, translational biotherapeutics, nano-biotechnology, transcriptome research, bio-informatics</li> <li>○ <b>ARC Training Centre for Innovative Bioengineering:</b> diagnostic therapeutic wearable and implanted technologies; materials, design and fabrication technologies; sensor and telemetry technologies: continuous assessment and optimisation for refinement of future implants</li> <li>○ <b>Computational Intelligence and Brain Computer Interface Centre:</b> natural cognition in operational environments, cognition neuroscience, human performance augmentation, wearable and wireless neuroimaging devices, VR</li> <li>○ <b>Human Performance Research Centre:</b> perceptual-cognitive predictors of success, injury prevention, endurance and performance</li> </ul> </li> </ul>
Western Sydney University	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> human-machine interaction, multisensory communication, speech and language, biomedical engineering, bioinstrumentation, health informatics</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>The MARCS Institute for Brain, Behaviour and Development:</b> Biomedical engineering and neuromorphic systems (BENS); human-machine interaction; multisensory communication; music cognition and action; speech and language</li> <li>○ <b>Bioelectronics Neuroscience (BENS) Research Group:</b> neuromorphic engineering and intelligent sensors, biomedical engineering and bioinstrumentation, implantable devices</li> <li>○ <b>Health Informatics (eHealth) Research Group and Telehealth Research and Innovation Lab:</b> personal monitoring, health data mining/analysis, medical images, computational learning and pattern recognition, health environments, human-computer interaction, care delivery and management</li> </ul> </li> </ul>
University of Wollongong	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> human performance, thermal physiology, injury prevention and protection design, coordination</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Centre for Human and Applied Physiology:</b> evaluation and assessment of physiological impacts of activities and functions; optimal performance conditions; cardiovascular physiology and nutrition laboratory; exercise and applied cardiovascular physiology laboratory; thermal physiology laboratory; temperature regulation, thermal sensitivity, cooling, employment standards, high stress environments</li> </ul> </li> </ul>
University of Newcastle	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> pharmaceuticals, drug development, human performance monitoring, injury mechanics, cognitive psychology, cognitive and stress simulations, VR, AR</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>i3 Lab:</b> simulations to optimise human performance, assessment and modelling of cognitive load and decision making, human interface systems, online measurement of stress, gamification, VR and AR programs</li> </ul> </li> </ul>

	<ul style="list-style-type: none"><li>○ <b>Cognitive Psychology Research Group:</b> decision making, human memory, cognitive development, skill acquisition, attention, multitasking, spatial cognition, animal cognition and evolutionary psychology</li></ul>
--	---

## NSW R&D Capabilities in Agtech

### Summary of R&D capabilities and facilities – NSW universities & Agtech priority technologies

Finance and capital markets	
CSU	<b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>School of management and marketing:</b> finance, agriculture</li> <li>○ <b>Graham centre:</b> economic modelling</li> <li>○ <b>AgriFutures:</b> trading name for Rural Industries Research and Development Corporation (RIRDC), invests in research, leadership, innovation and learning</li> </ul>
UNE	<b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>UNE Business School:</b> accounting, agribusiness, business and economics</li> <li>○ <b>UNE SMART Region Incubator:</b> regional business incubator</li> </ul>
Agricultural research, farm management, decision support tools	
USYD	<b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Digital Farm:</b> plant science, animal science, soil science, agronomy, spatial statistics, farm production, spatial livestock management and herd-specific genetic management (animal-specific health), welfare and production management</li> <li>○ <b>The University of Sydney Institute of Agriculture:</b> plant breeding and production, carbon, water and soil, quality food, animal agriculture, development agriculture</li> <li>○ <b>ARC Training Centre for the Australian Food Processing Industry:</b> tissue engineering, process optimisation, bioengineering, nutraceutical and function food</li> <li>○ <b>Plant breeding and production institute:</b> Digital Ag &amp; Irrigation data science, crop water relations, soil management, dryland cropping systems, remote sensing, digital and precision agriculture, food provenance, irrigation scheduling, and agricultural sustainability reporting.</li> </ul>
CSU	<b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Graham Centre:</b> profitability and sustainability of grain and red meat value chains</li> <li>○ <b>Drought Resilience and Innovation Hub:</b> coordination, innovation, technology, uptake</li> </ul>
Food safety, traceability, packaging	
MQ	<b>Capabilities:</b> <ul style="list-style-type: none"> <li>● <b>Centre for workplace futures:</b> supply chain management, logistic and transport, sustainable economic development</li> </ul>
UNE	<b>Capabilities:</b> <ul style="list-style-type: none"> <li>● <b>Institute for rural futures:</b> sustainable rural and regional communities, circular economy mapping</li> </ul>
Biotech, novel crops	
SCU	<b>Capabilities:</b> <ul style="list-style-type: none"> <li>● <b>Centre for organics research:</b> agricultural supply chains, organics production, crop adaptation, bioinformatics</li> </ul>
USYD	<b>Capabilities:</b> <ul style="list-style-type: none"> <li>● <b>Sydney Knowledge Hub:</b> Bioscout</li> </ul>

### Machine learning, AI, IoT and autonomous systems

UNSW	<b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Robotics and Autonomous Systems Research Group:</b> advanced flight and ground control systems, perception, localisation, navigation, precision guidance, path tracking, sensors and fusion, vectored trust aerial vehicles, dynamic modelling and simulation, optimisation, cooperative control</li> <li>○ <b>Autonomous Systems Laboratory:</b> ground and aerial vehicle design, build and testing, sensor integration, sensing and data fusion, path planning, mapping and localization, precision navigation of unmanned ground vehicles, communications, control systems</li> <li>○ <b>Trusted Autonomy (UNSW Canberra):</b> AI, transparent and explainable AI, biometrics including multimodel biometrics, cognitive engineering, neuroengineering, intelligent control, game play, simulation, guidance including distributed guidance, human performance, human-autonomy teaming, human-swarm interaction, machine learning, multi-agent</li> </ul>
------	--

	systems, swarm robotics, sensing and machine vision, skill-bootstrapping, computational motivation
USYD	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Australian Centre for Field Robotics:</b> robotics principles and systems; sensors, fusion and perception; movement, control and decisions; modelling, system identification, learning and adapting; architectures, cooperation, intelligent systems; perception and path planning; sensing, navigation, imaging; dynamic walking robots; electronics fabrication and assembly, anechoic test facility, environmental test chamber, flight-vehicle fabrication laboratory, remote aviation test facility</li> <li>○ <b>Centre for Robotics and Intelligent Systems:</b> multidisciplinary centre – ethical, economic, legal, educational and employment implications of robotics and intelligence systems; machine perception and sensing, information modelling, data fusion, managing uncertainty; decision making and interaction; systems development</li> <li>○ <b>UBTECH Sydney Artificial Intelligence Centre:</b> artificial intelligence for image capture and processing, data mining and analytics, and advanced probabilistic methods</li> <li>○ <b>Human-centred Technology Research Group:</b> emotional and affect sensors, social robotics, machine learning, data mining, personalisation, human-robot interfaces (natural language, visualisation, touch, movement)</li> <li>○ <b>Trusted Autonomous Systems Defence CRC:</b> littoral operations</li> <li>○ <b>Digital farm:</b> predictive analytics and machine learning, robotic/autonomous sensing, control, learning and systems engineering for agriculture</li> </ul>
UTS	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Centre for Autonomous Systems (CAS):</b> robots in unknown and complex environments, assistive robotics, human-robot interaction, robotics for maintenance, prototypes (partnering with RMS)</li> <li>○ <b>Centre for Artificial Intelligence (CAI):</b> AI, computer vision, machine learning, brain computer interface, social robotics, computational intelligence, Computation intelligence and Brain-Computer Interface (CIBCI) lab</li> <li>○ <b>Advanced Analytics Institute (AAI):</b> information processing, visualisation, machine learning, human behaviour recognition, adaptive intelligent software agents, cyber-physical systems</li> <li>○ <b>Trusted Autonomous Systems Defence CRC:</b> land networked autonomy</li> <li>○ <b>Australian Artificial Intelligence Unit:</b> AI, advanced algorithms, data science, machine learning, brain computer interface, bioinspired neural networks and information systems</li> </ul>
UoN	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Newcastle Robotics Laboratory:</b> Adaptive control, artificial emotions, AI, classification and clustering, machine learning, companion robots, computational neuroscience, data mining, digital control, image processing, dimensionality reduction, evolutionary computation, extended Kalman filters, feedback control and regulation, manifold learning, motor control and legged locomotion, neural networks, reinforcement learning, robot programming, support vector machines, vision systems</li> <li>○ <b>Priority Research Centre for Complex Dynamic Systems and Control:</b> mathematical modelling and analysis, dynamic systems, optimisation, scheduling, estimation, signal processing, communication systems, electrical machines, power electronics and drive</li> <li>○ <b>Precision Mechatronics Laboratory:</b> piezo robotics, piezo actuators and amplifiers, biomedical devices, electroactive optics, nanopositioner design and control theory,</li> </ul>
UoW	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Defence Materials Technology Centre (DMTC):</b> robotics for jiggging and welding; lean automation</li> <li>○ <b>Facility for Intelligent Fabrication (FIF):</b> application of welding and automation-related technology in defence industry</li> <li>○ <b>Decision Systems Lab:</b> applied A, autonomous vehicles, complex systems and decision making, and operations research (partnering with BAE)</li> </ul>
WSU	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Robotics, Vision and Signal Processing (RVSP) Research Group:</b> signal and image processing, pattern recognition, computer vision and computational intelligence in robotic applications</li> <li>○ <b>Artificial Intelligence Research Group (AIRG):</b> Knowledge representation and reasoning; computational properties of existential rules; Answer Set Programming (ASP); Blockchain: data integrity verification, access control frameworks, data query; Intelligent agents: automated negotiation, reasoning strategies, trading agents; Machine learning: image processing, AI real time analysis and adaption; network security, secured cloud data access, rule-based control.</li> </ul>

	<ul style="list-style-type: none"> <li>○ <b>Intelligent &amp; Sustainable Systems Research Group:</b> power electronics and drive systems, actuators, induction and reluctance generators, power system protection, micro electromechanical devices, Fuzzy Logic Control Systems, Neuro-Fuzzy Applications</li> </ul>
MQ	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Centre for Language Technology:</b> Natural language processing, computational linguistics and language technology, information extraction, text summarisation, machine learning, data science, controlled natural languages as high level specification languages, Processable English (PENG) and Situation Awareness by Inference and Logic (SAIL)</li> </ul>
Industry	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Farmbot:</b> monitoring device (water, diesel, trough levels, rainfall, staff, flow, pressure)</li> <li>○ <b>Maisa Digital:</b> digital transmitter</li> <li>○ <b>Agerris:</b> air and ground field robotic systems, intelligent tools and AI solutions</li> </ul>
<b>Data analytics, supply chains and logistics</b>	
USYD	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Digital farm:</b> spatial statistics and geostatistics, predictive analytics and machine learning, sample design for on-farm surveys of soil, plant and animal, experimental design and analysis for on-farm experimentation and implementation, image processing and process modelling. Digital data acquisition, delivery, fusion and analysis for agriculture, data analytics for planning and optimisation of agricultural supply chains. Supply logistics and business management, site-specific crop and pasture management</li> </ul>
UTS	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Institute for Sustainable Futures (food systems):</b> value chains, markets, stakeholder values, food systems</li> </ul>
CSU	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Graham Centre:</b> digital twin farm, integrated system of data collection, management and analysis, yield mapping</li> </ul>
<b>Communication, computer science and software engineering</b>	
UNSW	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Wireless Communications Lab:</b> design and test facilities, M2M communication transceivers technologies and protocols, IoT, 5G, wireless powered communication networks, cross-layer coding, delayed bit interleaved coded modulation</li> <li>○ <b>Telecommunications Research Group:</b> multiuser information theory, processing and iterative receiver design, wireless network coding, cooperative communications, cognitive radio, dedicated short range communications, wireless sensor networks, security and trust, telepresence systems, quantum coding for communications, speech processing, cognitive load measurement, signal processing, compression, image enhancement, polymer and silica optical fibres, photonic fibre device and sensors, diamond-based optical circuitry, self-assembly photonic materials</li> <li>○ <b>Energy Systems Research Group:</b> renewable generation and integration, power system operations, protection systems, storage, power electronics, electric drive systems</li> <li>○ <b>Nano/Micro Systems Research Group:</b> microwave and millimetre-wave systems, MEMS/CMOS fabrication and circuits, bio-medical microelectronics, cryogenic environments, micro-actuators, nanofabrication, solid state devices, ultra-low power CMOS</li> <li>○ <b>Systems and Control Research Group:</b> automated signal processing and interpretation, power system control, guidance, hybrid dynamical systems, networked control systems, neural coding, real-time control and controller implementation, reconfigurable computing, signal processing, stochastic systems and control, system identification</li> <li>○ <b>Australian National Fabrication Facility (ANFF) NSW node:</b> advanced semiconductor manufacturing, nanofabrication</li> <li>○ <b>Australia-US Institute for Advanced Photovoltaics and Australian PV Institute:</b> silicon solar cells, organic and earth-abundant inorganic thin-film cells, optics, characterisation, manufacturing</li> <li>○ <b>Solar Industrial Research Facility (SERF):</b> silicon wafer solar cells, fabrication and characterisation</li> <li>○ <b>School of chemical engineering:</b> food processing, ultrasonics, Radio Frequency Plasma, modelling</li> </ul>
USYD	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> IoT, photonic signal processing, microwave photonics, wireless engineering, millimetre wave communications, cooperative wireless heterogeneous systems, ultra-dense networks, energy harvesting, wireless powered communications, nanoengineering, power engineering</li> <li>● <b>Capabilities:</b></li> </ul>

	<ul style="list-style-type: none"> <li>○ <b>Centre for IoT and Telecommunications:</b> IoT connectivity, analytics and intelligence; passive and cognitive radios for IoT; wireless engineering, millimetre wave communications, wireless imaging, 5G, ultra-dense networks, energy harvesting techniques for the Internet of Things (IoT), wireless powered communications, network visualisation and software-defined networks, public safety communications and IoT security</li> <li>○ <b>Fibre-optics and photonics engineering research group:</b> integrated microwave photonics, photonic signal processing, non-invasive biosensing technologies, optoelectronic sensing technology, nonlinear fibre optics, photonic crystals for terahertz applications, optically-controlled phased arrays</li> <li>○ <b>The University of Sydney Nano Institute:</b> nanobots, hybrid plasmonic waveguide for on-chip photonic devices, integrated microwave photonics, linking fundamental to applied photonics, nano-engineered reversible energy storage, nanoscale photonic circuits</li> <li>○ <b>Sir William Tyree Power Engineering Laboratory:</b> a scaled physical model of a power system with metering, controls, protection choices, and capability to reconfigure networks with different parameters and load choices</li> <li>○ <b>Sydney Informatics Hub:</b> support, training, research in data management, statistics, data science, software engineering, simulation, visualisation, bioinformatics, research computing</li> </ul>
UTS	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> electrical machines, power electronics, control electronics, power systems, smart grid, wireless communications, photonics, biomedical devices, AI, high-speed data communication</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Wireless Communications and Networking Lab:</b> 5G communications networks, multiple-input multiple-output (MIMO) techniques, wireless sensing, Software Defined Networking (SDN), IoT, Blockchain applications, testing (partnering with Intel, NBN, NSW DPI)</li> <li>○ <b>Photonics Laboratories (iPL):</b> interdisciplinary research for novel materials, processes, optical fibres, devices and applications of photonic technologies for IoT</li> <li>○ <b>Centre for Electrical Machines and Power Electronics (CEMPE):</b> electrical machines, electromagnetics, magnetic materials, power electronics, control electronics, control engineering, power systems and smart grid</li> <li>○ <b>Centre for Artificial Intelligence (CAI):</b> AI, computer vision, machine learning, brain computer interface, social robotics, computational intelligence, Computation intelligence and Brain-Computer Interface (CIBCI) lab</li> <li>○ <b>Global Big Data Technologies Centre:</b> high-speed data communications, reconfigurable and cognitive antennas and radio systems, super-sensitive receivers, low-latency data transfers, signal processing and software defined networks,</li> <li>○ <b>Centre for Real-time Information Networks (CRIN):</b> Intelligent transport systems: Applying sensing, information gathering and processing, telecommunications, data analytics to improve the performance of transportation systems. Security, Trust and Privacy Research Program: prevention, detection of attacks, preservation of information security and privacy, IoT security, cloud security. Wireless embedded networked sensing and localisation: embedding of detection, processing and communications technology, wireless embedded networked sensors and applications.</li> <li>○ <b>Centre for Clean Energy Technology:</b> Advanced battery technologies for automotive and smart electricity grid applications, supercapacitors for high power applications, hydrogen production and storage, hydrogen fuel-cells, bio-fuel cells, powertrain for electric and hybrid cars, graphene</li> <li>○ <b>Institute of Biomedical Materials and Devices:</b> nanophotonics and nanomedicine</li> <li>○ <b>Radio Frequency and Communication Technologies (RFCT) Lab:</b> embedded RF prototyping, sustainable FR technologies and RF device management through software</li> </ul> </li> </ul>
MQ	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> wireless communications, antenna engineering, photonics, reconfigurable electronics and antennas, future wireless networks, 5G</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Wireless Communications Research Team:</b> electromagnetic and microwave engineering, nonlinear electronic circuits and systems, satellite communications, VLSI design and computer architecture, wireless communications, signal processing, compression and encryption, low-power design, interference mitigation, cognitive radio networks, underwater acoustic sensor networks, cloaking, ultra-wideband and super-wideband planar antenna, wireless localisation</li> <li>○ <b>Centre for Electromagnetic and Antenna Engineering:</b> antennas, cavity resonators, antenna arrays, microstrip antennas</li> <li>○ <b>Future Wireless Networks research group:</b> mobile cellular network architectures, heterogeneous networks, body area networks, mm-wave network architectures, cognitive communication systems, ad-hoc networks, device-to-device communications, spectrum sharing, SDN, signal processing</li> <li>○ <b>Reconfigurable Electronics and Antennas research group:</b> reconfigurable electronics and antennas</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ <b>Macquarie University Photonics Research Centre:</b> photonic sources, laser applications, terahertz photonics, novel waveguide lasers, topological beams, unabled UV lasers, natural and engineered optical materials, advanced semiconductor materials and applications, astrophotonics, quantum photonics</li> </ul>
UoN	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> wireless networks, smart grids, mesh/relay networks, secure communications, signal processing, organic electronics, photovoltaics, energy technologies, dynamic systems, optimisation, scheduling</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Telecommunications Networks Research Groups:</b> self-configurable Field Area Networks (FAN)s, smart grid communications, cognitive wireless networks, protocols for AUV swarms, self-organising networks, power optimised mesh/relay networks, ad hoc wireless mesh networks, energy efficient wireless sensor networks</li> <li>○ <b>Signal Processing Microelectronics Research Centre:</b> MIMO communications testing, model predictive control, future wireless, system identification, filtering and smoothing, variance quantification, network information theory,</li> <li>○ <b>Centre for Secure and Reliable Communications:</b> data transmission in multi-terminal communication networks, near-capacity codes for communications channel conditions, information-theoretic security, optimising and managing 5G networks, quantum key distribution</li> <li>○ <b>Priority Research Centre for Complex Dynamic Systems and Control:</b> mathematical modelling and analysis, dynamic systems, optimisation, scheduling, estimation, signal processing, communication systems, electrical machines, power electronics and drive</li> <li>○ <b>Priority Research Centre for Organic Electronics:</b> organic solar cells, organic thin film transistors and devices, organic photonic devices, scanning helium microscopy</li> <li>○ <b>Priority Research Centre for Frontier Energy Technologies and Utilisation:</b> low emission technologies for process industries and generation, renewable energy systems, energy efficiency, transportation fuels, energy conversion</li> </ul> </li> </ul>
WSU	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> power electronics and drive systems, wireless and mobile networks</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Intelligence and Sustainable Electrical Systems Research Group:</b> micro-electrical devices, power quality issues, motors, actuators, power electronics, generators, renewable energy and conversion,</li> <li>○ <b>Networking, Security and Cloud Research (NSCR) Group:</b> Wireless and mobile networks, ad hoc networks, sensor networks, performance modelling and analysis, and application of AI in networked systems, IoT, network security, and secure cloud</li> </ul> </li> </ul>
UoW	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> signal and information processing, wireless sensor networks</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Information and Communication Technology Research Institute and Signals, Information and Communications Research Institute:</b> signal and information processing, emerging networks and applications, communications research laboratory, wireless sensor networks, low power wireless communications, link schedulers for next-gen networks</li> </ul> </li> </ul>
Industry	<ul style="list-style-type: none"> <li>● <b>Strengths:</b></li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Titan class:</b> software development, strategic design, IoT for agriculture, support and training</li> <li>○ <b>AgriWebb:</b> reporting database</li> <li>○ <b>Hone:</b> spectrometers, phone app, chemometrics cloud software</li> <li>○ <b>PCT Agcloud:</b> precision ag data solutions</li> </ul> </li> </ul>
<b>Material Sciences and Manufacturing</b>	
UNSW	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> precision and nano processing, multi-scale fabrication and advanced manufacturing, sustainable manufacturing, composites, modelling and simulation, biomaterials, nanotechnology, automation, metallurgy</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Materials Science and Engineering Research Groups:</b> biomaterials, ceramics, composites, electronic and superconducting ceramics, failure analysis, computational analysis, modelling, high-temperature materials, pyrometallurgical processes, energy conversion, nanotechnology, nanomaterials for hydrogen storage, metallurgy, polymers, sustainable processing, metallurgy (partnering with Lockheed Martin, GE Aerospace, CSIRO)</li> <li>○ <b>Manufacturing Engineering Research Groups:</b> precision and nano processing: precision manufacturing, bio-manufacturing, nanotechnology, characterisation, tribology, solid and computational mechanics; multi-scale fabrication and advanced manufacturing: abrasive jet machining, laser and laser-assisted fabrication and machining, micro-cutting and cutting</li> </ul> </li> </ul>

	<p>tools, additive manufacturing; sustainable manufacturing and life cycle engineering, acoustic metamaterials</p> <ul style="list-style-type: none"> <li>○ <b>Australian National Fabrication Facility (ANFF) NSW node:</b> nanofabrication, three electron beam lithography systems, full Si-MOS process line and tools for MOS-incompatible processes to run in parallel, molecular beam epitaxy systems</li> <li>○ <b>Centre for Sustainable Materials Research and Technology (SMaRT):</b> recycling and material transformation, sustainability of material processes, sustainable manufacturing</li> <li>○ <b>ARC Training Centre for Automated Manufacture of Advanced Composites (AMAC):</b> complex shapes, metal-composite hybrids, impact and damage assessments, smart materials</li> <li>○ <b>Innovative Manufacturing CRC:</b> Additive manufacturing, automation and robotics, advanced materials, sensors and data analysis, augmented and virtual reality</li> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul>
USYD	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> nanomaterials, nanomechanics, biomaterials, composites, smart materials, testing and characterisation, structural materials, high precision and nano manufacturing, corrosion</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>University of Sydney Nano Institute:</b> synthesis of nanomaterials, nanocomposites, nanotubes, nanowires, nanoparticles and carbon-based materials, physical and chemical characterisation, new characterisation technologies and methods, materials for energy conservation and storage, sensors, biomedical applications, tissue process, molecular nanoscience, 'nanobots', nano safety and sustainability, nanoscale fluid flow, self-assembly</li> <li>○ <b>Centre for Advanced Materials Technology:</b> nanomechanics and nanotribology, nano and bio-materials, ultraprecision and nano-machining, fracture mechanics, smart materials and structures, eco-materials, superhard films and coatings, polymer blends and alloys, and functionally graded materials</li> <li>○ <b>Centre for Advanced Structural Engineering:</b> structural stability and thin-walled structures; composite structures; reinforced and concrete structures; prefabricated systems; modular construction; high-performance buildings; adaptive structural systems; experimental techniques; materials science; computational analysis</li> <li>○ <b>Institute of Biomedical Engineering and Technology:</b> biomaterials for tissue repair and regeneration, biomaterials for orthopaedic implants, biomaterials and stem cells, characterisation of biomaterials (safety, toxicity, biocompatibility and biodegradability)</li> <li>○ <b>Advanced materials facilities:</b> mechanical testing, microscopy and materials characterisation, smart materials and structure, nano mechanical technology and testing, advanced composites and manufacturing laboratories</li> <li>○ <b>ARC Training Centre for Innovative BioEngineering:</b> biomaterial design and fabrication for musculoskeletal tissue regeneration</li> <li>○ <b>Innovative Manufacturing CRC:</b> Additive manufacturing, automation and robotics, advanced materials, sensors and data analysis, augmented and virtual reality</li> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul> </li> </ul>
UoW	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> design, fabrication, welding, robotics, automation, steels, polymers, testing, superconducting materials, intelligent materials, nanotechnology, organic conductors, superconductors, electronic materials, materials and condensed matter physics</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Defence Materials Technology Centre (DMTC):</b> Materials and construction techniques for fabrication of land, marine, aerospace &amp; personnel survivability platforms: materials selection, welding, wire arc additive manufacturing, optimal joint properties, robotics for jiggling and welding; lean automation; surface processing; high strength steels; 'next generation' armours; programming, manipulation and scanning; weld and component modelling</li> <li>○ <b>Australian Institute of Innovative Materials and Institute for Superconducting and Electronic Materials:</b> multifunction materials facility (design to commercialisation), design and fabrication, applied superconductivity for devices; energy conversion and transmission; spintronic and electronic materials for applications; terahertz science; and nano-structured materials, body armour</li> <li>○ <b>Intelligent Polymer Research Institute (lead node of Electromaterials Science CoE and materials node of ANFF):</b> intelligent polymers and nanostructures, nanotechnology, electrochemistry and applications of organic conductors, nano biotechnology and biomaterials, cellular interactions, chemical and electrical sensing networks</li> <li>○ <b>National Facility for Physical Blast Simulation (NFPBS):</b> purpose-built blast simulator, high-speed data acquisition system, high-speed cameras; analysis of blast pressure, structural deformations and material strain</li> <li>○ <b>Facility for Intelligent Fabrication (FIF):</b> application of welding and automation-related technology in defence industry</li> <li>○ <b>Welding Engineering Research Group:</b> welding process technology, materials weldability, robotic demonstration, laser welding, microstructural analysis</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ <b>Engineering Materials Research Centre (EMRC) and Steel Research Hub:</b> design, synthesis and characterisation of advanced ferrous materials</li> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul>
UTS	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> nanomaterials, additive manufacturing, prototyping, biomedical materials, high speed metal printing</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Innovative Manufacturing CRC:</b> Additive manufacturing, automation and robotics, advanced materials, sensors and data analysis, augmented and virtual reality (partnering with Downer)</li> <li>○ <b>ProtoSpace and UTS Rapido:</b> additive and advanced manufacturing facility: prototyping up to 1m<sup>3</sup>, rapid metal printing, fused, melting and direct energy deposition; scanning; multihead, hybrid 3D, multimaterials and colour printers (partnering with HP)</li> <li>○ <b>Institute for Biomedical Materials and Devices (IBMD):</b> fabrication and analysis of nanomaterials; biophotonics, biotechnology, and nanoparticle synthesis labs: upconversion nanoplatfroms (UNCP) characterisation, production, analysis and control</li> <li>○ <b>Institute for Nanoscale Technology (INT):</b> Synthetic nano-chemistry, analytical chemistry, materials for energy storage, medical nanomaterials, nano-metallurgy, materials for solar energy and thermal control, nano-plasmonics</li> <li>○ <b>Microstructural Analysis Unit (MAU):</b> advanced microscopy, characterisation and fabrication</li> </ul> </li> </ul>
WSU	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> materials characterisation, construction, and structures: safety, rehabilitation, energy efficiency, composites, nano-composites, concrete, simulation and modelling</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Advanced Materials and Smart Structures (AMSS) research group:</b> Materials and processing: nano-composite materials and structures, functional nanostructures and self-assembly, thermal interface materials, carbon fibre composites; smart structures and safety: composite construction, fibre reinforced polymer composites for structures, assessment and rehabilitation of structures,</li> <li>○ <b>Centre for Infrastructure Engineering:</b> safety and reliability of structures; sustainability; materials development, application, characterisation, recycling, remediation, disposal, modelling and monitoring; high performance steel, concrete (recycled, geopolymer), fibre reinforced cementitious composites, geofoam, metal foams, and nanocomposites</li> <li>○ <b>Centre for Smart Modern Construction:</b> composite structural materials, energy efficiency, simulation and modelling of materials and structures, supply chain optimisation</li> <li>○ <b>Advanced Materials Characterisation Facility (AMCF):</b> characterisation of materials and biological structures at nano and micro scales, chemical composition, thermal analysis</li> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul> </li> </ul>
MQ	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> fabrication of materials and micro-devices</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Materials Engineering Research Group:</b> fabricating materials and micro-devices; nanoparticles for chemical and optical detection of molecules; electrical, mechanical and optical detection for particles, molecules and physiological states</li> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul> </li> </ul>
UoN	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> nanostructured fluids, nanomaterials, energy applications, simulation, modelling and failure mechanics, corrosion</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Newcastle Institute for Energy and Resources (NIER):</b> Advanced Materials for Energy Application research concentration: organic solar cells, nanostructured fluids, responsive polymers, alloy materials for thermal storage; Centre for Ironmaking Materials Research (CIMR): iron ore sintering and cokemaking processes</li> <li>○ <b>Global Innovative Centre for Advanced Nanomaterials (GICAN):</b> development, characterisation and application of multi-dimensional advanced functional mesoporous materials, and multidimensional nano-hybrid materials</li> <li>○ <b>Materials Engineering Research Group:</b> simulation and modelling, thermodynamics of solids, ceramics, failure mechanics, microstructural and crystal structure analysis, corrosion</li> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul> </li> </ul>
Other	<ul style="list-style-type: none"> <li>● <b>Strengths:</b></li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>NSW Circular:</b> network for circular economy in NSW</li> </ul> </li> </ul>
<b>Advanced sensors</b>	
UNSW	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> antennas, sensors for autonomous vehicles, biosensors, eye tracking, gas sensors, signal and image processing, lasers, optics, photonics, smart plasmonic sensors, remote</li> </ul>

	<p>sensing, spectroscopy, wireless sensors, distributed network sensors, optical fibre sensors, immunosensors, porous silicon sensors, ground penetrating probes (partnering with NASA JPL), underground positioning systems, big data integration</p> <ul style="list-style-type: none"> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Biosensors and Biointerfaces Group:</b> biosensors, immunosensors, electrochemical detection, porous silicon sensors, nanoparticle-based biosensors, smart plasmonic sensors</li> <li>○ <b>Data to Decisions CRC:</b> big data integration, analytics, prediction, and policy</li> <li>○ <b>Mechanical Engineering:</b> Digital viticulture, horticultural sensing, image processing, autonomous systems, 3D mapping, unmanned ground vehicles, robotics</li> </ul> </li> </ul>
USYD	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> air quality, photonics, quantum integrated photonics, nanophotonics, sensors for autonomous vehicles, sensors for agriculture, environmental monitoring, optical sensing, ultrafast optical and non-linear signal processing, remote sensing, spectroscopy, sensors for food quality and safety, space sensors, biosensors, electromedical sensors, ground penetrating radar, image processing, data mining and analytics</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Australian Centre for Field Robotics:</b> sensors for autonomous vehicles, implemented in air, land and sea environments</li> <li>○ <b>The University of Sydney Nano Institute:</b> nanophotonics, all-optical and nonlinear signal processing, mid-infrared photonics and single photon generation</li> <li>○ <b>UBTECH Sydney Artificial Intelligence Centre:</b> artificial intelligence for image capture and processing, data mining and analytics, and advanced probabilistic methods</li> <li>○ <b>Digital farm:</b> sensors for spatial data on crop yield, animal movement, vehicles position, elevation, weather, soil moisture. Remote sensing (from UAVs to global platforms). Proximal sensing of soil and plants using visible, infrared and gamma spectroscopy, electromagnetic induction, LiDAR</li> </ul> </li> </ul>
UTS	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> air quality, biosensors, environmental monitoring, nanophotonics, signal and image processing, remote sensing, laser scanning systems, computer vision, water quality, wireless sensor networks, information processing, machine learning, human behaviour recognition, AI, big data analytics,</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Advanced Analytics Institute (AAI):</b> information processing, visualisation, machine learning, human behaviour recognition, adaptive intelligent software agents, cyber-physical systems</li> <li>○ <b>Global Big Data Technologies Centre:</b> high-speed data communications, reconfigurable and cognitive antennas and radio systems, super-sensitive receivers, low-latency data transfers, signal processing and software defined networks, spectrum sharing, 5G, security, surveillance, computer vision</li> <li>○ <b>Centre for Advanced Modelling and Geospatial Information Systems (CAMGIS):</b> remote sensing, digital image processing, laser scanning systems; optical, IR, thermal, hyper-spectral sensors</li> <li>○ <b>Data to Decisions CRC:</b> big data integration, analytics, prediction, and policy</li> </ul> </li> </ul>
MQ	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> antennas, air quality, biomedical sensors, photonics, lasers, environmental monitoring, water quality, health monitoring, remote sensing capacitive sensors, chemical sensors, electrochemical sensors, motion sensing, natural language processing, computation linguistics, signal and image processing, AI</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Optical and Photonics Engineering research group:</b> high power fibre lasers, mid-infrared fibre sources, mid-infrared light interactions, microwave photonics, microstructured polymer waveguides, terahertz technology, systems and applications</li> <li>○ <b>Macquarie University Photonics Research Centre:</b> photonic sources, laser applications, terahertz photonics, novel waveguide lasers, topological beams, untable UV lasers, natural and engineered optical materials, advanced semiconductor materials and applications, astrophotonics, quantum photonics</li> <li>○ <b>Centre for Language Technology:</b> Natural language processing, computational linguistics and language technology, information extraction, text summarisation, machine learning, data science, controlled natural languages as high level specification languages, Processable English (PENG) and Situation Awareness by Inference and Logic (SAIL)</li> <li>○ <b>Intelligent Systems Research Group:</b> data mining, machine learning, knowledge mining</li> </ul> </li> </ul>
UoW	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> chemical and electrical sensing networks, intelligent polymers and nanostructures, organic conductors, air quality, environmental monitoring, signal processing, IoT, wireless sensor networks, distributed AI</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Intelligent Polymer Research Institute (lead node of Electromaterials Science CoE and materials node of ANFF):</b> intelligent polymers and nanostructures, electrochemistry and applications of organic conductors, chemical and electrical sensing networks</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ <b>SMART Infrastructure Facility and SMART IoT hub:</b> prototyping; low-cost and low power water level, air quality, air pressure, pedestrian sensors</li> <li>○ <b>Centre for Big Data Analytics and Intelligent Systems:</b> distributed AI, collective intelligence in social systems, big data analytics, decision-making and problem solving, multi-agent technology, smart city and smart grids, smart modelling and simulations in complex systems, data mining, machine learning, IoT</li> </ul>
UoN	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> remote sensing, environmental monitoring, health monitoring</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Centre for Space Physics:</b> Remote sensing near-Earth space, electromagnetic wave monitoring</li> </ul> </li> </ul>
CSU	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> Remote sensing and GIS</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Spatial Data Analysis Network (SPAN):</b> Remote sensing, GIS, image processing, analysis</li> <li>○ <b>Graham Centre:</b> remote sensing, GIS, yield mapping</li> </ul> </li> </ul>
UNE	<ul style="list-style-type: none"> <li>● <b>Strengths:</b></li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Precision Agriculture Research Group:</b> sensors, remote sensing, SMART farms, livestock management, intelligent and autonomous systems</li> <li>○ <b>Applied Agricultural Remote Sensing Centre:</b> remote sensing, agriculture</li> </ul> </li> </ul>
<b>Quantum technologies</b>	
UNSW	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> Silicon quantum computing, quantum sensing using organic materials</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Centre for Quantum Computation and Communication Technology (CQC2T):</b> quantum communication for secure information capture, processing, storage and transmission; optical quantum computation; silicon quantum computation; quantum communication, distributed quantum computation, quantum sources, detectors and memory, architectures and control</li> <li>○ <b>Silicon Quantum Computing:</b> commercialisation of silicon quantum electronics, building a prototype 10-qubit silicon quantum computer (partnering with Australian and NSW Governments, Commonwealth Bank, Telstra)</li> </ul> </li> </ul>
USYD	<ul style="list-style-type: none"> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Sydney Nanoscience Hub – Quantum Nanoscience Lab and Quantum Control Lab:</b> advanced quantum measurement and instrumentation capabilities, quantum control and metrology (partnering with Microsoft via the global Station Q network)</li> <li>○ <b>ARC CoE for Engineered Quantum Systems (EQuS):</b> cross-disciplinary research in quantum physics, nanotechnology, quantum materials, quantum enabled diagnostics and imaging, quantum engines and instruments</li> <li>○ <b>Q-Ctrl:</b> spin-out startup focused on control techniques to stabilise quantum bits for quantum computers, quantum sensors and related technology (partnering with IBM)</li> </ul> </li> </ul>
UTS	<ul style="list-style-type: none"> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Centre for Quantum Software and Information:</b> quantum algorithms and complexity, AI applications of quantum computing, intermediate quantum computing and architectures, quantum programming and verification, quantum information theory and security</li> <li>○ <b>Centre for Quantum Computation and Communication Technology (CQC2T):</b> architectures, simulation and algorithms</li> </ul> </li> </ul>
MQ	<ul style="list-style-type: none"> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Macquarie University Research Centre in Quantum Science and Technology (QSCITECH):</b> quantum simulations and algorithms; quantum sensing applications, nano-diamonds for applications in quantum science and biology; quantum optics and photonics; hybrid quantum systems for sensing, communications and computing</li> <li>○ <b>ARC CoE for Engineered Quantum Systems (EQuS):</b> nano-diamonds for quantum-based applications including quantum information technology and sensing</li> </ul> </li> </ul>
UoW	<ul style="list-style-type: none"> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Institute of Cybersecurity and Cryptology (iC2):</b> post-quantum cryptography, quantum-proof encryption algorithms (partnering with US National Institute of Standards and Technology (NIST)).</li> </ul> </li> </ul>

## NSW R&amp;D Capabilities in Advanced Manufacturing

<b>(A) Advanced sensors and data analytics</b>	
<p><i>Now: Predominantly used during production (remote monitoring of single attributes such as temperature or flow rates).</i>  <i>In the future: Applied across the value chain, including predictive maintenance, logistical tracking for operational efficiencies, quality control and service offering (when integrated into end product) (CSIRO, 2016).</i></p>	
MQ	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> antennas, air quality, biomedical sensors, photonics, astrophotonics, gas sensing, fibre sensing, lasers, environmental monitoring, water quality, health monitoring, small scale medical body-area communications, IR, remote sensing capacitive sensors, chemical sensors, electrochemical sensors, gesture recognition, motion sensing, natural language processing, computation linguistics, signal and image processing, AI</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Biomedical Imaging and Sensing Group:</b> MRI, biomedical signal processing, optical sensing, MEMs biomimetic sensors, wearable and implantable devices,</li> <li>○ <b>Optical and Photonics Engineering research group:</b> high power fibre lasers, mid-infrared fibre sources, mid-infrared light interactions, microwave photonics, microstructured polymer waveguides, terahertz technology, systems and applications</li> <li>○ <b>Macquarie University Photonics Research Centre:</b> photonic sources, laser applications, terahertz photonics, novel waveguide lasers, topological beams, unbleached UV lasers, natural and engineered optical materials, advanced semiconductor materials and applications, astrophotonics, quantum photonics</li> </ul> </li> </ul>
UNSW	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> antennas, sensors for autonomous vehicles, biosensors, eye tracking, gas sensors, signal and image processing, lasers, optics, photonics, smart plasmonic sensors, remote sensing, spectroscopy, wireless sensors, distributed network sensors, space sensors, optical fibre sensors, immunosensors, porous silicon sensors, optical towed-array sonars (partnering with Thales, Zeddef); ferroelectric crystals for sonar (partnering with USN ONR), ground penetrating probes (partnering with NASA JPL), underground positioning systems, big data integration</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Biosensors and Biointerfaces Group:</b> biosensors, immunosensors, electrochemical detection, porous silicon sensors, nanoparticle-based biosensors, smart plasmonic sensors</li> <li>○ <b>Australian Centre for Space Engineering Research (ACSER):</b> space sensors</li> <li>○ <b>Data to Decisions CRC:</b> big data integration, analytics, prediction, and policy (partnering with Dept. of Defence, DST, BAE, Leidos)</li> <li>○ <b>Innovative Manufacturing CRC:</b> sensors and data analysis</li> </ul> </li> </ul>
UoN	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> remote sensing, environmental monitoring, health monitoring</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Centre for Space Physics:</b> Remote sensing near-Earth space, electromagnetic wave monitoring</li> </ul> </li> </ul>
USYD	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> air quality, photonics, quantum integrated photonics, nanophotonics, sensors for autonomous vehicles, sensors for agriculture, environmental monitoring, medical and health monitoring sensors, optical sensing, ultrafast optical and non-linear signal processing, remote sensing, spectroscopy, sensors for food quality and safety, space sensors, biosensors, electromedical sensors, ground penetrating radar, image processing, data mining and analytics</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Australian Centre for Field Robotics:</b> sensors for autonomous vehicles, implemented in air, land and sea environments</li> <li>○ <b>The University of Sydney Nano Institute:</b> nanophotonics, all-optical and nonlinear signal processing, mid-infrared photonics and single photon generation</li> <li>○ <b>UBTECH Sydney Artificial Intelligence Centre:</b> artificial intelligence for image capture and processing, data mining and analytics, and advanced probabilistic methods</li> </ul> </li> </ul>
UTS	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> air quality, biosensors, environmental monitoring, nanophotonics, signal and image processing, remote sensing, laser scanning systems, computer vision, large-scale surveillance, water quality, wireless sensor networks, information processing, machine learning, human behaviour recognition, AI, big data analytics,</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Advanced Analytics Institute (AAI):</b> information processing, visualisation, machine learning, human behaviour recognition, adaptive intelligent software agents, cyber-physical systems</li> <li>○ <b>UTS Photonics laboratories:</b> optical fibres, devices, grating fabrication, laser processing, novel 3D printing.</li> <li>○ <b>Centre for Advanced Modelling and Geospatial Information Systems (CAMGIS):</b> remote sensing, digital image processing, laser scanning systems; optical, IR, thermal, hyper-spectral sensors</li> <li>○ <b>Data to Decisions CRC:</b> big data integration, analytics, prediction, and policy (partnering with Dept. of Defence, DST, BAE, Leidos)</li> </ul> </li> </ul>

UoW	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> chemical and electrical sensing networks, intelligent polymers and nanostructures, organic conductors, air quality, environmental monitoring, signal processing, IoT, wireless sensor networks, distributed AI, low power wireless communications</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Intelligent Polymer Research Institute (lead node of Electromaterials Science CoE and materials node of ANFF):</b> intelligent polymers and nanostructures, electrochemistry and applications of organic conductors, chemical and electrical sensing networks</li> <li>○ <b>SMART Infrastructure Facility and SMART IoT hub:</b> prototyping; low-cost and low power water level, air quality, air pressure, pedestrian sensors</li> <li>○ <b>Information and Communication Technology Research Institute and Signals, Information and Communications Research Institute:</b> signal and information processing, emerging networks and applications, wireless sensor networks, low power wireless communications</li> </ul> </li> </ul>
WSU	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> neuromorphic cognition and event-based sensors, health monitoring, neural network architectures for sensors</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>The MARCS Institute for Brain, Behaviour and Development:</b> Neuromorphic systems (BENS); event-based sensors, neuromorphic cognition, microelectronic 3D imaging, neuromorphic recognition, human-machine interaction; multisensory communication; speech and language (partnering with Defence, NATO)</li> <li>○ <b>Biomedical Engineering and Neuromorphic Systems Research Program:</b> improved electronic signal processing systems applying neuromorphic engineering approaches</li> </ul> </li> </ul>
CSIRO <sup>1</sup>	<ul style="list-style-type: none"> <li>• <b>Data61 at Eveleigh</b></li> </ul>

<sup>1</sup> Includes only CSIRO capabilities based in NSW.

<b>(B) Smart robotics and automation</b> <i>Now: Replace workers for tasks that are complex, high precision, repetitive, dull or hazardous e.g. handling operations and robotic welding.</i> <i>In the future: Assistive robots that work collaboratively with humans and each other, with improved sensing, awareness and decision-making capabilities that allow full autonomy and self-learning behaviour (CSIRO, 2016).</i>	
MQ	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> language technology, language processing, machine learning, computer-human interface</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Centre for Language Technology:</b> Natural language processing, computational linguistics and language technology, information extraction, text summarisation, machine learning, data science, controlled natural languages as high level specification languages, Processable English (PENG) and Situation Awareness by Inference and Logic (SAIL) (partnering with DST)</li> <li>○ <b>Intelligent Systems Research Group:</b> data mining, machine learning, knowledge mining</li> </ul> </li> </ul>
UNSW	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> advanced control, perception, sensors, data fusion, precision guidance, testing, simulation, artificial intelligence, machine learning, human-robot interface, swarms</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Robotics and Autonomous Systems Research Group:</b> advanced flight and ground control systems, perception, localisation, navigation, precision guidance, path tracking, sensors and fusion, vectored trust aerial vehicles, dynamic modelling and simulation, optimisation, cooperative control</li> <li>○ <b>Autonomous Systems Laboratory:</b> ground and aerial vehicle design, build and testing, sensor integration, sensing and data fusion, path planning, mapping and localization, precision navigation of unmanned ground vehicles, communications, control systems</li> <li>○ <b>Trusted Autonomy (UNSW Canberra):</b> AI, transparent and explainable AI, biometrics including multimodel biometrics, cognitive engineering, neuroengineering, intelligent control, game play, simulation, guidance including distributed guidance, human performance, human-autonomy teaming, human-swarm interaction, machine learning, multi-agent systems, swarm robotics, sensing and machine vision, skill-bootstrapping, computational motivation</li> <li>○ <b>ARC Training Centre for Automated Manufacture of Advanced Composites (AMAC):</b> complex shapes, metal-composite hybrids, impact and damage assessments, smart materials (partnering with DST)</li> <li>○ <b>Nano/Micro Systems Research Group:</b> MEMS/CMOS fabrication and circuits, bio-medical microelectronics, micro-actuators, nanofabrication, solid state devices, ultra-low power CMOS</li> <li>○ <b>Systems and Control Research Group:</b> automated signal processing and interpretation, power system control, guidance, hybrid dynamical systems, networked control systems, neural coding, real-time control and controller implementation, signal processing</li> <li>○ <b>Innovative Manufacturing CRC:</b> automation and robotics</li> <li>○ <b>Data to Decisions CRC:</b> big data integration, analytics, prediction, and policy (partnering with Dept. of Defence, DST, BAE, Leidos)</li> </ul> </li> </ul>
UoN	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> Robotics, automated manufacturing systems, AI, image processing, machine learning, dynamic systems, optimisation, precision mechatronics</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Newcastle Robotics Laboratory:</b> Adaptive control, artificial emotions, AI, classification and clustering, machine learning, companion robots, computational neuroscience, data mining, digital control, image processing, dimensionality reduction, evolutionary computation, extended Kalman filters, feedback control and regulation, manifold learning, motor control and legged locomotion, neural networks, reinforcement learning, robot programming, support vector machines, vision systems</li> <li>○ <b>Priority Research Centre for Complex Dynamic Systems and Control:</b> mathematical modelling and analysis, dynamic systems, optimisation, scheduling, estimation, signal processing, communication systems, electrical machines, power electronics and drive</li> <li>○ <b>Precision Mechatronics Laboratory:</b> piezo robotics, piezo actuators and amplifiers, biomedical devices, electroactive optics, nanopositioner design and control theory,</li> </ul> </li> </ul>
USYD	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> robotics principles and systems, sensors and fusion, machine learning and adapting, perception and path planning, navigation, fabrication and assembly, test facilities, multidisciplinary approach, ethics, law and regulation, AI, analytics, social robotics</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Australian Centre for Field Robotics:</b> robotics principles and systems; sensors, fusion and perception; movement, control and decisions; modelling, system identification, learning and adapting; architectures, cooperation, intelligent systems; perception and path planning; sensing, navigation, imaging; dynamic walking robots; electronics fabrication and assembly, anechoic test facility, environmental test chamber, flight-vehicle fabrication laboratory, remote aviation test facility (partnering with DST, South Korea Agency of Defence Development)</li> <li>○ <b>Centre for Robotics and Intelligent Systems:</b> multidisciplinary centre – ethical, economic, legal, educational and employment implications of robotics and intelligence systems; machine perception and sensing, information modelling, data fusion, managing uncertainty; decision making and</li> </ul> </li> </ul>

	<p>interaction; systems development (partnering with Thales, DST, Ford, Rio Tinto, Qantas, TfNSW)</p> <ul style="list-style-type: none"> <li>○ <b>UBTECH Sydney Artificial Intelligence Centre:</b> artificial intelligence for image capture and processing, data mining and analytics, and advanced probabilistic methods</li> <li>○ <b>Human-centred Technology Research Group:</b> emotional and affect sensors, social robotics, machine learning, data mining, personalisation, human-robot interfaces (natural language, visualisation, touch, movement)</li> <li>○ <b>Trusted Autonomous Systems Defence CRC:</b> littoral operations (partnering with Thales, DST)</li> <li>○ <b>Centre for Translational Data Science:</b> big data, machine learning and data science</li> <li>○ <b>Centre for Distributed and High Performance Computing:</b> algorithmics and analytics; clouds, green computing and virtualisation; internetworking and IoT, and service computing</li> </ul>
UTS	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> AI, machine learning, brain-computer interface, computation intelligence, human behaviour recognition, social robotics, prototypes, proof-of-concept systems, big data processing and analytics, IoT</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Centre for Autonomous Systems (CAS):</b> robots in unknown and complex environments, assistive robotics, human-robot interaction, robotics for maintenance, prototypes (partnering with RMS)</li> <li>○ <b>Centre for Artificial Intelligence (CAI):</b> AI, computer vision, machine learning, brain computer interface, social robotics, computational intelligence, Computation intelligence and Brain-Computer Interface (CIBCI) lab</li> <li>○ <b>Advanced Analytics Institute (AAI):</b> information processing, visualisation, machine learning, human behaviour recognition, adaptive intelligent software agents, cyber-physical systems</li> <li>○ <b>Computational Intelligence and Brain Computer Interface Centre:</b> AI systems, wearable devices, hardware design, signal processing, machine learning, BCI integrated platforms</li> <li>○ <b>Trusted Autonomous Systems Defence CRC:</b> land networked autonomy (partnering with BAE, DST)</li> <li>○ <b>Global Big Data Technologies Centre:</b> mission critical ad-hoc networks (e.g. high capacity, low latency passive sensor networks); communication networks for UAVs; meta-material based antennas and arrays; underwater object recognition; computational intelligence and brain computer interfaces</li> <li>○ <b>Data to Decisions CRC:</b> big data integration, analytics, prediction, and policy (partnering with Dept. of Defence, DST, BAE, Leidos)</li> </ul> </li> </ul>
UoW	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> autonomous jiggling and welding, lean manufacturing automation, application in defence, autonomous vehicles, complex systems, operations research, pattern recognition and computer vision</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Defence Materials Technology Centre (DMTC):</b> robotics for jiggling and welding; lean automation (partnering with Thales, DST)</li> <li>○ <b>Facility for Intelligent Fabrication (FIF):</b> application of welding and automation-related technology in defence industry</li> <li>○ <b>Decision Systems Lab:</b> applied A, autonomous vehicles, complex systems and decision making, and operations research (partnering with BAE)</li> <li>○ <b>Institute of Cybersecurity and Cryptology (iC<sup>2</sup>):</b> machine learning, pattern recognition and computer vision, data fusion, visual authentication</li> <li>○ <b>Centre for Big Data Analytics and Intelligent Systems:</b> distributed AI, collective intelligence in social systems, big data analytics, decision-making and problem solving, multi-agent technology, smart modelling and simulations in complex systems, data mining, machine learning, IoT</li> </ul> </li> </ul>
WSU	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> signal and image processing, computer vision, knowledge representation and reasoning, blockchain, intelligent agents, machine learning, information security, power electronics and drive systems</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Robotics, Vision and Signal Processing (RVSP) Research Group:</b> signal and image processing, pattern recognition, computer vision and computational intelligence in robotic applications</li> <li>○ <b>Artificial Intelligence Research Group (AIRG):</b> Knowledge representation and reasoning; computational properties of existential rules; Answer Set Programming (ASP); Blockchain: data integrity verification, access control frameworks, data query; Intelligent agents: automated negotiation, reasoning strategies, trading agents; Machine learning: image processing, AI real time analysis and adaption; network security, secured cloud data access, rule-based control.</li> <li>○ <b>Intelligent &amp; Sustainable Systems Research Group:</b> power electronics and drive systems, actuators, induction and reluctance generators, power system protection, micro electromechanical devices, Fuzzy Logic Control Systems, Neuro-Fuzzy Applications</li> </ul> </li> </ul>

<b>(C) Augmented and virtual reality</b>	
<p><i>Now: Predominantly restricted to gaming and consumer electronic markets, with limited use in the manufacturing sector.</i>  <i>In the future: Used to overlay product designs with end-use environments, optimise machine settings in the virtual world, facilitate remote collaboration and train or guide workers through complex/dangerous tasks (CSIRO, 2016).</i></p>	
MQ	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> wireless and sensing technologies, human-computer interface, neurological devices</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Virtual and Interactive Simulations of Reality (VISOR) research group:</b> human-computer interaction, virtual reality, graphics, interactive storytelling</li> <li>○ <b>WiMed Research Centre:</b> wireless and sensing technologies, biocompatible materials and sensors, neurological devices</li> <li>○ <b>Department of Cognitive Science:</b> non-invasive transcranial brain and electrical stimulation, eye tracking, language acquisition, behavioural cognition, body perception and control</li> <li>○ <b>Centre for Elite Performance:</b> machine-human interactions, creativity in movement-based expertise, VR and AR, eye tracking</li> </ul> </li> </ul>
UNSW	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> speech signal processing and analysis, human decision science, eye tracking</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Human decision science:</b> human decision processes, computational modelling, cognition, emotion, eye tracking, physiological measurement, VR, machine learning</li> <li>○ <b>Speech signal processing:</b> automatic inference of emotion and mental state from speech and other biometrics, voice biometrics, automatic language and pronunciation identification, behavioural and biomedical signal processing, automatic task analysis (partnering with US Army, ITC-Pacific)</li> <li>○ <b>Innovative Manufacturing CRC:</b> augmented and virtual reality</li> </ul> </li> </ul>
UoN	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> human performance monitoring, cognitive load and decision making, human interface</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Centre for Medical Engineering Research:</b> multidisciplinary centre, image analysis, virtual reality</li> <li>○ <b>i3 Lab:</b> simulations, assessment and modelling of cognitive load and decision making, human interface systems, stress, gamification, VR and AR programs</li> </ul> </li> </ul>
USYD	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> visualisation, wearable, sensor and telemetry technologies, data fusion</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>ARC Training Centre for Innovative Bioengineering:</b> wearable technologies; materials, design and fabrication technologies; sensor and telemetry technologies</li> <li>○ <b>Innovative Manufacturing CRC:</b> augmented and virtual reality</li> </ul> </li> </ul>
UTS	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> data visualisation, machine learning, 3D imaging, biosensing surfaces</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>UTS Data Arena:</b> 360-degree interactive data visualisation facility</li> <li>○ <b>Perceptual Imaging Lab (PILab):</b> AR, VR, 3D imaging, 3D scanning, colour, psychophysics, image and signal processing, machine learning, human vision and perception, affective computing, machine learning and optics</li> <li>○ <b>ARC Training Centre for Innovative Bioengineering:</b> wearable technologies; materials, design and fabrication technologies; sensor and telemetry technologies</li> <li>○ <b>Computational Intelligence and Brain Computer Interface Centre:</b> AI, natural cognition, cognition neuroscience, human performance augmentation, wearable and wireless neuroimaging devices, VR, signal processing, machine learning, BCI integrated platforms</li> <li>○ <b>Innovative Manufacturing CRC:</b> augmented and virtual reality</li> </ul> </li> </ul>
UoW	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> virtual reality systems, data visualisation, smart materials, macro/micro/nano actuators,</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Institute of Cybersecurity and Cryptology (iC<sup>2</sup>):</b> machine learning, pattern recognition and computer vision, data fusion, data visualisation, visual authentication and virtual reality systems (partnering with Australian Signals Directorate (ASD), DST, Data 61)</li> <li>○ <b>Intelligent Polymer Research Institute:</b> Development and application of smart materials, mechanically-active materials, fabrication and assembly of smart materials into devices</li> </ul> </li> </ul>
WSU	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> human-machine interaction, multisensory communication, speech and language, biomedical engineering, bioinstrumentation, health informatics</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>The MARCS Institute for Brain, Behaviour and Development:</b> Biomedical engineering and neuromorphic systems (BENS); human-machine interaction; multisensory communication; music cognition and action; speech and language</li> <li>○ <b>Bioelectronics Neuroscience (BENS) Research Group:</b> neuromorphic engineering and intelligent sensors, devices</li> </ul> </li> </ul>

(D) Advanced materials	
<p><i>Now: Reactive use to address specific product limitations e.g. enhanced durability, weight, look and feel.</i></p> <p><i>In the future: Proactive integration at early design phase to offer multiple novel attributes e.g. biocompatibility, biodegradability, energy efficiency and self-repairing (CSIRO, 2016).</i></p>	
MQ	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> fabrication of materials</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Materials Engineering Research Group:</b> fabricating materials and micro-devices; nanoparticles for chemical and optical detection of molecules; electrical, mechanical and optical detection for particles, molecules and physiological states</li> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul> </li> </ul>
UNSW	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> composites, modelling and simulation, biomaterials, nanotechnology, metallurgy</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Materials Science and Engineering Research Groups:</b> biomaterials, ceramics, composites, electronic and superconducting ceramics, failure analysis, computational analysis, modelling, high-temperature materials, energy conversion, nanotechnology, nanomaterials for hydrogen storage, metallurgy, polymers, metallurgy (partnering with Lockheed Martin, GE Aerospace, CSIRO)</li> <li>○ <b>Centre for Sustainable Materials Research and Technology (SMaRT):</b> recycling and material transformation, sustainability of material processes</li> <li>○ <b>Impact Dynamics Research Group:</b> dynamic loading testing, visualisation, data capture, diagnostics, characterisation</li> <li>○ <b>Advanced Composite Research Unit:</b> advanced composite materials and structures for aerospace, marine, automotive and construction industries</li> <li>○ <b>ARC Training Centre for Automated Manufacture of Advanced Composites (AMAC):</b> complex shapes, metal-composite hybrids, impact and damage assessments, smart materials (partnering with DST)</li> <li>○ <b>ARC Training Centre for Fire Retardant Materials and Safety Technologies:</b> advanced fire retardant materials and structures</li> <li>○ <b>Innovative Manufacturing CRC:</b> advanced materials</li> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul> </li> </ul>
UoN	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> nanostructured fluids, nanomaterials, energy applications, simulation, modelling and failure mechanics, corrosion</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Newcastle Institute for Energy and Resources (NIER):</b> Advanced Materials for Energy Application research concentration: organic solar cells, nanostructured fluids, responsive polymers, alloy materials for thermal storage; Centre for Ironmaking Materials Research (CIMR): iron ore sintering and cokemaking processes (partnering with BHP Billiton).</li> <li>○ <b>Global Innovative Centre for Advanced Nanomaterials (GICAN):</b> development, characterisation and application of multi-dimensional advanced functional mesoporous materials, and multidimensional nano-hybrid materials</li> <li>○ <b>Materials Engineering Research Group:</b> simulation and modelling, thermodynamics of solids, ceramics, failure mechanics, microstructural and crystal structure analysis, corrosion</li> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul> </li> </ul>
USYD	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> nanomaterials, nanomechanics, biomaterials, composites, smart materials, testing and characterisation, structural materials, corrosion</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>University of Sydney Nano Institute:</b> synthesis of nanomaterials, nanocomposites, nanotubes, nanowires, nanoparticles and carbon-based materials, physical and chemical characterisation, new characterisation technologies and methods, materials for energy conservation and storage, sensors, biomedical applications, tissue process, self-assembly</li> <li>○ <b>Centre for Advanced Materials Technology:</b> nanomechanics and nanotribology, nano and bio-materials, smart materials and structures, eco-materials, superhard films and coatings, polymer blends and alloys, and functionally graded materials</li> <li>○ <b>Centre for Advanced Structural Engineering:</b> structural stability and thin-walled structures; composite structures; reinforced and concrete structures; adaptive structural systems; experimental techniques; materials science;</li> <li>○ <b>Institute of Biomedical Engineering and Technology:</b> biomaterials for tissue repair and regeneration, biomaterials for orthopaedic implants, biomaterials and stem cells, characterisation of biomaterials (safety, toxicity, biocompatibility and biodegradability)</li> <li>○ <b>Advanced materials facilities:</b> mechanical testing, microscopy and materials characterisation, smart materials and structure, nano mechanical technology and testing, advanced composites and manufacturing laboratories</li> <li>○ <b>ARC Training Centre for Innovative BioEngineering:</b> biomaterial design and fabrication for musculoskeletal tissue regeneration</li> <li>○ <b>Innovative Manufacturing CRC:</b> advanced materials</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul>
UTS	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> nanomaterials, biomedical materials</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Innovative Manufacturing CRC:</b> advanced materials</li> <li>○ <b>Institute for Biomedical Materials and Devices (IBMD):</b> fabrication and analysis of nanomaterials; biophotonics, biotechnology</li> <li>○ <b>Institute for Nanoscale Technology (INT):</b> Synthetic nano-chemistry, analytical chemistry, materials for energy storage, medical nanomaterials, nano-metallurgy, materials for solar energy and thermal control, nano-plasmonics</li> </ul> </li> </ul>
UoW	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> steels, polymers, superconducting materials, intelligent materials, nanotechnology, organic conductors, superconductors, electronic materials, materials and condensed matter physics</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Defence Materials Technology Centre (DMTC):</b> Materials and construction techniques for fabrication of land, marine, aerospace &amp; personnel survivability platforms: materials selection, welding, wire arc additive manufacturing, optimal joint properties, robotics for jiggling and welding; lean automation; surface processing; high strength steels; programming, manipulation and scanning; weld and component modelling (partnering with Thales, DST, ANSTO, Bluescope, Bisalloy)</li> <li>○ <b>Australian Institute of Innovative Materials and Institute for Superconducting and Electronic Materials:</b> multifunction materials facility (design to commercialisation), design and fabrication, applied superconductivity for devices; energy conversion and transmission; spintronic and electronic materials for applications; terahertz science; and nano-structured materials, body armour (partnering with DoD, DST)</li> <li>○ <b>Intelligent Polymer Research Institute (lead node of Electromaterials Science CoE and materials node of ANFF):</b> intelligent polymers and nanostructures, nanotechnology, electrochemistry and applications of organic conductors, nano biotechnology and biomaterials, cellular interactions, chemical and electrical sensing networks</li> <li>○ <b>National Facility for Physical Blast Simulation (NFPBS):</b> purpose-built blast simulator, high-speed data acquisition system, high-speed cameras; analysis of blast pressure, structural deformations and material strain</li> <li>○ <b>Engineering Materials Research Centre (EMRC) and Steel Research Hub:</b> design, synthesis and characterisation of advanced ferrous materials</li> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul> </li> </ul>
WSU	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> materials characterisation, construction, and structures; composites, nano-composites, concrete, simulation, modelling</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Advanced Materials and Smart Structures (AMSS) research group:</b> Materials and processing: nano-composite materials and structures, functional nanostructures and self-assembly, thermal interface materials, carbon fibre composites; smart structures and safety: composite construction, fibre reinforced polymer composites for structures, assessment and rehabilitation of structures,</li> <li>○ <b>Centre for Infrastructure Engineering:</b> safety and reliability of structures; sustainability; materials development, application, characterisation, recycling, remediation, disposal, modelling and monitoring; high performance steel, concrete (recycled, geopolymer), fibre reinforced cementitious composites, geofoam, metal foams, and nanocomposites</li> <li>○ <b>Centre for Smart Modern Construction:</b> composite structural materials</li> <li>○ <b>Advanced Materials Characterisation Facility (AMCF):</b> characterisation of materials and biological structures at nano and micro scales, chemical composition, thermal analysis</li> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul> </li> </ul>
ANSTO <sup>2</sup>	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> materials analysis, advanced materials for radiochemistry and nuclear, granular materials, fatigue, energy materials, planetary materials, nuclear fuels</li> </ul>
CSIRO <sup>3</sup>	<ul style="list-style-type: none"> <li>● <b>CSIRO Lindfield</b></li> <li>● <b>CSIRO Newcastle Energy Research Hub</b></li> </ul>

<sup>2</sup> Includes only ANSTO capabilities based in NSW.

<sup>3</sup> Includes only CSIRO capabilities based in NSW.

<b>(E) Additive, precision and sustainable manufacturing and processing technologies</b>	
<p><i>Now: Prototyping and one-off production runs of customised high-value complex metal componentry and low-value consumer products, with high capital costs stalling wider spread adoption.</i></p> <p><i>In the future: Reduced capital costs will allow greater adoption of the technology for production of complete complex products and associated advanced business models such as customer-led design and just-in-time production (CSIRO, 2016).</i></p>	
MQ	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> fabrication of materials and micro-devices, microprocessing, microfabrication</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Materials Engineering Research Group:</b> fabricating materials and micro-devices; nanoparticles for chemical and optical detection of molecules; electrical, mechanical and optical detection for particles, molecules and physiological states</li> <li>○ <b>OptoFab (ANFF Node):</b> microprocessing, microfabrication and characterisation of fibre, planar and bulk materials: glass, metals, ceramics, silicon, polymers and crystals.</li> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul> </li> </ul>
UNSW	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> precision and nano processing, multi-scale fabrication and advanced manufacturing, sustainable manufacturing, modelling and simulation, automation</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Materials Science and Engineering Research Groups:</b> pyrometallurgical processes, energy conversion, nanotechnology, sustainable processing, metallurgy (partnering with Lockheed Martin, GE Aerospace, CSIRO)</li> <li>○ <b>Manufacturing Engineering Research Groups:</b> precision and nano processing: precision manufacturing, bio-manufacturing, nanotechnology, characterisation, tribology, solid and computational mechanics; multi-scale fabrication and advanced manufacturing: abrasive jet machining, laser and laser-assisted fabrication and machining, micro-cutting and cutting tools, additive manufacturing; sustainable manufacturing and life cycle engineering</li> <li>○ <b>Australian National Fabrication Facility (ANFF) NSW node:</b> nanofabrication, three electron beam lithography systems, full Si-MOS process line and tools for MOS-incompatible processes to run in parallel, molecular beam epitaxy systems</li> <li>○ <b>Centre for Sustainable Materials Research and Technology (SMaRT):</b> recycling and material transformation, sustainability of material processes, sustainable manufacturing</li> <li>○ <b>Innovative Manufacturing CRC:</b> Additive manufacturing, automation and robotics</li> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul> </li> </ul>
UoN	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> simulation, modelling and failure mechanics, corrosion</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Materials Engineering Research Group:</b> simulation and modelling, thermodynamics of solids, ceramics, failure mechanics, microstructural and crystal structure analysis, corrosion</li> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul> </li> </ul>
USYD	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> testing and characterisation, high precision and nano manufacturing, additive manufacturing, corrosion</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>University of Sydney Nano Institute:</b> synthesis of nanomaterials, nanocomposites, nanotubes, nanowires, nanoparticles and carbon-based materials, physical and chemical characterisation, new characterisation technologies and methods, self-assembly</li> <li>○ <b>Centre for Advanced Materials Technology:</b> ultraprecision and nano-machining, fracture mechanics</li> <li>○ <b>Centre for Advanced Structural Engineering:</b> prefabricated systems; modular construction; high-performance buildings; adaptive structural systems; experimental techniques</li> <li>○ <b>Innovative Manufacturing CRC:</b> Additive manufacturing, automation and robotics</li> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul> </li> </ul>
UTS	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> additive manufacturing, prototyping, high speed metal printing</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Innovative Manufacturing CRC:</b> Additive manufacturing, automation and robotics</li> <li>○ <b>ProtoSpace and UTS Rapido:</b> additive and advanced manufacturing facility: prototyping up to 1m<sup>3</sup>, rapid metal printing, fused, melting and direct energy deposition; scanning; multihead, hybrid 3D, multimaterials and colour printers (partnering with HP)</li> <li>○ <b>Institute for Biomedical Materials and Devices (IBMD):</b> fabrication and analysis of nanomaterials; biophotonics, biotechnology, and nanoparticle synthesis labs: upconversion nanoplateforms (UNCP) characterisation, production, analysis and control</li> <li>○ <b>Microstructural Analysis Unit (MAU):</b> advanced microscopy, characterisation and fabrication</li> </ul> </li> </ul>
UoW	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> design, fabrication, welding, robotics, automation, testing, nanotechnology</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Defence Materials Technology Centre (DMTC):</b> Materials and construction techniques for fabrication of land, marine, aerospace &amp; personnel survivability platforms: materials selection, welding, wire arc additive manufacturing, optimal joint properties, robotics for jiggging and welding; lean automation; surface processing; weld and component modelling (partnering with Thales, DST,</li> </ul> </li> </ul>

	<p>ANSTO, Bluescope, Bisalloy)</p> <ul style="list-style-type: none"> <li>○ <b>Facility for Intelligent Fabrication (FIF):</b> application of welding and automation-related technology in defence industry</li> <li>○ <b>Welding Engineering Research Group:</b> welding process technology, materials weldability, robotic demonstration, laser welding, microstructural analysis</li> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul>
WSU	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> construction, and structures: safety, rehabilitation, energy efficiency, simulation, modelling</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Advanced Materials and Smart Structures (AMSS) research group:</b> Materials and processing: nano-composite materials and structures, functional nanostructures and self-assembly</li> <li>○ <b>Centre for Smart Modern Construction:</b> energy efficiency, simulation and modelling of materials and structures, supply chain optimisation</li> <li>○ Member of Advanced Manufacturing Growth Centre (AMGC)</li> </ul> </li> </ul>

<b>(F) Quantum Technologies</b>	
<i>In the future: Used in quantum sensing technologies improving manufacturing the production processes; quantum simulations to improve material design, simulation and fabrication; secure quantum communications.</i>	
MQ	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> quantum simulations and theory, nano-diamonds, quantum sensing</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Macquarie University Research Centre in Quantum Science and Technology (QSCITECH):</b> quantum simulations and algorithms; quantum sensing applications, nano-diamonds for applications in quantum science and biology; quantum optics and photonics; hybrid quantum systems for sensing, communications and computing</li> <li>○ <b>ARC CoE for Engineered Quantum Systems (EQuS):</b> nano-diamonds for quantum-based applications including quantum information technology and sensing</li> </ul> </li> </ul>
UNSW	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> Silicon quantum computing, quantum sensing using organic materials</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Centre for Quantum Computation and Communication Technology (CQC2T):</b> quantum communication for secure information capture, processing, storage and transmission; optical quantum computation; silicon quantum computation; quantum communication, distributed quantum computation, quantum sources, detectors and memory, architectures and control (partnering with NASA, Lockheed Martin, DST, IBM)</li> <li>○ <b>Silicon Quantum Computing:</b> commercialisation of silicon quantum electronics, building a prototype 10-qubit silicon quantum computer (partnering with Australian and NSW Governments, Commonwealth Bank, Telstra)</li> </ul> </li> </ul>
USYD	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> topological quantum architecture, spin qubits, trapped ions, quantum theory</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Sydney Nanoscience Hub – Quantum Nanoscience Lab and Quantum Control Lab:</b> advanced quantum measurement and instrumentation capabilities, quantum control and metrology (partnering with Microsoft via the global Station Q network)</li> <li>○ <b>ARC CoE for Engineered Quantum Systems (EQuS):</b> cross-disciplinary research in quantum physics, nanotechnology, quantum materials, quantum enabled diagnostics and imaging, quantum engines and instruments</li> <li>○ <b>Q-Ctrl:</b> spin-out startup focused on control techniques to stabilise quantum bits for quantum computers, quantum sensors and related technology (partnering with IBM)</li> </ul> </li> </ul>
UTS	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> quantum software and information processing</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Centre for Quantum Software and Information:</b> quantum algorithms and complexity, AI applications of quantum computing, intermediate quantum computing and architectures, quantum programming and verification, quantum information theory and security</li> <li>○ <b>Centre for Quantum Computation and Communication Technology (CQC2T):</b> architectures, simulation and algorithms</li> </ul> </li> </ul>
UoW	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> Post-quantum cryptography</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Institute of Cybersecurity and Cryptology (iC2):</b> post-quantum cryptography, quantum-proof encryption algorithms (partnering with US National Institute of Standards and Technology (NIST).</li> </ul> </li> </ul>

<b>Industry collaboration</b>	
<i>Summary of selected advanced manufacturing technologies where there are significant and/or multiple existing collaborations between the university and industry.</i>	
MQ	<ul style="list-style-type: none"> <li>• <b>Technologies:</b> quantum <i>[TBD – awaiting data from uni]</i></li> </ul>
UNSW	<ul style="list-style-type: none"> <li>• <b>Technologies:</b> advanced composites, nanocomposites, biosensors, photonics, energy storage, silicon solar cells, autonomous systems, advanced manufacture of solar cells, quantum control, bioprinting, additive manufacturing, sustainable manufacturing</li> </ul>
UoN	<ul style="list-style-type: none"> <li>• <b>Technologies:</b> biosensors, machine learning, data analytics and optimisation, remote sensing, autonomous control, VR and AR, advanced nanomaterials, metallic and carbon foams, additive manufacturing</li> </ul>
USYD	<ul style="list-style-type: none"> <li>• <b>Technologies:</b> quantum computing and technologies, autonomous systems, nanotechnology, data analytics and optimisation, sensing, photonics, <i>[TBD – awaiting data from uni]</i></li> </ul>
UTS	<ul style="list-style-type: none"> <li>• <b>Technologies:</b> autonomous systems, maintenance, smart materials, additive manufacturing, <i>[TBD – awaiting data from uni]</i></li> </ul>
UoW	<ul style="list-style-type: none"> <li>• <b>Technologies:</b> lean automated manufacturing, automated welding, advanced alloys, advanced steels, electromaterials, surface engineering, material durability, additive manufacturing, simulations, VR, process analytics and optimisation, sensors</li> </ul>
WSU	<ul style="list-style-type: none"> <li>• <b>Technologies:</b> <i>[TBD – awaiting data from uni]</i></li> </ul>

## NSW R&D Capabilities in Digitalisation Technology

### Summary of capability of NSW universities

Machine learning, AI, IoT and autonomous systems	
UNSW	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Robotics and Autonomous Systems Research Group:</b> advanced flight and ground control systems, perception, localisation, navigation, precision guidance, path tracking, sensors and fusion, vectored trust aerial vehicles, dynamic modelling and simulation, optimisation, cooperative control</li> <li>○ <b>Autonomous Systems Laboratory:</b> ground and aerial vehicle design, build and testing, sensor integration, sensing and data fusion, path planning, mapping and localization, precision navigation of unmanned ground vehicles, communications, control systems</li> <li>○ <b>Trusted Autonomy (UNSW Canberra):</b> AI, transparent and explainable AI, biometrics including multimodal biometrics, cognitive engineering, neuroengineering, intelligent control, game play, simulation, guidance including distributed guidance, human performance, human-autonomy teaming, human-swarm interaction, machine learning, multi-agent systems, swarm robotics, sensing and machine vision, skill-bootstrapping, computational motivation</li> </ul>
USYD	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Australian Centre for Field Robotics:</b> robotics principles and systems; sensors, fusion and perception; movement, control and decisions; modelling, system identification, learning and adapting; architectures, cooperation, intelligent systems; perception and path planning; sensing, navigation, imaging; dynamic walking robots; electronics fabrication and assembly, anechoic test facility, environmental test chamber, flight-vehicle fabrication laboratory, remote aviation test facility</li> <li>○ <b>Centre for Robotics and Intelligent Systems:</b> multidisciplinary centre – ethical, economic, legal, educational and employment implications of robotics and intelligence systems; machine perception and sensing, information modelling, data fusion, managing uncertainty; decision making and interaction; systems development</li> <li>○ <b>UBTECH Sydney Artificial Intelligence Centre:</b> artificial intelligence for image capture and processing, data mining and analytics, and advanced probabilistic methods</li> <li>○ <b>Human-centred Technology Research Group:</b> emotional and affect sensors, social robotics, machine learning, data mining, personalisation, human-robot interfaces (natural language, visualisation, touch, movement)</li> <li>○ <b>Trusted Autonomous Systems Defence CRC:</b> littoral operations</li> <li>○ <b>Digital farm:</b> predictive analytics and machine learning, robotic/autonomous sensing, control, learning and systems engineering for agriculture</li> </ul>
UTS	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Centre for Autonomous Systems (CAS):</b> robots in unknown and complex environments, assistive robotics, human-robot interaction, robotics for maintenance, prototypes (partnering with RMS)</li> <li>○ <b>Centre for Artificial Intelligence (CAI):</b> AI, computer vision, machine learning, brain computer interface, social robotics, computational intelligence, Computation intelligence and Brain-Computer Interface (CIBCI) lab</li> <li>○ <b>Advanced Analytics Institute (AAI):</b> information processing, visualisation, machine learning, human behaviour recognition, adaptive intelligent software agents, cyber-physical systems</li> <li>○ <b>Trusted Autonomous Systems Defence CRC:</b> land networked autonomy</li> <li>○ <b>Australian Artificial Intelligence Unit:</b> AI, advanced algorithms, data science, machine learning, brain computer interface, bioinspired neural networks and information systems</li> </ul>
UoN	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Newcastle Robotics Laboratory:</b> Adaptive control, artificial emotions, AI, classification and clustering, machine learning, companion robots, computational neuroscience, data mining, digital control, image processing, dimensionality reduction, evolutionary computation, extended Kalman filters, feedback control and regulation, manifold learning, motor control and legged locomotion, neural networks, reinforcement learning, robot programming, support vector machines, vision systems</li> <li>○ <b>Priority Research Centre for Complex Dynamic Systems and Control:</b> mathematical modelling and analysis, dynamic systems, optimisation, scheduling, estimation, signal processing, communication systems, electrical machines, power electronics and drive</li> <li>○ <b>Precision Mechatronics Laboratory:</b> piezo robotics, piezo actuators and amplifiers, biomedical devices, electroactive optics, nanopositioner design and control theory,</li> </ul>

UoW	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Defence Materials Technology Centre (DMTC):</b> robotics for jiggling and welding; lean automation</li> <li>○ <b>Facility for Intelligent Fabrication (FIF):</b> application of welding and automation-related technology in defence industry</li> <li>○ <b>Decision Systems Lab:</b> applied A, autonomous vehicles, complex systems and decision making, and operations research (partnering with BAE)</li> </ul>
WSU	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Robotics, Vision and Signal Processing (RVSP) Research Group:</b> signal and image processing, pattern recognition, computer vision and computational intelligence in robotic applications</li> <li>○ <b>Artificial Intelligence Research Group (AIRG):</b> Knowledge representation and reasoning; computational properties of existential rules; Answer Set Programming (ASP); Blockchain: data integrity verification, access control frameworks, data query; Intelligent agents: automated negotiation, reasoning strategies, trading agents; Machine learning: image processing, AI real time analysis and adaption; network security, secured cloud data access, rule-based control.</li> <li>○ <b>Intelligent &amp; Sustainable Systems Research Group:</b> power electronics and drive systems, actuators, induction and reluctance generators, power system protection, micro electromechanical devices, Fuzzy Logic Control Systems, Neuro-Fuzzy Applications</li> </ul>
MQ	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Centre for Language Technology:</b> Natural language processing, computational linguistics and language technology, information extraction, text summarisation, machine learning, data science, controlled natural languages as high level specification languages, Processable English (PENG) and Situation Awareness by Inference and Logic (SAIL)</li> </ul>
<b>Communication, computer science and software engineering</b>	
UNSW	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Wireless Communications Lab:</b> design and test facilities, M2M communication transceivers technologies and protocols, IoT, 5G, wireless powered communication networks, cross-layer coding, delayed bit interleaved coded modulation</li> <li>○ <b>Telecommunications Research Group:</b> multiuser information theory, processing and iterative receiver design, wireless network coding, cooperative communications, cognitive radio, dedicated short range communications, wireless sensor networks, security and trust, telepresence systems, quantum coding for communications, speech processing, cognitive load measurement, signal processing, compression, image enhancement, polymer and silica optical fibres, photonic fibre device and sensors, diamond-based optical circuitry, self-assembly photonic materials</li> <li>○ <b>Energy Systems Research Group:</b> renewable generation and integration, power system operations, protection systems, storage, power electronics, electric drive systems</li> <li>○ <b>Nano/Micro Systems Research Group:</b> microwave and millimetre-wave systems, MEMS/CMOS fabrication and circuits, bio-medical microelectronics, cryogenic environments, micro-actuators, nanofabrication, solid state devices, ultra-low power CMOS</li> <li>○ <b>Systems and Control Research Group:</b> automated signal processing and interpretation, power system control, guidance, hybrid dynamical systems, networked control systems, neural coding, real-time control and controller implementation, reconfigurable computing, signal processing, stochastic systems and control, system identification</li> <li>○ <b>Australian National Fabrication Facility (ANFF) NSW node:</b> advanced semiconductor manufacturing, nanofabrication</li> <li>○ <b>Australia-US Institute for Advanced Photovoltaics and Australian PV Institute:</b> silicon solar cells, organic and earth-abundant inorganic thin-film cells, optics, characterisation, manufacturing</li> <li>○ <b>Solar Industrial Research Facility (SERF):</b> silicon wafer solar cells, fabrication and characterisation</li> <li>○ <b>School of chemical engineering:</b> food processing, ultrasonics, Radio Frequency Plasma, modelling</li> </ul>
USYD	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> IoT, photonic signal processing, microwave photonics, wireless engineering, millimetre wave communications, cooperative wireless heterogeneous systems, ultra-dense networks, energy harvesting, wireless powered communications, nanoengineering, power engineering</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Centre for IoT and Telecommunications:</b> IoT connectivity, analytics and intelligence; passive and cognitive radios for IoT; wireless engineering, millimetre wave communications, wireless imaging, 5G, ultra-dense networks, energy harvesting techniques for the Internet of</li> </ul> </li> </ul>

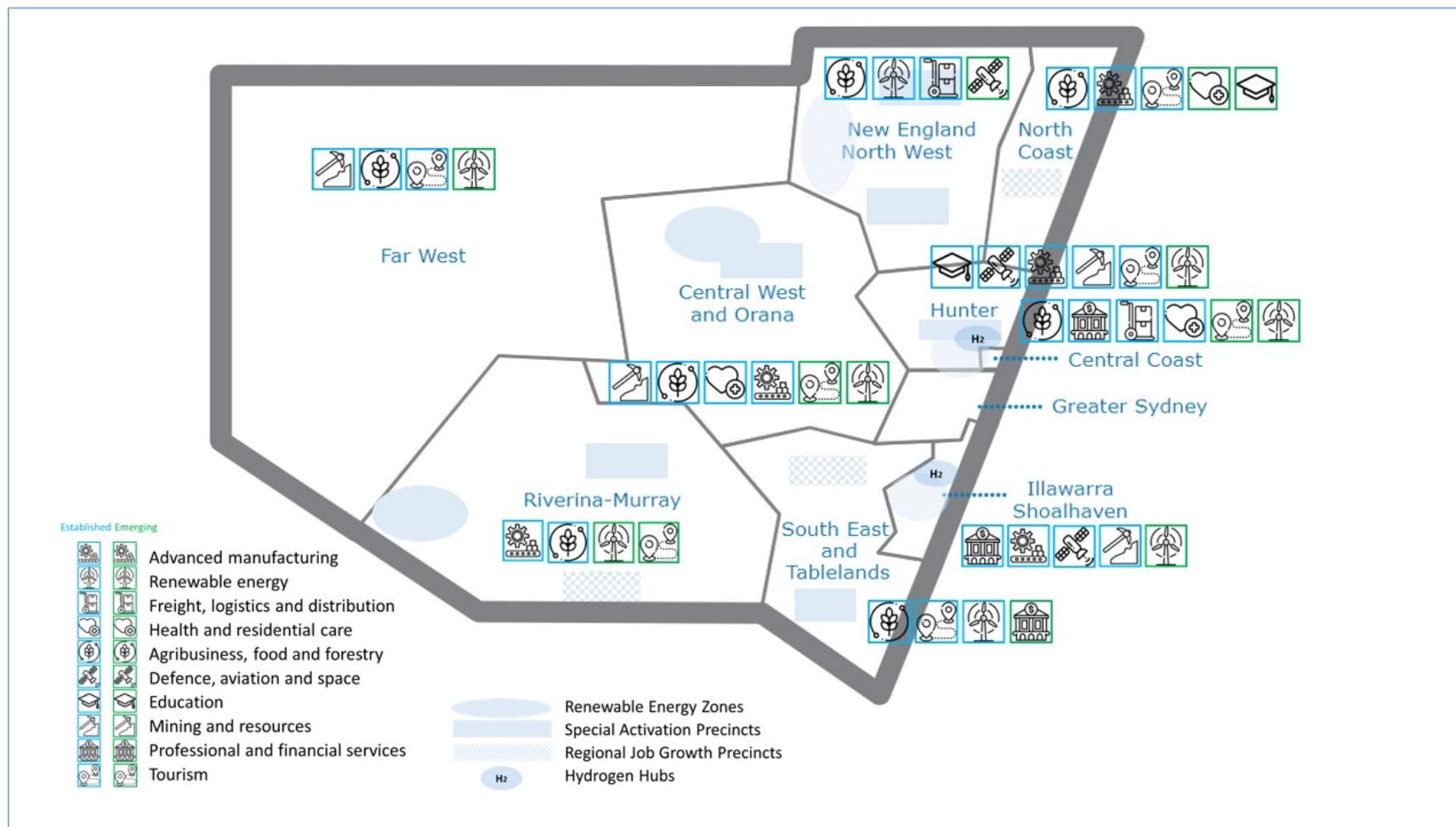
	<p>Things (IoT), wireless powered communications, network visualisation and software-defined networks, public safety communications and IoT security</p> <ul style="list-style-type: none"> <li>○ <b>Fibre-optics and photonics engineering research group:</b> integrated microwave photonics, photonic signal processing, non-invasive biosensing technologies, optoelectronic sensing technology, nonlinear fibre optics, photonic crystals for terahertz applications, optically-controlled phased arrays</li> <li>○ <b>The University of Sydney Nano Institute:</b> nanobots, hybrid plasmonic waveguide for on-chip photonic devices, integrated microwave photonics, linking fundamental to applied photonics, nano-engineered reversible energy storage, nanoscale photonic circuits</li> <li>○ <b>Sir William Tyree Power Engineering Laboratory:</b> a scaled physical model of a power system with metering, controls, protection choices, and capability to reconfigure networks with different parameters and load choices</li> <li>○ <b>Sydney Informatics Hub:</b> support, training, research in data management, statistics, data science, software engineering, simulation, visualisation, bioinformatics, research computing</li> </ul>
UTS	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> electrical machines, power electronics, control electronics, power systems, smart grid, wireless communications, photonics, biomedical devices, AI, high-speed data communication</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Wireless Communications and Networking Lab:</b> 5G communications networks, multiple-input multiple-output (MIMO) techniques, wireless sensing, Software Defined Networking (SDN), IoT, Blockchain applications, testing (partnering with Intel, NBN, NSW DPI)</li> <li>○ <b>Photonics Laboratories (iPL):</b> interdisciplinary research for novel materials, processes, optical fibres, devices and applications of photonic technologies for IoT</li> <li>○ <b>Centre for Electrical Machines and Power Electronics (CEMPE):</b> electrical machines, electromagnetics, magnetic materials, power electronics, control electronics, control engineering, power systems and smart grid</li> <li>○ <b>Centre for Artificial Intelligence (CAI):</b> AI, computer vision, machine learning, brain computer interface, social robotics, computational intelligence, Computation intelligence and Brain-Computer Interface (CIBCI) lab</li> <li>○ <b>Global Big Data Technologies Centre:</b> high-speed data communications, reconfigurable and cognitive antennas and radio systems, super-sensitive receivers, low-latency data transfers, signal processing and software defined networks,</li> <li>○ <b>Centre for Real-time Information Networks (CRIN):</b> Intelligent transport systems: Applying sensing, information gathering and processing, telecommunications, data analytics to improve the performance of transportation systems. Security, Trust and Privacy Research Program: prevention, detection of attacks, preservation of information security and privacy, IoT security, cloud security. Wireless embedded networked sensing and localisation: embedding of detection, processing and communications technology, wireless embedded networked sensors and applications.</li> <li>○ <b>Centre for Clean Energy Technology:</b> Advanced battery technologies for automotive and smart electricity grid applications, supercapacitors for high power applications, hydrogen production and storage, hydrogen fuel-cells, bio-fuel cells, powertrain for electric and hybrid cars, graphene</li> <li>○ <b>Institute of Biomedical Materials and Devices:</b> nanophotonics and nanomedicine</li> <li>○ <b>Radio Frequency and Communication Technologies (RFCT) Lab:</b> embedded RF prototyping, sustainable FR technologies and RF device management through software</li> </ul> </li> </ul>
MQ	<ul style="list-style-type: none"> <li>● <b>Strengths:</b> wireless communications, antenna engineering, photonics, reconfigurable electronics and antennas, future wireless networks, 5G</li> <li>● <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Wireless Communications Research Team:</b> electromagnetic and microwave engineering, nonlinear electronic circuits and systems, satellite communications, VLSI design and computer architecture, wireless communications, signal processing, compression and encryption, low-power design, interference mitigation, cognitive radio networks, underwater acoustic sensor networks, cloaking, ultra-wideband and super-wideband planar antenna, wireless localisation</li> <li>○ <b>Centre for Electromagnetic and Antenna Engineering:</b> antennas, cavity resonators, antenna arrays, microstrip antennas</li> <li>○ <b>Future Wireless Networks research group:</b> mobile cellular network architectures, heterogeneous networks, body area networks, mm-wave network architectures, cognitive communication systems, ad-hoc networks, device-to-device communications, spectrum sharing, SDN, signal processing</li> <li>○ <b>Reconfigurable Electronics and Antennas research group:</b> reconfigurable electronics and antennas</li> <li>○ <b>Macquarie University Photonics Research Centre:</b> photonic sources, laser applications, terahertz photonics, novel waveguide lasers, topological beams, unabled UV lasers, natural</li> </ul> </li> </ul>

	and engineered optical materials, advanced semiconductor materials and applications, astrophotonics, quantum photonics
UoN	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> wireless networks, smart grids, mesh/relay networks, secure communications, signal processing, organic electronics, photovoltaics, energy technologies, dynamic systems, optimisation, scheduling</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Telecommunications Networks Research Groups:</b> self-configurable Field Area Networks (FAN)s, smart grid communications, cognitive wireless networks, protocols for AUV swarms, self-organising networks, power optimised mesh/relay networks, ad hoc wireless mesh networks, energy efficient wireless sensor networks</li> <li>○ <b>Signal Processing Microelectronics Research Centre:</b> MIMO communications testing, model predictive control, future wireless, system identification, filtering and smoothing, variance quantification, network information theory,</li> <li>○ <b>Centre for Secure and Reliable Communications:</b> data transmission in multi-terminal communication networks, near-capacity codes for communications channel conditions, information-theoretic security, optimising and managing 5G networks, quantum key distribution</li> <li>○ <b>Priority Research Centre for Complex Dynamic Systems and Control:</b> mathematical modelling and analysis, dynamic systems, optimisation, scheduling, estimation, signal processing, communication systems, electrical machines, power electronics and drive</li> <li>○ <b>Priority Research Centre for Organic Electronics:</b> organic solar cells, organic thin film transistors and devices, organic photonic devices, scanning helium microscopy</li> <li>○ <b>Priority Research Centre for Frontier Energy Technologies and Utilisation:</b> low emission technologies for process industries and generation, renewable energy systems, energy efficiency, transportation fuels, energy confusion</li> </ul> </li> </ul>
WSU	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> power electronics and drive systems, wireless and mobile networks</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Intelligence and Sustainable Electrical Systems Research Group:</b> micro-electrical devices, power quality issues, motors, actuators, power electronics, generators, renewable energy and conversion,</li> <li>○ <b>Networking, Security and Cloud Research (NSCR) Group:</b> Wireless and mobile networks, ad hoc networks, sensor networks, performance modelling and analysis, and application of AI in networked systems, IoT, network security, and secure cloud</li> </ul> </li> </ul>
UoW	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> signal and information processing, wireless sensor networks</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Information and Communication Technology Research Institute and Signals, Information and Communications Research Institute:</b> signal and information processing, emerging networks and applications, communications research laboratory, wireless sensor networks, low power wireless communications, link schedulers for next-gen networks</li> </ul> </li> </ul>
<b>Quantum technologies</b>	
UNSW	<ul style="list-style-type: none"> <li>• <b>Strengths:</b> Silicon quantum computing, quantum sensing using organic materials</li> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Centre for Quantum Computation and Communication Technology (CQC2T):</b> quantum communication for secure information capture, processing, storage and transmission; optical quantum computation; silicon quantum computation; quantum communication, distributed quantum computation, quantum sources, detectors and memory, architectures and control</li> <li>○ <b>Silicon Quantum Computing:</b> commercialisation of silicon quantum electronics, building a prototype 10-qubit silicon quantum computer (partnering with Australian and NSW Governments, Commonwealth Bank, Telstra)</li> </ul> </li> </ul>
USYD	<ul style="list-style-type: none"> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Sydney Nanoscience Hub – Quantum Nanoscience Lab and Quantum Control Lab:</b> advanced quantum measurement and instrumentation capabilities, quantum control and metrology (partnering with Microsoft via the global Station Q network)</li> <li>○ <b>ARC CoE for Engineered Quantum Systems (EQuS):</b> cross-disciplinary research in quantum physics, nanotechnology, quantum materials, quantum enabled diagnostics and imaging, quantum engines and instruments</li> <li>○ <b>Q-Ctrl:</b> spin-out startup focused on control techniques to stabilise quantum bits for quantum computers, quantum sensors and related technology (partnering with IBM)</li> </ul> </li> </ul>
UTS	<ul style="list-style-type: none"> <li>• <b>Capabilities:</b> <ul style="list-style-type: none"> <li>○ <b>Centre for Quantum Software and Information:</b> quantum algorithms and complexity, AI applications of quantum computing, intermediate quantum computing and architectures, quantum programming and verification, quantum information theory and security</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ <b>Centre for Quantum Computation and Communication Technology (CQC2T):</b> architectures, simulation and algorithms</li> </ul>
MQ	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Macquarie University Research Centre in Quantum Science and Technology (QSCITECH):</b> quantum simulations and algorithms; quantum sensing applications, nano-diamonds for applications in quantum science and biology; quantum optics and photonics; hybrid quantum systems for sensing, communications and computing</li> <li>○ <b>ARC CoE for Engineered Quantum Systems (EQuS):</b> nano-diamonds for quantum-based applications including quantum information technology and sensing</li> </ul>
UoW	<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>○ <b>Institute of Cybersecurity and Cryptology (iC2):</b> post-quantum cryptography, quantum-proof encryption algorithms (partnering with US National Institute of Standards and Technology (NIST)).</li> </ul>

## Regional NSW Industry Profile and Opportunities

This document is prepared for the NSW R&D Platform which is an initiative under the Accelerating Research and Development NSW Action Plan. This mapping exercise stocktakes regional industry profiles and identifies development opportunities based on their economy size, infrastructure investment, workforce and innovation activities. The result is visualised in a map below, supported by a summary table and detailed assessment.



Summary Table

Industry		Advanced manufacturing	Agribusiness, food and forestry	Defence, aviation and space	Education	Freight, logistics and distribution	Health and residential care	Mining and resources	Professional and financial services	Renewable energy	Tourism
<b>Central Coast</b>	Economy		●			●	●		●	●	●
	Infrastructure		●			●	●		●		
			●			●	●		●		
	Innovation		●			●	●		●		
	Economy	●	●				●	●		●	●
	Infrastructure	●	●				●	●		●	
	Workforce	●	●				●	●		●	
		●	●				●	●		●	
	Economy	●		●	●			●		●	●
		●		●	●			●		●	●
	Workforce	●		●	●			●		●	●
	Innovation	●		●	●			●		●	●
<b>Illawarra-Shoalhaven</b>	Economy	●		●				●	●	●	
	Infrastructure	●		●				●	●	●	
	Workforce	●		●				●	●	●	
	Innovation	●		●				●	●	●	
	Economy		●	●		●				●	
			●			●				●	
			●			●				●	
			●			●				●	
	Economy	●	●		●		●				●
	Infrastructure	●	●		●		●				●
	Workforce	●	●		●		●				●

Industry		Advanced manufacturing	Defence, aviation and space	Education	Mining and resources	Professional and financial services	Renewable energy	Tourism
Riverina-Murray	Innovation	●	●					●
	Economy	●	●				●	●
	Infrastructure	●	●				●	●
	Workforce	●	●					
	Innovation	●	●					
South East and Tablelands	Economy		●			●	●	●
			●			●	●	●
	Workforce		●			●	●	●
	Innovation		●				●	
Far West	Economy		●			●	●	●
	Infrastructure		●			●	●	●
	Workforce		●			●		
	Innovation		●			●		

## Contents

<b>Regional NSW Industry Profile and Opportunities</b> .....	<b>1</b>
Summary Table .....	2
1. NSW Regional Industry Opportunities .....	5
1.1. Central Coast.....	5
1.2. Central West and Orana .....	8
1.3. Hunter .....	11
1.4. Illawarra-Shoalhaven.....	14
1.5. New England-North West.....	16
1.6. North Coast.....	18
1.7. Riverina-Murray .....	21
1.8. South East and Tablelands.....	23
1.9. Far West .....	26
2. NSW new industrial precincts, renewable energy zones and hydrogen hubs .....	28
2.1. Special Activation Precincts and Regional Jobs Precincts .....	28
2.2. Renewable Energy Zones.....	31
2.3. Hydrogen Hubs .....	32
Reference.....	35

## 1. NSW Regional Industry Opportunities

### 1.1. Central Coast

#### 1.1.1. Regional economy and demographic profile

Regional GDP	Population			Employment			Business
	Estimated residential in 2020	Forecast growth to 2041	Tertiary Education	Employed persons	Unemployment rate	Working age population	
<b>\$10.9 billion</b>	344,016	431,864	59.1%	140,759	6.9%	58.2%	22,604

#### 1.1.2. Established industry

Industry	Economic values	Workforce	Infrastructure	Innovation activities (R&D hubs and precincts)	Key players
<b>Agribusiness and food</b>	\$114 million agricultural production by value, poultry processing and nursery and cut flowers accounting for 60% and 20% respectively.	1,166 employed	<ul style="list-style-type: none"> <li>- Proximity to the M1 motorway and NorthConnex motorway tunnel</li> <li>- International market access via Port of Newcastle or Port Botany (Sydney)</li> <li>- Growing hub for food and agricultural innovation and research centres</li> </ul>	<ul style="list-style-type: none"> <li>- Food manufacturing specialisation</li> <li>- Central Coast Food Innovation Cluster</li> <li>- DPI Central Coast and Tocal Institute</li> </ul>	Sanitarium, Sara Lee Bakery (McCain), MasterFoods (Mars Food) and Life Health Food, FMC (US based agricultural science company), LowerSTC
<b>Professional and financial services</b>	322 financial and insurance companies added between 2013 and 2017, 22% growth	11.1% of total employment in the region	<ul style="list-style-type: none"> <li>- Gosford City Centre redevelopment</li> <li>- Broad range of affordable commercial property options</li> </ul>	<ul style="list-style-type: none"> <li>- Central Coast Education and Employment Precinct</li> </ul>	ServicesAustralia, ATO and NSW government agencies

Industry	Economic values	Workforce	Infrastructure	Innovation activities (R&D hubs and precincts)	Key players
			<ul style="list-style-type: none"> <li>- Early adoption of National Broadband Network with download speeds up to 100MBps</li> <li>- Just over one hour by road or rail to Sydney CBD.</li> </ul>		
<b>Freight, logistics and distribution</b>		Over 5,000 people employed	<ul style="list-style-type: none"> <li>- Major investments in the Pacific Highway and NorthConnex motorway</li> <li>- Access to Port Botany or Port of Newcastle via Sydney-Newcastle railway line.</li> </ul>		Woolworth logistic center, Freighthinx,
<b>Health and residential care</b>	Health and aged care services contributes \$1.6 billion to NSW economy	22,294 people employed contributing to 16% of total local employment	<ul style="list-style-type: none"> <li>- \$348 million Gosford Hospital redevelopment project</li> <li>- \$200 million Wyong Hospital redevelopment</li> <li>- Nine community health care centres</li> </ul>	- Central Coast Education and Employment Precinct	Local hospitals and health care centres, Aurrum

*1.1.3. Emerging industry*

Industry	Economic potential and opportunities	Infrastructure development and planning	Innovation activities
<b>Tourism</b>	Around 9 per cent of total tourism expenditure in regional NSW occurs in Central Coast. Tourism has been steadily increasing since 2010 with a 3.8% average annual increase in overnight stays and total expenditure of \$722.2 million in the year ended June 2019.	- Transport and logistic infrastructure development projects will support the growth tourism industry to attract visitors from Sydney and other large cities.	
<b>Renewable Energy</b>	Great local solar energy potential and NSW local government area that has the highest installed small scale solar capacity (2012 data) <sup>1</sup>	- Hunter-Central Coast Renewable Energy Zones is under development at early stages of feasibility studies.	UoN Ourimbah Campus

<sup>1</sup> NSW Government. <https://energy.nsw.gov.au/sites/default/files/2018-12/NSW%20Renewable%20Energy%20Action.pdf>

## 1.2. Central West and Orana

### 1.2.1. Regional economy and demographic profile

Regional GDP	Population			Employment			Business
	Estimated residential in 2020	Forecast growth to 2041	Tertiary Education	Employed persons	Unemployment rate	Working age population	
\$ 14.5 billion	290,604	306,011	57.1%	129,467	6.2%	60.6	28,165

### 1.2.2. Established industry

Industry	Economic values	Workforce	Infrastructure	Innovation activities, R&D hubs and precincts	Key players
<b>Mining and resources</b>	Contributing \$1.7 billion to NSW economy and 16.8% of total NSW gross value added	5,000 employed, with over 15% hold tertiary qualifications in engineering and technologies.	<ul style="list-style-type: none"> <li>- Significant deposits of coal, gold copper and high-grade nickel, cobalt and lithium.</li> <li>- Existing gold and copper mining and coal production and proposals to further develop critical mineral deposits.</li> </ul>		<ul style="list-style-type: none"> <li>- CMOC</li> <li>- Northparkes</li> </ul>
<b>Agribusiness and food</b>	6.3% of total NSW gross value added in agribusiness and food and 6% of NSW's total agricultural production	18% of Regional NSW agribusiness and food manufacturing workers.	<ul style="list-style-type: none"> <li>- Main Western railway line to Adelaide and Sydney, road transport to</li> </ul>	<ul style="list-style-type: none"> <li>- Parkes Special Activation Precinct</li> <li>- Orange Agri-Finance Hub</li> <li>- NSW DPI research facilities in</li> </ul>	

Industry	Economic values	Workforce	Infrastructure	Innovation activities, R&D hubs and precincts	Key players
	from sheep, beef cattle and grain farming.		Adelaide, Brisbane, Melbourne and Sydney	Trangie, Orange, Cowra and Condobolin	
<b>Health and residential care</b>	Health care and social assistance sector contributed \$1.3 billion to NSW state economy, 3.7% of the total contribution in the state from health and aged care. There were 901 new companies added to the sector between 2013 and 2017, presenting a 3.3% growth.	16,500 employed in the region's health care and social assistance sector	<ul style="list-style-type: none"> <li>- \$241 million Dubbo hospital redevelopment</li> <li>- \$70.7 million Mudgee hospital redevelopment</li> </ul>	<ul style="list-style-type: none"> <li>- USYD's School of Rural Health in Orange and Dubbo deliver education and research programs</li> <li>- The Royal Flying Doctor Service is based in Dubbo and offers a multi-million dollar flight simulator training facility.</li> </ul>	<ul style="list-style-type: none"> <li>- Local hospitals and health care centres</li> <li>- USYD</li> </ul>
<b>Advanced manufacturing</b>	Contributing to \$464 million in value to NSW economy. There are 930 manufacturing businesses in the region with a 3.8% growth in number from 2013 to 2017.	6,993 employed , 6.5% of local workforce	<ul style="list-style-type: none"> <li>- Freight hubs and major roads with access to major cities</li> <li>- Parkes SAP</li> </ul>	<ul style="list-style-type: none"> <li>- CSIRO as partner for SAPs development</li> </ul>	<ul style="list-style-type: none"> <li>- Mars</li> <li>- S&amp;P Industrial</li> </ul>

*1.2.3. Emerging industry*

Industry	Economic potential and opportunities	Infrastructure development and planning	Innovation activities
<b>Renewable energy</b>	Central-West Orana (CWO) REZ pilot expects to attract \$5.2 billion private investment for a 3,000 MW new electricity capacity. NSW Government has committed over \$40 million for the CWO REZ	- A study corridor has been identified by TransGrid and NSW Government for the new shared transmission infrastructure to connect CWO REZ to the national electricity grid	- TransGrid is actively seeking innovative solutions for energy systems in the CWO REZ
<b>Tourism</b>	Tourism industry is growing with emerging strengths in ecotourism, gastronomy and wine. Tourism expenditure reached \$1.9 billion in 2019 with an annual average increase of 8.7% since 2010.	- Inland rail corridor and access to major cities and international airport	

### 1.3. Hunter

#### 1.3.1. Regional economy and demographic profile

Regional GDP	Population			Employment			Business
	Estimated residential in 2020	Forecast growth to 2041	Tertiary Education	Employed persons	Unemployment rate	Working age population	
\$34.7 billion	747,944	863,131	58.3%	306,239	7.6%	60%	50,862

#### 1.3.2. Established industry

Industry	Economic values	Workforce	Infrastructure	Innovation activities, R&D hubs and precincts	Key players
<b>Education</b>	Attracting international students with a wide range of undergraduate and postgraduate programs. Growing cluster of innovation and well-connected to industry customers.	25,751 employed in education and training	- Research infrastructure located at UoN's five campuses, CSIRO and private organisations	- Energy and Resources Knowledge Hub - CSIRO Energy Centre - Port Stephens Fisheries Institute - Newcastle Institute for Energy and Resources - Three76 Hub (Newcastle Innovation Hub)	- University of Newcastle - Hunter Innovation Network - CSIRO

Industry	Economic values	Workforce	Infrastructure	Innovation activities, R&D hubs and precincts	Key players
				<ul style="list-style-type: none"> <li>- Upper Hunter Innovation Hub</li> <li>- Dantia Smart Hub (DaSH) and</li> <li>- Hunter Medical Research Institute.</li> </ul>	
<b>Defence</b>	Defence industry contributes \$944 million to NSW economy leveraging \$11.7 million NSW Government Investment in Williamstown	Highly skilled workforce for aerospace, ship building and naval and commercial vessel maintenance	<ul style="list-style-type: none"> <li>- Coastal locations to serve defence maritime, land and aerospace projects</li> <li>- RAAF Base Williamstown and Australian Army Singleton Military Area Base</li> <li>- Williamstown SAP</li> </ul>	<ul style="list-style-type: none"> <li>- Williamstown Defence Hub</li> <li>- UoN's I2N Hub Williamstown</li> </ul>	<ul style="list-style-type: none"> <li>- Thales</li> <li>- RAFF</li> <li>- NSW Government</li> <li>- Boeing</li> <li>- BAE Systems</li> <li>- Lockheed Martin</li> <li>- Raytheon</li> </ul>
<b>Advanced manufacturing</b>	Almost 2000 businesses that contribute \$2 billion to NSW economy with diverse advanced manufacturing capabilities in serving mining, defence, chemical processing, construction and energy sectors.	19,656 employees and every one in four have a STEM education	<ul style="list-style-type: none"> <li>- Access to rail, port and airport and close to Sydney in supplying products and services</li> </ul>	<ul style="list-style-type: none"> <li>- Eighteen04 (CleanTech incubator)</li> <li>- HunterNet</li> </ul>	<ul style="list-style-type: none"> <li>- Cowan Manufacturing</li> <li>- Hedweld</li> <li>- UoN</li> </ul>
<b>Mining and resources</b>	Mining industries accounts for 38% of economic output of Hunter region.	17,700 employees (2012 data)	<ul style="list-style-type: none"> <li>- Connectively to major markets via railway,</li> </ul>	<ul style="list-style-type: none"> <li>- UoN and Newcastle Institute for</li> </ul>	<ul style="list-style-type: none"> <li>- Glencore</li> <li>- Yancoal</li> <li>- NIER</li> <li>- KEPCO</li> </ul>

Industry	Economic values	Workforce	Infrastructure	Innovation activities, R&D hubs and precincts	Key players
			road, port and local airport.	Energy and Resource - CSIRO Energy	- Malabar Coal
<b>Tourism</b>	Over 2,200 businesses contributing \$238.6 million to NSW economy. 8.1% annual increase on average in visitors since year ended June 2010 with 12.9 million international and domestic visitors in year ending June 2019	25,000 employees accounting for 8% of regional total	- Hunter Valley's wine, food, hospitality and tourism infrastructure - Newcastle airport		- Newcastle airport and port

### 1.3.3. Emerging industry

Industry	Economic potential and opportunities	Infrastructure development and planning	Innovation activities
Renewable Energy	Existing electricity infrastructure and transmission networks could support large renewable projects in the region. Close to energy load centres and have access to deep sea port for hydrogen exporting.	- Hunter-Central Coast REZ in early planning stage - One of the two initial hydrogen hubs identified by NSW Government	- UoN, NIER and CSIRO are working on hydrogen trials and demo projects. - Hunter NERA Cluster

## 1.4. Illawarra-Shoalhaven

### 1.4.1. Regional economy and demographic profile

Regional GDP	Population			Employment			Business
	Estimated residential in 2020	Forecast growth to 2041	Tertiary Education	Employed persons	Unemployment rate	Working age population	
\$15.5 billion	420,140	504,910	59.7%	165,053	6.9%	64.1%	24,934

### 1.4.2. Established industry

Industry	Economic values	Workforce	Infrastructure	Innovation activities, R&D hubs and precincts	Key players
Professional and finance services	\$2.8 billion to NSW economy	Over 16,000 employee and almost 60% of the workshop is tertiary educated	<ul style="list-style-type: none"> <li>- NBN and access to high speed internet</li> <li>- 7.3MW Tier 3 data centre</li> </ul>	<ul style="list-style-type: none"> <li>- UoW Innovation Campus</li> <li>- iAccelerate (incubator)</li> </ul>	<ul style="list-style-type: none"> <li>- Stellar</li> <li>- Commonwealth Government (Department of Human Services and Health)</li> </ul>
Advanced manufacturing	Over 954 businesses with a strong heavy industry history	9,904 employee, one in four are in STEM and almost 60% manufacturing workers have trade certificate or higher	<ul style="list-style-type: none"> <li>- Access to heavy industry zones with 24/7 operation time</li> <li>- Rail, road, port and air links to domestic and</li> </ul>	<ul style="list-style-type: none"> <li>- UoW and significant research capabilities in advanced materials, automation, robotics and steel</li> </ul>	<ul style="list-style-type: none"> <li>- Bisalloy Steels, Manildra, BlueScope, NowChem and CSR</li> </ul>

Industry	Economic values	Workforce	Infrastructure	Innovation activities, R&D hubs and precincts	Key players
			international markets		
Defence	Long history of defence	Highly skilled and experienced workforce	- HMAS Albatross - HMAS Creswell	- Abatross Aviation Technology Park	- Sikorsky, Lockheed Martin and BAE Systems
Mining and resources	Coal mining and export	Highly skilled and experienced workforce	- Rail, road and port with access to markets		- Centennial Coal South32

#### 1.4.3. Emerging industry

Industry	Economic potential and opportunities	Infrastructure development and planning	Innovation activities
Renewable Energy	Existing electricity infrastructure and transmission networks could support large renewable projects in the region. Close to energy load centres and have access to deep sea port for hydrogen exporting.	- Illawarra REZ in early planning stage - One of the two initial hydrogen hubs identified by NSW Government - Proposals around hydrogen export facilities and demo projects for local users	- UoW - Local industries are trailing hydrogen projects

## 1.5. New England-North West

### 1.5.1. Regional economy and demographic profile

Regional GDP	Population			Employment			Business
	Estimated residential in 2020	Forecast growth to 2041	Tertiary Education	Employed persons	Unemployment rate	Working age population	
\$8.4 billion	187,071	190,965	55.7%	87,296	6.4%	60.6%	20,256

### 1.5.2. Established industry

Industry	Economic values	Workforce	Infrastructure	Innovation activities, R&D hubs and precincts	Key players
Agribusiness and food processing	Output accounts for 4.9% of NSW total	11,292 employees with 6% tertiary educated in agriculture and environmental degrees (compared to 2% national level)	<ul style="list-style-type: none"> <li>- Inland rail, road and airways</li> <li>- Investments in regional airports and highways</li> <li>- Moore SAP</li> </ul>	<ul style="list-style-type: none"> <li>- UNE (smart region incubator)</li> <li>- TAFE</li> <li>- NSW DPI institutes at Glen Inners, Armidale, Tamworth</li> <li>- Australian Cotton Research Institute</li> <li>- CSIRO</li> </ul>	<ul style="list-style-type: none"> <li>- Costa Group</li> <li>- UNE</li> </ul>

Industry	Economic values	Workforce	Infrastructure	Innovation activities, R&D hubs and precincts	Key players
Renewable energy	Established solar and wind generation, great potential in bioenergy, hydro and geothermal energy. 71 new energy and electricity services businesses between 2011 and 2017.	700 new jobs created in last three years	<ul style="list-style-type: none"> <li>- Energy infrastructure, interconnector upgrades</li> <li>- New England REZ</li> </ul>	<ul style="list-style-type: none"> <li>- UNE</li> </ul>	<ul style="list-style-type: none"> <li>- Goldwind</li> <li>- Partners Group and CWP Renewables</li> </ul>
Freight, logistics and distribution	Established logistic and distribution sector in supporting agricultural commodities and export.	4,000 employees in transport, postal and warehousing	<ul style="list-style-type: none"> <li>- New England highway upgrade</li> <li>- Inland rail</li> <li>- Moree SAP</li> </ul>		<ul style="list-style-type: none"> <li>- CHS Boradbent</li> </ul>

### 1.5.3. Emerging industry

Industry	Economic potential and opportunities	Infrastructure development and planning	Innovation activities
<b>Defence and aerospace</b>	Excellent climatic and airspace conditions for aviation and defence sector to expand	<ul style="list-style-type: none"> <li>- Tamworth Airport hosts AviSkills Aviation Engineering Training, Sigma Aerospace and interest from private pilot training colleges to relocate</li> </ul>	

## 1.6. North Coast

## 1.6.1. Regional economy and demographic profile

Regional GDP	Population			Employment			Business
	Estimated residential in 2020	Forecast growth to 2041	Tertiary Education	Employed persons	Unemployment rate	Working age population	
\$17.8 billion	528,663	570,351	59.1%	203,551	8.1%	55.4%	43,321

## 1.6.2. Established industry

Industry	Economic values	Workforce	Infrastructure	Innovation activities, R&D hubs and precincts	Key players
Agribusiness, food and forest	Contributes to \$2.5 billion to NSW economy. The region contributes to 30% of NSW fruit and nuts supply. Established livestock industries comprising over 53% of region's agribusiness output.	Almost 10,000 employees and 3% of the workforce holds tertiary qualification in agriculture or environment (compared to 2% national level).	<ul style="list-style-type: none"> <li>- Established road, rail, port and airport freight networks and service suppliers facilitating easy access to domestic and international markets.</li> <li>- Established livestock infrastructure</li> <li>- Growth forecasted in freight transport</li> </ul>	<ul style="list-style-type: none"> <li>- Southern Cross University, the University of Newcastle and Charles Sturt University</li> <li>- NSW DPI research institutes at Wollongbar, Grafton and Ebor</li> </ul>	<ul style="list-style-type: none"> <li>- North Coast Fresh Food and Cold Storage Co-operative, Clarence River Fishermen's Co-operative, Norco and Northern Co-operative Meat Company</li> <li>-</li> </ul>

Industry	Economic values	Workforce	Infrastructure	Innovation activities, R&D hubs and precincts	Key players
			using the Pacific Highway		
Advanced manufacturing	Metal, transport and timber manufacturing with 1,691 businesses in the region. Established industries in milling, timber and other wood product manufacturing. Growth in marine equipment manufacturing and technology development.	Over 10,000 employees	<ul style="list-style-type: none"> <li>- Reflight transport connections by the Pacific Highway and North Coast rail line</li> <li>- Access to regional airports</li> </ul>		<ul style="list-style-type: none"> <li>- Birdon</li> <li>- Local manufacturers for Nestle and Akubra Hats, and the Macleay Valley Food Bowl brand.</li> </ul>
Tourism	Tourism industry contributes to \$3.6 billion to NSW economy. Largest tourist destination in regional NSW with over 5.9 million overnight visitor.	16% of NSW's accommodation sector employment.	<ul style="list-style-type: none"> <li>- Connections to major cities and coast towns via Pacific Highway</li> </ul>		<ul style="list-style-type: none"> <li>- TirpaDeal</li> <li>- National parks</li> </ul>

### 1.6.3. Emerging industry

Industry	Economic potential and opportunities	Infrastructure development and planning	Innovation activities
<b>Health</b>	Established and growing health precincts in Tweed Heads, Lismore, Coffs Harbour and	NSW Government invested more than \$110 million for upgrades to hospitals and health facilities, including over	<ul style="list-style-type: none"> <li>- UNSW's Rural Clinical School in</li> </ul>

Industry	Economic potential and opportunities	Infrastructure development and planning	Innovation activities
	Port Macquarie in serving local residents and visitors.	\$75 million to fund the Lismore Base Hospital redevelopment and \$35 million for other health facilities.	Port Macquarie.
<b>Education</b>	Growing sector that provide education services to residents in NSW and Queensland and help retain younger residents. Regional universities attract more interstate and international students by promoting a range of specialist courses.	Established education precincts built on major university campuses and education facilities including Southern Cross University, the University of Newcastle, Charles Sturt University, UNSW and TAFE (School of Audio Engineering based in Byron Bay). New education precincts are under development at Tweed.	<ul style="list-style-type: none"> <li>- Regional universities</li> <li>- TAFE NSW</li> </ul>

## 1.7. Riverina-Murray

### 1.7.1. Regional economy and demographic profile

Regional GDP	Population			Employment			Business
	Estimated residential in 2020	Forecast growth to 2041	Tertiary Education	Employed persons	Unemployment rate	Working age population	
\$13.2 billion	282,501	284,269	55.6%	132,545	5.2%	61.9%	26,833

### 1.7.2. Established industry

Industry	Economic values	Workforce	Infrastructure	Innovation activities, R&D hubs and precincts	Key players
Agribusiness, food and forest	Agriculture production contribute \$3.1 billion to NSW economy.	Almost 19% of NSW agribusiness and food workforce residents in the region, 6% of the workforce holds tertiary qualification in agriculture or environment (compared to 2% national level).	<ul style="list-style-type: none"> <li>- Agriculture land (5.1 million hectares of available arable land for grazing, 2.2 million hectares for dryland cropping and 0.5 million hectares for irrigated cropping)</li> <li>- Access to water and irrigation infrastructure and water storage capacity over 5.6 million megalitres</li> </ul>	<ul style="list-style-type: none"> <li>- AgTech Cluster based at CSU Wagga Wagga</li> <li>- Graham Centre for Agricultural Innovation</li> <li>- NSW DPI research institutions in Wagga Wagga, Yanco and Narranderan Fisheries Centre.</li> </ul>	<ul style="list-style-type: none"> <li>- SunRice</li> <li>- CopRice</li> <li>- Hyne Timber</li> </ul>

Industry	Economic values	Workforce	Infrastructure	Innovation activities, R&D hubs and precincts	Key players
Advanced manufacturing	Over 900 businesses	Over 12,000 employees and one in four with STEM education	<ul style="list-style-type: none"> <li>- Rail, road and airports</li> <li>- Wagga Wagga SAP</li> </ul>	<ul style="list-style-type: none"> <li>- Multi-disciplinary research at Charles Sturt University</li> </ul>	<ul style="list-style-type: none"> <li>- Southern Oil</li> <li>- Renewed metal</li> <li>- Newtecoply</li> </ul>

### 1.7.3. Emerging industry

Industry	Economic potential and opportunities	Infrastructure development and planning	Innovation activities
<b>Renewable energy</b>	Wagga Wagga REZ have potential for wind generated energy, while Griffith and Carrathool are suitable for large-scale solar power generation and geothermal energy.	Bomen Solar Farm located within Wagga Wagga SAP are supported with existing electricity infrastructure with planning work underway for extension for large generation in the REZ areas. Local industry has existing demand for natural gas and exploring opportunities of hydrogen.	<ul style="list-style-type: none"> <li>- Southern Oil (hydrogen)</li> <li>- TransGrid is actively looking for innovative solutions for energy systems.</li> </ul>
<b>Tourism</b>	The industry contributes \$1.5 billion to NSW Economy. Increasing number of visitors with a 4.5% annual rate between 2013 to 2019 and domestic overnight visitors increase by 32.9% since 2014.	<ul style="list-style-type: none"> <li>- national freight corridors connect the region to ports and international airports in Sydney, Melbourne and Canberra</li> <li>- Growth in eco-tourism, agritorium, lifestyle activities form domestic and international visitors</li> </ul>	

## 1.8. South East and Tablelands

### 1.8.1. Regional economy and demographic profile

Regional GDP	Population			Employment			Business
	Estimated residential in 2020	Forecast growth to 2041	Tertiary Education	Employed persons	Unemployment rate	Working age population	
\$10.1 billion	229,910	278,215	5%	97,339	4.9%	61.2%	25,723

### 1.8.2. Established industry

Industry	Economic values	Workforce	Infrastructure	Innovation activities, R&D hubs and precincts	Key players
Agribusiness and food	Contributes \$1.8 billion to NSW with over 5,000 businesses	Over 7,000 employees, 6% of the workforce holds tertiary qualification in agriculture or environment (compared to 2% national level).	<ul style="list-style-type: none"> <li>- Over 2.5 million hectares of pastures</li> <li>- Railway and freight route to Sydney</li> </ul>	<ul style="list-style-type: none"> <li>- CSIRO Boorowa research facility</li> <li>- NSW DPI Jindabyne Gaden Fishery</li> </ul>	<ul style="list-style-type: none"> <li>- Bega</li> </ul>
Tourism	Tourism contributes \$4.7 billion to NSW economy where \$3.4 billion from domestic overnight visitor expenditure across the Snowy Mountains, Capital Country and South Coast. An	Over 10,000 employees	<ul style="list-style-type: none"> <li>- Access to Canberra International airport</li> <li>- Snowy Mountains SAP</li> </ul>		<ul style="list-style-type: none"> <li>- Event, Hospitality and Entertainment Group</li> <li>- Vail Resorts</li> </ul>

Industry	Economic values	Workforce	Infrastructure	Innovation activities, R&D hubs and precincts	Key players
	annual growth of 3.9% in domestic and international visitors since 2014.		<ul style="list-style-type: none"> <li>- High quality and diverse tourism attraction and facilities including ski resorts, national parks and coastal activities.</li> </ul>		
Renewable energy	81 businesses in energy and electricity services	1,560 employees with more than 61% of the workforce have tertiary qualification and 22% have a STEM education.	<ul style="list-style-type: none"> <li>- Snowy Hydro Scheme</li> <li>- Established transmission networks connecting to main grid to support large generation and storage project.</li> <li>- 24 MW Woodlawn bioreactor</li> </ul>	<ul style="list-style-type: none"> <li>- ANU</li> </ul>	South Waste Region of Renewable Excellence

### 1.8.3. Emerging industry

Industry	Economic potential and opportunities	Infrastructure development and planning	Innovation activities
<b>Professional and financial services</b>	The Australian Government is likely to continue to be the largest employer with 20% share of jobs and Canberra's growth will provide a wider range of service and job	<ul style="list-style-type: none"> <li>- Transport network and access to Canberra</li> </ul>	

Industry	Economic potential and opportunities	Infrastructure development and planning	Innovation activities
	opportunities in public administration, professional services and education.		

## 1.9. Far West

## 1.9.1. Regional economy and demographic profile

Regional GDP	Population			Employment			Business
	Estimated residential in 2020	Forecast growth to 2041	Tertiary Education	Employed persons	Unemployment rate	Working age population	
\$2 billion	39,742	39,889	51.8%	20,036	7%	60.9%	3817

## 1.9.2. Established industry

Industry	Economic values	Workforce	Infrastructure	Innovation activities, R&D hubs and precincts	Key players
Mining and resources	Contributes \$511 million with diverse mineral deposits including zinc, lead, silver, cobalt and mineral sands. Significant commercial interest in production of rutile, ilmenite, leucoxene and zircon. Mineral sands mining and production near Murray River continues to expand.	1,575 employees accounting for 9% of regional workforce. Highly skilled local workforce with 15.4% holding tertiary engineering and related technologies qualifications.	- Heavy mineral sand mines and production infrastructure		- Iluka - BHP
Tourism	239 businesses contribute \$357 million to NSW economy with expenditure increasing on average of 7.1%. Visitor numbers have increased	1,507 employees accounting for 8.6% of the region's total employment.	- natural heritage, national parks and rich Aboriginal culture and artefacts.		

Industry	Economic values	Workforce	Infrastructure	Innovation activities, R&D hubs and precincts	Key players
	on average 5.7% annually and 6.3% for overnight visitors.				
Agribusiness and food	Agriculture production contributes to \$1.3 billion NSW economy with diversified products and processing opportunities in livestock (goat meat), broad acre cropping and grazing, grains, oil seeds, horticulture and floriculture.	2,631 employees representing 15% of the region's workforce. 4% tertiary qualified in agricultural or environmental studies (compared to 2% national average).	- Freight hub at Broken Hill and access to eastern seaboard markets	NSW DPI Dareton Agricultural Research and Advisory Station	

### 1.9.3. Emerging industry

Industry	Economic potential and opportunities	Infrastructure development and planning	Innovation activities
<b>Renewable energy</b>	Excellent solar exposure and optimal wind condition for large scale energy generation projects. 700 new jobs added from last three years in energy and electricity services.	- Established transmission network supporting two large solar farms with a total of 155MW capacity	

## 2. NSW new industrial precincts, renewable energy zones and hydrogen hubs

### 2.1. Special Activation Precincts and Regional Jobs Precincts

Special Activation Precincts (SAPs) have been adopted by NSW Government as a new way of planning and delivering industrial and commercial infrastructure projects in dedicated areas in region NSW. SAPs aim to bring together planning and investment support services and provide business with certainty to establish and grow with certainty and confidence. The creation of SAPs is part of the NSW Government's 20 Year Economic Vision for Regional NSW and will be delivered as part of the \$4.2 billion Snowy Hydro Legacy Fund. The Regional Growth NSW Development Corporation is responsible for the delivery of the Special Activation Precincts (SAPs) in line with the Activation Precincts State Environmental Planning Policy and SAPs' Master Plans.

Special Activation Precinct	Description (i.e. economic opportunities, jobs creation, major infrastructure and commitments)	Capability and priority industries	Status and plan
<b>Parkes SAP</b>	As the first announced SAP, the Parkes SAP covers an area of 4,800 hectares and strategically located at the only junction of Australia's two rail spines, the Inland Rail and the Trans-Australia Railway. Parkes SAP hosts the National Logistics Hub and will provide suppliers access to 80 per cent of Australia's markets within 12 hours by road or rail, allowing local products to be delivered across Australia. This SAP expects to create up to 3,000 jobs across a range of industries, including freight and logistics, resource recovery, value-added agriculture and renewable energy. This SAP will have a focus on sustainability as Australia's first UNIDO Eco-Industrial Park.	Cold chain logistics, grain-based food production and manufacturing, critical minerals extraction and process, e-waste recycling and repurposing, plant-based meat substitutes, plastics recycling, data centres and telecommunication infrastructure.	The Master Plan and new planning framework have been finalised and the Parkes SAP is now in the delivery phase.
<b>Wagga Wagga SAP</b>	The Wagga Wagga SAP will cover an area of approximately 4,500 hectares, including 300 hectares already developed as part of the Bomen Business Park. This SAP will incorporate the Riverina Intermodal Freight and Logistics (RiFL) hub in having faster and easier access to national and international markets for regional producers. This	Freight and logistics, agribusiness, advanced manufacturing, education and training, renewable energy, battery recycling and waste recovery.	Draft Master Plan is now on exhibition for community and stakeholder contributions.

Special Activation Precinct	Description (i.e. economic opportunities, jobs creation, major infrastructure and commitments)	Capability and priority industries	Status and plan
	SAP expects to create up to 6,000 jobs across a range of industries, including renewables, sustainability and recycling, advanced manufacturing, freight and logistics and value-added agriculture.		
<b>Williamtown SAP</b>	The Williamtown SAP will cover 10,000 hectares of land and aims to create will create a defence and aerospace precinct building on RAAF Base, Newcastle Airport and Astra Aerolab precincts. This SAP expects to create over 4,300 new jobs by bring together large multinationals, local SMEs and research and development institutions.	Defence, aerospace, advanced manufacturing, education and training.	Master planning is underway.
<b>Moree SAP</b>	The Moree SAP will cover 58,000 hectares and aims to build a modern agriculture production and manufacturing precincts. This SAP will have access to the Inland rail router and Newell Highway to deliver products to Australian and international markets.	Freight and logistic, high value agriculture production and innovative farming, value-adding industries including fertiliser manufacturing, grain products, meat products and nut processing.	Master planning is underway.
<b>Narrabri SAP</b>	The Narrabri SAP will build on the Narrabri Gas Project to attract investment and create new jobs. Low cost and reliable supply of natural gas can support energy-intensive industries and those require natural gas in feedstock such as metal smelters and chemical manufacturers	Value-added production, manufacturing, freight and logistics.	Master planning process except to commence in 2021.
<b>Snowy Mountains SAP</b>	The Snowy Mountains SAP covers 70,000 hectares focusing on tourism industry around Jindabyne town centre, Kosciuszko National Park, Thredbo, Perisher and Charlotte Pass. The work will also look at opportunities to activate destination tourism at Eden.	Tourism, hospitality industry, sport and recreation.	Master planning is underway.

Regional Job Precincts are an extension of the SAP program to provide planning support to help fast-track approvals to drive growth, investment and development opportunities within regional NSW. The Regional Job Precincts will drive local planning reform to attract investment and grow jobs in regional NSW.

Regional Job Precinct	Description (i.e. economic opportunities, priority industries, major infrastructure and commitments)	Status and next steps
<b>Albury</b>	The Albury Regional Job Precinct will build on the NEXUS Industrial Precinct to enable development across a range of sectors such as freight and logistics, agribusiness and manufacturing. This Precinct will build on work already done as part of the Albury-Wondonga Regional Deal to attract investment and grow local capabilities.	NSW Government is working with Albury City Council, local businesses and communities to identify gaps and opportunities for the precinct.
<b>Richmond Valley</b>	The Richmond Valley Regional Job Precinct will build on existing industries of agriculture, manufacturing and renewable energy in the region. This precinct is strategically located at the intersection of Bruxner Highway, Summerland Way and Casiano. The Precinct will focus on agriculture, manufacturing and renewable energy industries.	NSW Government is working with Richmond Valley Council, local businesses and communities to identify gaps and opportunities for the precinct.
<b>South Jerrabomberra</b>	The South Jerrabomberra Regional Job Precinct will build on the Poplars Innovation Precinct to enable development across defence, space, cyber-security, information technology and scientific research.	NSW Government is working with Queanbeyan-Palerang Council, local businesses and communities to identify gaps and opportunities for the precinct.
<b>Namoi</b>	The Namoi Regional Job Precinct will focus on growing opportunities in intensive agriculture and livestock production.	NSW Government is working with NSW Agriculture Commissioner, Namoi Regional Council, local businesses and communities to identify gaps and opportunities for the precinct.

## 2.2. Renewable Energy Zones

The Renewable Energy Zones (REZs) are modern-day energy systems deployment, combining renewable energy generation, storage, and transmission and distribution infrastructure. NSW is pioneering the REZs development and the NSW Government has set out a plan for priority REZs roll out in the Energy Corporation of NSW will lead the delivery of NSW REZs and coordinate transmission, generation, firming and storage projects to deliver efficient and coordinated investment.

Renewable Energy Zone	Description (i.e. energy resources, infrastructure and commitments)	Generation and storage capacity <sup>2</sup>
<b>Priority REZs identified by NSW Government</b>		
<b>Central-West Orana (CWO) REZ</b>	The CWO REZ is electrically close to the Sydney load centre and has moderate wind and solar resources. Currently there is more than 700 MW of commissioned and committed generation within CWO REZ, most of this generation is derived from solar energy. The CWO has been identified by the NSW Government as the state's first pilot REZ – expected to unlock 3,000 MW of transmission hosting capacity by the mid–2020s. Construction of the pilot REZ is expected to begin in 2022. CWO EOI received over 27,000 MW applications in 2019.	2030: 150 MW Solar 2040: 2200 MW Solar, 800 MW Wind
<b>New England REZ</b>	The New England REZ (previously known as Northern NSW Tablelands REZ) is identified by the NSW Government as one of three potential priority renewable energy zones in 2019 Electricity Strategy. This REZ has moderate to good wind and solar resources in close proximity to the 330 kV network. Interest in the area includes large scale solar and wind generation as well as pumped hydro generation.	2030: 100 MW Solar 2040: 100 MW Solar, 3750 MW Wind, 1150 MW Storage
<b>South-West REZ</b>	This zone has over 1,000 MW of generation currently in service and committed, all of which is solar generation. For any further large scale renewable generation to connect in this area, additional transmission infrastructure would be required to get the generation from this REZ to the Sydney load centre. The capacity within this REZ and ability to transfer energy from the REZ to the main load centres in the greater Sydney area will be improved by the proposed NSW-SA interconnector, Project EnergyConnect, together with Humelink. One option for VNI West (Kerang route) would further increase the hosting capacity of this REZ.	2040: 600 MW Solar and 150 MW Storage
<b>Hunter-Central Coast REZ</b>	The NSW Government is in the early stages of planning for REZs in the Hunter-Central Coast as set out under the Electricity Infrastructure Investment Act 2020. <sup>5</sup>	TBC

<sup>2</sup> AEMO (2020). Integrated System Plan 2020 Modelling Central Scenario.

Renewable Energy Zone	Description (i.e. energy resources, infrastructure and commitments)	Generation and storage capacity <sup>2</sup>
<b>Illawarra REZ</b>	The NSW Government is in the early stages of planning for REZs in the Illawarra regions of NSW as set out under the Electricity Infrastructure Investment Act 2020. <sup>6</sup>	TBC
<b>Other NSW REZs identified by AEMO</b>		
<b>North West REZ</b>	This REZ has high quality solar resources, the wind resource is estimated to be inadequate for wind farm development. This REZ encompasses the 132 kV network which require significant network upgrades to accommodate new generation capacity.	2030: 100 MW Solar 2040: 3450 MW Solar, 50 MW Wind and 200 MW Storage
<b>Southern NSW Tablelands REZ</b>	This REZ has excellent wind resources with one of the highest wind capacity factor in NSW. There is currently just over 640 MW of renewable generation installed within this zone where over 630 MW of which is wind generation. However, there has been significant opposition from the community within this area for the connection of any additional wind generation.	2030: 250 MW Wind 2040: 250 MW Wind
<b>Tumut REZ</b>	This REZ has great potential for additional pumped hydro generation. The proposed HumeLink transmission line will enable the connection of just over 2,000 MW of pumped hydro generation (Snowy 2.0) in this area.	2030: 2040 MW Storage 2040: 2040 MW Storage
<b>Cooma-Monaro REZ</b>	This REZ has great deep storage potential in pumped hydro. This REZ has moderate to good quality wind resources with one wind farm, Boco Rock Wind Farm (113 MW) within the REZ.	2040: 300 MW Wind
<b>Wagga Wagga REZ</b>	This REZ has moderate wind and solar resources. Bomen Solar Farm, 100 MW, is committed and will connect to the network north of Wagga Wagga. This REZ has been identified due to strong interest from industry.	2040: 1000 MW Solar
<b>Broken Hill</b>	This REZ has excellent solar resources. It is connected to the national grid via a 220 kV line that services the existing solar, wind and gas generation in the area. Significant development of VRE in this REZ could prove costly as it would require significant transmission network augmentation due to the distance of the REZ from the main transmission paths of the shared network.	TBC

### 2.3. Hydrogen Hubs

NSW Government has indicated that Hunter and Illawarra regions will be the first two regions to develop hydrogen hubs for large scale production with a commitment of at least \$70 million funding to their development as part of the NSW Net Zero Industry and Innovation Program. The NSW Government are facilitating discussions among stakeholders to progress the concept of hydrogen hubs at the two regions.

Hub	Existing industries and key players	Major proposals and projects in the region
<b>Hunter Hub<sup>3</sup></b>	<p>Orica ammonia production  University of Newcastle  CSIRO Newcastle Energy  NERA Hunter Hydrogen Cluster  Local Government (Macquarie Lake Council and Central Coast Council)  Infinite Blue Energy</p>	<ul style="list-style-type: none"> <li>• Newcastle FCEVs: hydrogen FCEVs for local council garbage truck fleet and buses</li> <li>• New ammonia production plan: a proposal for a new ammonia production plant with 35MW capacity on the site of Liddell to utilise existing transmission lines, water permit and landholding; ammonia powered mining haul trucks for the Muswellbrook Coal (owned by Japanese Idemitsu); Caterpillar (CAT) providers ammonia haul truck (major trucks supplier and holds ammonia combustion engine patents).</li> <li>• Project NEO: proposal of 1000 MW green hydrogen production via a combination of solar and wind, aiming to replace Hunter fossil baseload energy users with hydrogen power. Announced May 2020 and plan to have feasibility and detailed design over 18 months. Project is estimated at \$2.7 billion.</li> <li>• NERA Hunter Hydrogen Cluster: a national hydrogen cluster initiative</li> </ul>
<b>Port Kembla Hub<sup>4</sup></b>	<p>BlueScope Steel  Coregas  OCEANEX Energy  Australian Industrial Energy (AIE), owned by Squadron Energy  Australian Industrial Power (AIP), owned by Squadron Energy  EnergyAustralia  Jemena  APA  H2X  Local Government</p>	<ul style="list-style-type: none"> <li>• Coregas refueling station: In March 2021, Coregas was awarded funding of the Port Kembla Investment Fund to develop a hydrogen refuelling station for use with hydrogen-powered prime movers at its existing hydrogen production facility embedded with the BlueScope Port Kembla steel works site.</li> <li>• AIE Port Kembla Gas Terminal: \$250 million investment for a LNG import terminal with dedicated connection to eastern gas networks. Planning approval received in 2020 and lease signed for 25 years.</li> <li>• Port Kembla Hydrogen Export Terminal: \$300 million proposal for liquefied hydrogen export facilities.</li> <li>• AIP Port Kembla Power Station: \$800 million proposal for a hydrogen/natural gas dual-powered gas station with 800 MW capacity. Project shortlisted in Commonwealth Government's Underwriting New Generation Investment scheme.</li> </ul>

<sup>3</sup> Information based on conversation with stakeholders for OCSE projects and public released documents.

<sup>4</sup> Information based on OCSE Port Kembla Site Visit March 2021 and public released documents.

Hub	Existing industries and key players	Major proposals and projects in the region
		<ul style="list-style-type: none"><li>• EnergyAustralia Tallawarra Power Stations: Existing Tallawarra A is capable of 10 per cent hydrogen blending with minimum modification and proposed Tallawarra B is looking in hydrogen co-firing options.</li><li>• Oceanex offshore wind farm: 2000 MW offshore wind capacity with \$10 billion investment, pre-feasibility study has been commenced.</li></ul>

## Reference

Regional NSW. [Regional NSW Regions.](#)

Regional NSW. [Regional NSW Industry Sectors.](#)

NSW Government. [Regional Plans.](#)

NSW Government. [Special Activation Precincts.](#)

NSW Government. [Parkes Special Activation Precinct Master Plan.](#)

NSW Government. [Regional Job Growth Precincts.](#)

NSW Primary Industry. [Research and Development.](#)

NSW Government. [Renewable Energy Zones.](#)

NSW Health. [Local health districts.](#)

ANSTO. [Research Facilities.](#)

AEMO (2020). Integrated System Plan.

CSIRO. [Research and Infrastructure.](#)

Australian Bureau of Statistics. Regional population and growth forecast, business numbers and census data.

NSW Government (2019). [NSW Mineral Strategy and high-tech metal resources map.](#)

OCSE (2019). NSW Innovation Precinct Mapping (internal document).

OCSE (2020). NSW Research Map Database (internal document).

OCSE. [Research and Development.](#)

KPMG (2020). NSW: A clean energy superpower. [Industry opportunities enabled by cheap, clean and reliable electricity.](#)

## NSW Innovation Precinct and Network Mapping

This document was prepared for the NSW R&D Platform, an initiative under the Accelerating R&D NSW Action Plan (ARDAC Action Plan). This mapping provides information and assessment about NSW's physical and virtual innovation clusters, as Innovation Precincts and Innovation Networks respectively.

### NSW Innovation Precinct Mapping

Innovation Precincts are an important part of the NSW Government's R&D and economic development framework. One of the five priority actions recommended by the Accelerating R&D NSW Advisory Council's (ARDAC) Action Plan is turbocharge precincts by developing precincts to attract national and global technology industries and investment, and drive collaboration between universities, research organisations, start-ups, scale-ups and SMEs, to commercialise R&D. The ARDAC Action Plan recommends prioritising six innovation precincts for NSW, including Western Sydney Aerotropolis, Westmead Health and Innovation Precinct, Tech Central, Parkes, Wagga Wagga and Williamstown Special Activation Precincts.

This document presents a mapping of NSW innovation precinct in providing information to improve the reader's understanding of the current precincts landscape in NSW. For every innovation precinct, this mapping describes the main partners and economic sectors targeted by the precinct, the technology focus, the university and skills engagement, issues of place and amenity, and key precinct attributes. This mapping characterised NSW innovation precincts within the Commonwealth Government's definition for precincts<sup>1</sup>. These precincts also met the essential attributes identified by the NSW Innovation and Productivity Council<sup>2</sup>.

Innovation precincts are grouped under priority industries for NSW, which are Decarbonisation and ClimateTech, Health and MedTech, Financial services and FinTech, Primary industries and AgTech, Space and Defence industry as well as two technological enablers of Advanced Manufacturing and Digitalisation,

**Table 1. NSW Innovation Precincts Map**

Name	Status	Place	Technology	Skill and Training	University	Key Partner	Description
<b>Decarbonisation and ClimateTech</b>							
<b>Newcastle Energy and Hydrogen Cluster</b>	Energy established and hydrogen is	Newcastle and Hunter Region	Renewable energy, electricity system and hydrogen	Energy professional, hydrogen skills, mining workforce	UoN and NERI	CSIRO, Hunter Net, Orica, mining industries	This energy and hydrogen innovation precinct is led by UoN, NERI, CSIRO Energy and the newly established Hunter Hydrogen Cluster by NERA. Major energy infrastructure and development are under planning, including the Hunter Renewable Energy Zone and Hydrogen Hub announced by

<sup>1</sup> Department of Industry, Innovation and Science, *Statement of Principles for Australian Innovation Precincts*, October 2018 (<https://www.industry.gov.au/sites/g/files/net3906/f/October%202018/document/pdf/statement-of-principles-australian-innovation-precincts.pdf>)

<sup>2</sup> NSW Innovation and Productivity Council, *NSW Innovation Precincts: Lessons from International Experience*, September 2018.

Name	Status	Place	Technology	Skill and Training	University	Key Partner	Description
	under development			unskilling and transition		and local councils	NSW Government. Industrial partners have been actively involved on those initiatives and working collaboratively with research and government on the precinct planning and development. Hunter Hydrogen Hub is one of the two official hydrogen hubs announced by the NSW Government.
<b>Port Kembla Hydrogen Hub</b>	Under development	Illawarra and Port Kembla	Hydrogen	Hydrogen skills, mining workforce unskilling and transition	UoW	Bluescope, Coregas, Australian Industrial Energy, EnergyAustralia and local councils.	This innovation cluster is built around local steel manufacturing and major energy infrastructure projects with significant interest of LNG/Hydrogen industry. The newly announced Illawarra Renewable Energy Zone and BlueScope's Renewable Manufacturing Hub is in the region. Port Kembla Hydrogen Hub is one of the two official hydrogen hubs announced by the NSW Government.
<b>UNSW Energy and Hydrogen</b>	Established	UNSW Sydney	Renewable energy, electricity system and hydrogen	Energy professional and hydrogen skills	UNSW	Industry and government partners	This innovation precinct is underpinned by strong capabilities in energy and hydrogen industry. There are a few new research institutes and centres funded by Commonwealth Government and industry, including UNSW Energy Institute, RACE 2030 CRC (UNSW node), ARC Global Hydrogen Economy Training Hub and Hydrogen Energy Research Centre.
<b>Darling Basin CCS Hub</b>	Under development	Central West	Carbon capture, storage and utilisation	Mining workforce unskilling and transition.		Geological Survey NSW	This precinct is the only NSW-based CCS Hub announced by the Commonwealth Government. NSW CO2 Storage Assessment project is exploring carbon geological storage potential and options in the darling basin. There are a few R&D projects working on carbon capture and utilisation technologies at Vales Point Power Station and other testing facilities in NSW.
<b>Health and MedTech</b>							
<b>Westmead Health and Education Precinct</b>	<b>ARDAC Priority Precinct.</b>	Parramatta CBD, with well served transport,	Medical research, engineering and health	Healthcare practitioners and professional,	Western Sydney University and	Westmead Hospital, the Children's Hospital,	The Westmead Alliance was formed in 2013 in creating a shared vision and advocate for the interests of the precinct and has created a dynamic precinct of over 350 complementary enterprises since then. It specialises in

Name	Status	Place	Technology	Skill and Training	University	Key Partner	Description
<b>(Greater Parramatta)</b>	In development	Sydney Metro West and Parramatta Light Rail under development	and pharmaceuticals	research and education	University of Sydney	Cumberland Hospital, Western Sydney Area Health District and NSW Government	research, education and delivery of health services and clinical care, providing direct health services to almost 10% of Australia's population. The NSW Government, universities and the private sector have committed \$3 billion to improve facilities in the Precinct. A number of initiatives such as the Western Sydney University Launch Pad and the Research Hub actively support and mentor local tech startups through training events and seminars. A new 8,000 square metre innovation centre is also in the pipeline to provide a platform for connecting and facilitating industry and commercial partnerships.
<b>Liverpool Health and Innovation Precinct</b>	Established	A mixed use area that contains hospitals, schools and high density residential development with access to public transport. GSC 2017-18 Collaboration Area.	Health, advanced manufacturing and logistics in relation to medical technologies	Healthcare practitioners and professional, research and education	University of New South Wales, University of Wollongong, Western Sydney University, TAFE	Liverpool Hospital, Sydney South West Private Hospital, Sydney Business Chamber, South Western Local Health District (SWSLHD), Ingham Institute, NSW Government and Liverpool City Council	A health and research precinct anchored by the Liverpool Hospital. The precinct has existing strengths in cancer services and implementation of current edge technologies across health delivery (the entire patient journey), research and training, which to be leveraged to establish a Centre of Excellence for Cancer and Translational Research and Health Technology. Further opportunities exist around the development of an advanced manufacturing, automation and logistics hub for the manufacturing of components for medical devices, health related technology and prosthetics and healthcare logistics, leveraging Liverpool's manufacturing workforce profile, research and transport links. Liverpool area has been identified as a 2017-18 collaboration areas by the GSC and a Collaboration Area Place Strategy has been developed with key stakeholders.

Name	Status	Place	Technology	Skill and Training	University	Key Partner	Description
<b>Central Coast Education and Employment Precinct</b>	In development	Gosford City Centre as a focal centre for public facilities including hospital, schools and stadium.	Health, medical research and education	Healthcare practitioners and professional, research and education	University of Newcastle	Hunter and Central Coast Development Corporation, Gosford Hospital, Wyong Hospital, NSW and Commonwealth Government	This recently proposed precinct will build around a revitalised Gosford CBD to increase education and employment opportunities. The precinct will contain a Central Coast Medical School based on existing University of Newcastle's medical school and an affiliated Health and Medical Research Institute on the site of the redeveloping Gosford Hospital with a \$72.5 million commitment on health and medical research.
<b>Randwick Health and Education Precinct</b>	Existing	Medium to high density housing area contains hospitals and schools, proximity to Sydney Airport. South East Light Rail under construction. 2017-18 Collaborati	Advanced materials, medical research, energy and the environment, quantum computing, life sciences and robotics	Healthcare practitioners and professional, research and education	University of New South Wales and TAFE	Prince of Wales Hospital and Private Hospital, Sydney Children's Hospital, Royal Hospital for Women, NSW Government	The precinct is oriented around the University of New South Wales (UNSW) and the Randwick Health Campus, with four hospitals, nine medical research institutions. The precinct has been recognised in medical research areas in cancer, neuroscience, mental health, women's and children's health, infection and immunology and non-communicable diseases. A \$3 billion investment is planned by UNSW as well as other stakeholders in the precinct in the next 10 years to improve transport and public amenities surrounding the precinct and the affordability of spaces for innovation activity. Randwick has been identified as a 2017-18 collaboration areas by the GSC and a Collaboration Area Place Strategy has been developed with key stakeholders.

Name	Status	Place	Technology	Skill and Training	University	Key Partner	Description
		on Area by GSC					
<b>Camperdown Ultimo Health and Education Precinct (Harbour CBD)</b>	Existing	Established urban environment surrounded by universities and hospitals, close to Sydney Airport and Harbour CBD. GSC 2017-18 Collaboration Area.	Digital technology, medical research, engineering and creative industries	Healthcare practitioners and professional, research and education	University Sydney, UTS, University of Notre Dame and TAFE	Royal Prince Alfred Hospital, Sydney Local Health District, MRIs	The precinct includes internationally recognised research centres sitting within the hospital and two universities. The precinct holds the Sydney Startup Hub offering support to early-stage startups and HatchLab providing incubator programs and educational events. The rapid and continuing expansion of the precinct is having a multiplier effect on innovation and creative industries and start-ups. This area has been identified as a 2017-18 collaboration areas by the GSC and a Collaboration Area Place Strategy has been developed with key stakeholders.
<b>St Leonards</b>	In development	Mixed-use centre with high-rise offices and high density residential development, well served by public transport	Health and Education	Healthcare practitioners and professional, research and education	University Sydney, UTS, Australian Catholic University	Royal North Shore Hospital and NSW Government	The precinct is providing services to meet the health needs of four local government areas. The precinct holds tertiary teaching function of the University of Sydney (medicine, allied health), University of Technology, Sydney (nursing), and Australian Catholic University (nursing and allied health). Several medical research institutions are located within the precinct, includes NSW Trauma Centre and the Kolling Institute of Medical Research. There is potential to leverage the Royal North Shore public and private hospitals and the Mater Hospital to grow jobs in complementary health services and existing education facilities.
<b>Macquarie Park</b>	Existing	Established business	Biotechnology, digital	Healthcare practitioners	Macquarie University	NSW Government	The 350-hectare site is already Sydney's second largest business district has a focus on telecommunications,

Name	Status	Place	Technology	Skill and Training	University	Key Partner	Description
<b>Innovation District</b>		district with access to various train stations	technology, health and pharmaceutical and life sciences	and professional, research and education		, Ryde City Council, international corporations (Microsoft, Oracle, Sony, Canon, Foxtel, Orix and Goodman-Fielder) and SME	technology, pharmaceutical and electronic. Macquarie Business Park attracts more than 180 large international corporations and 200 small/medium businesses. The precinct provides an integrated medical and research network including Macquarie University Clinic, the University's Faculty of Medicine and Health Sciences and the University hospital where patients benefit from the collaboration of specialists and researchers.
<b>Campbelltown-Macarthur Health and Education</b>	In development	The key metropolitan centre in the Greater Western Sydney. GSC 2018-19 Collaboration Area.	Health, ag-tech and biosecurity	Healthcare practitioners and professional, research and education	Western Sydney University, TAFE and University Sydney	Campbelltown and Camden Hospitals, Campbelltown City Council	Campbelltown City Council has a strategy to redevelop the CBD and Campbelltown has a Health and Education Precinct with public and private hospitals. Campbelltown houses the Mt Annan Botanic Gardens which will have the Western Sydney Centre of Innovation in Plant Sciences aiming to become nation's premier international botanic research facility. Note also that the Elizabeth Macarthur Agricultural Institute is located in Menangle and is DPIs Centre of Excellence for Plant and Animal Health. It is NSW's premier quarantine and biosecurity facility with world recognised research scientists. An MOU was signed with Sydney University to advance an alliance to create a global hub for vet science, agriculture and soil research, agribusiness and training at the site. The Campbelltown-Macarthur area has been identified as one of the 2018-19 collaboration areas by the GSC and a Place Strategy is underdevelopment.
<b>Penrith Health and Education Precinct</b>	In development	Future rail connection to other innovation	Healthtech (telehealth and	Healthcare practitioners and professional,	Western Sydney University, University	Nepean Public and Private Hospitals,	The precinct has grown its research strengths in areas of translational medicine, preventative health, primary care, e-health and issues related to population health since its strategic vision 2011. New training and research facilities

Name	Status	Place	Technology	Skill and Training	University	Key Partner	Description
<b>(the Quarter)</b>		precincts and airport.  GSC 2017-18 Collaboration Area.	eHealth), robotic	research and education	Sydney and TAFE	Nepean Area Health District, Penrith City Council	have been established including a new Sydney Medical School Nepean building, the \$30 million Werrington Park Corporate Centre and TAFE's Health Service Training facility on its Kingswood campus. There are multiple new research program and initiatives such as the Nepean Medical Research Fund, Nepean Telehealth Technology Centre and LaunchPad Technology Business Incubator. A new 2016 Precinct Action Plan sets out a vision to become an international destination for investment in education, health services, research and related technology. Greater Penrith has been identified as one of the 2017-18 Collaboration Area by the GSC and a Place Strategy is underdevelopment.
<b>Blacktown Health</b>	In development	Blacktown CBD	Health, medical research and education	Healthcare practitioners and professional , research and education	Western Sydney University	Blacktown Hospital, Blacktown City Council, NSW Government	The health precinct is part of the Blacktown City redevelopment. The Blacktown City Council plans to attract investment for a private hospital facility leveraging NSW Government's \$700 million investment in Blacktown Hospital. The Precinct houses the Blacktown/Mt Druitt Clinical School and Research Centre which offers a range of research, from the liver and cancer-related research to metabolic research and diabetes.
<b>Bankstown-Lidcombe Health and Education</b>	In development	Proximity to Bankstown airport and access to road, rail and bus networks. GSC 2018-19 Collaboration Area.	Health, medical research and education	Healthcare practitioners and professional , research and education	Western Sydney University, TAFE	Bankstown-Lidcombe Hospital	Western Sydney University will establish a new teaching and research campus in the Bankstown centre to accommodate up to 7,000 students. TAFE Bankstown College is located within the precinct. Bankstown-Lidcombe Hospital is located close to the centre with a range of allied health care providers and services. A health and education precinct will emerge from the co-location of health and education facilities in the centre, as well as improved transport connections from Sydney Metro City & Southwest .Bankstown area has been identified as one of the 2018-19 collaboration areas by the GSC and a Collaboration Area Place Strategy has been developed with key stakeholders.

Name	Status	Place	Technology	Skill and Training	University	Key Partner	Description
<b>Frenchs Forest Health and Education Precinct</b>	In development	Collaboration Area identified by the GSC	Health and education	Healthcare practitioners, research and education		Northern Beaches Council, NSW Government	This new precinct will be anchored with a new \$600 million Northern Beaches Hospital which is under development and due to be completed in 2018. The new hospital will provide knowledge-intensive jobs, innovation and service delivery. The NSW Government is upgrading roads around the new Northern Beaches Hospital.
<b>Kogarah Health and Education Precinct</b>	Existing	Centre of medical expertise, access to public transport networks, close to Sydney Airport. GSC 2018-19 Collaboration Area.	Health, medical research and education	Healthcare professionals (more than 50% of jobs in the area)	UNSW, TAFE	St George Public and Private Hospitals, NSW Government	St George Public specialises in medical trauma services and houses the Medical Retrieval Service Coordination Centre for NSW. The NSW Government has committed \$277 million between 2014–2019 to support the hospital's expansion. St George & Sutherland Clinical School provides clinical studies for students at St George Hospital and St George College TAFE has an enrolment of 4,000 students. The precinct provides numerous allied health services including the research capacity at South Eastern Area Laboratory Services nearby. Kogarah has been identified as one of the 2018-19 collaboration areas by the GSC and a Place Strategy is underdevelopment.
<b>Parramatta North Precinct</b>	In development	Current limited transport options, proposed Parramatta light rail	Creative Industries,	Research and education	University of Sydney (in negotiations)	University of Sydney, NSW Government, Female Factory, NSW Health	The Parramatta North Precinct comprises approximately 26 hectares of NSW Government land located along the eastern foreshore of the Parramatta River opposite Westmead Hospital and Parramatta Park, and north of the Parramatta CBD. The rezoning of the precinct allows for approximately 2,800 new apartment units, 20,000 square metres of new commercial floor space, around 4,000 square metres of retail floor space, the preservation and adaptation of heritage buildings, and approximately 7.1 hectares of new public open space including a new river foreshore park.

Name	Status	Place	Technology	Skill and Training	University	Key Partner	Description
<b>Primary industries and AgTech</b>							
<b>Parkes Special Activation Precinct</b>	<b>ARDAC Priority Precinct.</b>  In development	Committed Inland rail project (Parkes to Narromine)	Freight and logistics, advanced manufacturing, ag-tech	Agriculture professional, landrail engineers and technicians		NSW Government and Australian Inland Rail	As the first Special Activation Precinct announced by the NSW Government, this precinct will develop the freight and logistics industry and optimise opportunities agriculture industry for the Central West NSW. It will provide an opportunity for local producers to access new markets, enterprise and connections with efficient transport networks. A draft master plan for the precinct is under development and to be finalised by the end of 2019.
<b>Wagga Wagga Special Activation Precinct</b>	<b>ARDAC Priority Precinct.</b>  In development	Highly accessible regional centre with rail, road and airway connections to other major cities	Agricultural technology, freight and logistics, education, advanced manufacturing	Agriculture professional, landrail engineers and technicians	Charles Sturt University	AgriFutures Australia, NSW Government, Wagga Wagga City Council and Australian Inland Rail	This regional activation area is built on the already developed Bomen Business Park aiming to expand into a 4,100 hectares world-class business precinct. The precinct will capitalise the inland rails and road network to create an efficient transport and logistics hub that will incorporate the existing Riverina Intermodal Freight & Logistics Hub. A lead and battery recycling facility is located within the precinct and there is a 120 MW solar farm planned by an Australian renewable energy company. The precinct has a growing reputation for international agricultural research with the established AgriPark. A draft master plan for the precinct is under development and to be finalised by the end of 2019.
<b>Agribusiness precinct – Aerotropolis</b>	In development	Highly accessible centre with global connections from Western Sydney Airport	Agricultural technology, freight and logistics, education, advanced agricultural manufacturing	Agricultural manufacturing	Nil	Sydney Markets, Vitex, Perich/Luddeham Pastoral Co (landowner), 2 globally significant freight/logis	Global airfreight gateway connecting high value and perishable fresh food, flowers, pharmaceuticals. Also significant landowners and other investors wanting a base to establish value-adding food manufacturing.

Name	Status	Place	Technology	Skill and Training	University	Key Partner	Description
						tics companies	
<b>Elizabeth Macarthur Agricultural Institute</b>	Established – opportunity for consolidation of other	DPI plus opportunity to add USyd and industry	Agricultural technology, education, advanced agricultural manufacturing	Agricultural professional, research and education	USyd	DPI plus USyd	USyd currently preparing a business case to consolidate their AgScience research and education facilities from Menangle into the DPI site – requires a decision regarding procurement approach, plus exploration of infrastructure needs.  Also opportunity for economic development at Campbelltown and development of student accommodation and supporting infrastructure in the Campbelltown CBD
<b>Armidale Agritech Innovation Precinct</b>	In development	Centred around UNE’s facilities and eight rural R&D properties	Agricultural technology	Agricultural professional, research and education	University of New England	Industry, Meat and Livestock Australia and Rural Research Development Corporation s	The precinct draws on the University of New England (UNE)’s strengths in environmental, crop science and technology and animal sciences. UNE has eight rural properties for research and education purposes. The precinct holds the award-winning Smart Farms Innovation Centre specialises in agriculture, farming and horticultural technologies and works closely with the national farming community to deliver innovative farming solutions. The precinct integrates an ag-tech cluster of more than 35 business and it launched a Smart Region Incubator enabling enterprises.
<b>The GATE (Global Ag-tech Ecosystems)</b>	In development	Based at NSW DPI’s Orange Agricultural Institute	Agriculture technology	Agricultural professional, research, education and entrepreneurs		NW Government , SpartkLab Culti8 and Horticulture Innovation.	The GATE is an NSW Department of Primary Industries initiative to develop ag-tech ideas and fast-track adoption of agricultural R&D. The precinct will provide access to the expertise of 600 scientific and technical staff and long-term data sets and facilitate on-farm validation of new technologies across 25 research stations and 13,000 hectares of trial farms. The GATE offers various business support to startups including from incubator, accelerator and commercialisation programs.
<b>Sydney Science Park</b>	In development , first buildings and	Luddenham , mix use of commercial and	STEM, general science, energy,	Research and entrepreneurs	A proposed STEM School	Celestino (owner and developer),	A \$5 billion project with 280 hectare food science, energy and health precinct with industry, CSIRO and education providers. CSIRO is establishing its first dedicated innovation zone and ‘Urban Living Lab’ in NSW at the site. ANSTO is developing a

Name	Status	Place	Technology	Skill and Training	University	Key Partner	Description
	school to open in 2021	residential, easy access to motorways and close to the new airport	health, food science, future cities			CSIRO, ANSTO	Collaborative Work Hub that connects activities at Lucas Heights to Sydney Science park. The site will also include a preschool to year 12 STEM focused high school. Offer 300,000 sq. m of commercial and research space, 100,000 sq. m of education space.
<b>UoN and Central Coast Food Innovation Cluster</b>	Proposed	TBC	Food and beverages	Food manufacturing and research	University of Newcastle	NSW Government and industries	The precinct aims to combine the diverse skills and expertise of participants to ensure an innovative approach to addressing industry and community concerns, such as identifying new products for market; establishing new opportunities to export; and issues such as nutritional value and food additives. The cluster will also generate new ideas and create opportunities for research breakthroughs which can be applied to real life issues.
<b>Financial Services, FinTech and Digitalisation</b>							
<b>Tech Central</b>	<b>ARDAC Priority Precinct.</b>  In development	Central to Eveleigh surrendered with existing economic assets and well supported with transport	Digital technology, startups	Entrepreneurship	University Technology Sydney, University of Sydney, TAFE and School of Entrepreneurship	NSW Government, Sydney Business Chamber, Tech Sydney, Atlassian, Fishburners and Stone & Chalk.	The NSW Government is partnering with the tech industry to help design a technology and innovation precinct, stretching from Central to Eveleigh. The precinct is already home to Australia's largest cluster of startup firms. Atlassian, Australia's largest tech company, along with other industry players including co-working space Fishburners, and industry representative body Tech Sydney, will work with the NSW Government to co-create the precinct. An NSW Government taskforce will also include representatives from University of Technology Sydney, University of Sydney and Sydney Business Chamber, as well as industry experts from a wide range of Australian startups.
<b>Bathurst Innovation Precinct</b>	Existing	203km northwest of Sydney CBD	Digital technology	Entrepreneurship, professional	University of Charles Sturt, TAFE Western	Bathurst Regional Council,	The precinct currently has 60 educational providers with a strong community and business involvement and it plays the role as a centre of innovation for the local communications and digital technology. It contacts an experimental

Name	Status	Place	Technology	Skill and Training	University	Key Partner	Description
				services and education		Reliance Bank	technology hub initiated by Reliance Bank and business accelerator training support provided by the University of Charles Sturt providing (CenWest Innovate).
<b>Wollongong Innovation Campus</b>	In development	Wollongong CBD with well served transport	Digital technology, health, engineering and materials research and medical research	Research, education and entrepreneurship	University of Wollongong	Australian and NSW Government , Wollongong City Council, research institutions and private sector	A 33-hectare greenfield site with an approved master plan to build an ecosystem for individuals and organisations for knowledge sharing, collaboration and connection between academia and industry. The UoW has collaboration initiatives including 'Global Challenges' multidisciplinary research funding, the iAccelerate business incubator and support facility for startups and entrepreneurs, and innovative institutes including the Australian Institute for Innovative Materials and the Sustainable Buildings Research Centre.
<b>The Sydney Startup Hub</b>	Existing (identified in the IPC 2018 Report)	Sydney CBD with easy access to train and bus network	Startups and Scale-ups, Fintech, Media-tech, Creative-tech, Transport, Logistics	Entrepreneurship		NSW Government and Sydney City Council, tenants including Stone & Chalk, Fishburners, Tank Stream Labs, The Studio, Future Transport Digital Accelerator, Microsoft ScaleUp Program, Caltex C-lab	Established by NSW Government funding to support innovation, strengthen the startup community, and grow new, sustainable, high-value jobs in NSW. The precinct covers over 17,000 m <sup>2</sup> of a refurbished CBD building and hosts 2,500 residents. It hosts leading local incubators and accelerators; and supports local startups, for example in fintech. It also offers subsidised rents to startups to help establish an ecosystem. Current tenants include NSW Government (Innovation NSW Office), international corporations, SME, startups, accelerator and incubators.

Name	Status	Place	Technology	Skill and Training	University	Key Partner	Description
<b>Sydney CBD</b>	Existing, (identified in the IPC 2018 Report)	Well supported transport to urban, regional and Sydney Airport	Digital technology, financial services	Financial service and entrepreneurship		Sydney City Council and the private sector	Australia's main financial and economic centre, this active precinct has a strong presence of venture capital financing and is home to many of the largest companies located in the country. It is also one of the main commercial hubs for the Asia-Pacific. There is an entrepreneurial and innovative culture, particularly in the digital and financial technology sector.
<b>Newcastle Innovation Precinct</b>	In development	Newcastle CBD with access to train, bus network and newly built light rail and to Newcastle Airport	Digital technology, energy and the environment, engineering and medical research	Research, education and entrepreneurship	University of Newcastle	Newcastle City Council	This precinct builds on the University of Newcastle (UoN)'s strengths in science, engineering, energy and the environment, health and medicine, and well-established initiatives and programs. Key facilities include the Hunter Medical Research Institute, Newcastle Institute for Energy and Resources (NIER), and acceleration programs such as the Hunter Innovation Project and the Integrated Innovation Network (I2N) and the NSW Energy and Resources Knowledge Hub hosted by NIER. The UoN is working with Newcastle City Council in developing the CBD area of the precinct, which includes the \$95 million NeW Space building opened in 2017 and a \$9.8 million Innovation Hub due for completion in 2019.
<b>North Sydney</b>	Existing, (identified in the IPC 2018 Report)	Access to train and bus network	Medtech, Biotech, pharmaceuticals, robotics, EdTech, STEM	Research, financial services and entrepreneurship	Australian Catholic University	Startups, SMEs and international technology companies such as IBM, Vodafone and Cisco Systems. North Sydney Innovation Network	A high-density area with an emerging technology and startup culture which has seen traditional office spaces being converted into innovation hubs and co-working spaces (e.g. Workinc). ACU has a startup hub, Collaborate Plus, in their North Sydney campus providing a co-working space for new SMEs. There are also around eight shared startup spaces on the North Shore; CSIRO's Lindfield Collaboration Hub; established medtech, biotech and pharmaceutical companies; startups/small businesses specialising in robotics, EdTech and STEM; and Royal North Shore Hospital. The North Sydney Innovation Network (not-for-profit) helps connect local businesses, government and industry on the North Shore.

Name	Status	Place	Technology	Skill and Training	University	Key Partner	Description
<b>Coffs Harbour Innovation Hub</b>	Emerging	Limited transport options, close to regional airport	Healthcare, Education and digital technology	Research and education	Southern Cross University, Coffs harbour Education Campus, North Coast Institute of TAFE	Chamber of Commerce	One of the largest urban regional centres in the mid North Coast and centred around the Coffs Harbour Education Campus Technology Park. It aims to provide an outstanding facility for technology based business development and growth in the region.
<b>CSIRO Lindfield Innovation Hub</b>	In development	Limited transport options or access to other precincts	Physics and materials sciences	Research and education		CSIRO, National Measurement Institute and NSW Government	The Hub is an innovation incubator for start-ups and SME's to develop unique, high-tech products and devices. It provides a dedicated space for early stage and established companies with access to CSIRO's facilities and science knowledge.
<b>Space and Defence</b>							
<b>Western Sydney Aerotropolis - Aerospace and Defence Industries Precinct</b>  <b>[and Agribusiness Precinct – see above under Agri]</b>	<b>ARDAC Priority Precinct.</b>  In development	Located at Badgerys Creek, the new airport to open in 2026, major infrastructure committed on Elizabeth Drive, Road updates and M12	Aerospace, Defence, Electronics, ag-tech, food science, circular economy and advanced manufacturing	A diverse range of skills and professional	NUW Alliance (University of Wollongong, University of Newcastle and UNSW) and Western Sydney University	Western City and Aerotropolis Authority, NSW Government, Northrop Grumman, Hitachi, MHI	Several precincts proximate to the Aerotropolis within the Western Parkland City covering industrial sectors on aerospace and defence, food and agribusiness, health, advanced manufacturing and tourism.  An aerospace and defence industries precinct under development which is accompanied by an Aerospace Institute offering STEM focused high school, vocational education and training, and tertiary education. Northrop Grumman has committed to invest \$50m an advanced defence electronics maintenance operation at the site. The site is proximate to the new airport under construction, as well as RAAF facilities at Richmond and Glenbrook, and the Holsworthy Army Barracks. The NSW Government is working to attract further primes and SMEs to the site.

Name	Status	Place	Technology	Skill and Training	University	Key Partner	Description
		linking M7 to airport.					<p>The Department of Primary Industries, in collaboration with the Western City &amp; Aerotropolis Authority, is examining what a world-leading agribusiness precinct might look like in Western Sydney, as part of the NSW Government's commitment to the City Deal. This precinct would support the production and value-adding of sustainable, high-quality fresh produce and pre-prepared consumer foods, bringing opportunities to existing and new businesses, markets and products.</p> <p>On the advanced manufacturing part, the precinct is building on the existing Smithfield Wetherill Park Business Hub which already hosts 1,000 manufacturing, wholesale, transport and services firms.</p>
<b>Bankstown airport/Milperra industrial area</b>	Existing and in development	Well located with access to air transport, major roads (A34 and M5) and rail freight network.	Aviation/aerospace and electronics, advanced manufacturing	Manufacturing (one third of workforce in the area) Aviation training and technicians	UNSW (Aviation School) and Western Sydney University	Bankstown Airport Limited, Canterbury-Bankstown Council, NSW Government	<p>The Bankstown airport occupies 313 hectares and is used largely for general aviation, parcel freight and recreational flying. It has an important role for fixed-wing and helicopter flight training and as a base for emergency services. <i>The Bankstown Airport Masterplan 2014</i> sets aside 130 hectares of land adjacent to Milperra for future development for an industrial economic and employment hub. The airport anticipates aircraft movements to increase to 282,000 movements per year to 2036. This precinct has been identified as one of the 2018-19 Collaboration Area by the GSC and a Place Strategy is underdevelopment.</p>
<b>Williamstown Defence Aerospace and Aviation Precinct</b>	<b>ARDAC Priority Precinct.</b>  In development	RAAF base and headquarters to Australia's Air Combat Group, 15 km from	Aerospace, maintenance, repair and overhaul, electronics, advanced manufacturing,	Air Force air combat capability, infantry training, ship building and repair.	University of Newcastle	Royal Australian Air Force, Williamstown Aerospace Centre (tenants including BAE	<p>BAE Systems has a major base at Williamstown in the Hunter servicing the large RAAF base. Williamstown is the centre of BAE System's Australia air combat sustainment activities, including deeper maintenance and line maintenance for the RAAF fleets of 33 Hawk 127 lead-in fighters. The presence of BAE Systems acts as a catalyst for other business development in the region. BAE Systems Australia has been assigned Airframe Maintenance, Component Maintenance and Warehousing Depot roles supporting the F-35 Fleet in the</p>

Name	Status	Place	Technology	Skill and Training	University	Key Partner	Description
		Newcastle City				Systems, Lockheed Martin, Boeing Defence Australia, Nova Systems, Bohemia Interactive)	Pacific, which could be up to 130 aircraft. This includes F-35 from foreign air force assets operating in the region, such as those from South Korea, Japan, Singapore and the US. Further opportunities exist for regional component maintenance (repair and testing) and warehousing for the regional F-35 Joint Strike Fighter fleet.
<b>Nowra defence precinct</b>	Existing	Located at the Albatross Aviation Technology Park, close to HMAS Albatross.	Air targets, electronics and testing, systems integration and simulation.	Naval aviation skilled technicians, maintenance and repair		Royal Australian Navy, Sikorsky Aircraft (Lockheed Martin)	The two modern and dedicated buildings cover over 11,400 square metres at the Albatross Aviation Technology Park, adjacent to the Royal Australian Navy's MH-60R operational squadron facilities at HMAS Albatross. The Albatross Aviation Technology Park is designed specifically to support defence and aviation industries, leveraging the nearby airfield of HMAS Albatross, southwest of Nowra. International companies and locally-based SMEs operating from the park primarily service the Royal Australian Navy but also other Australian Defence Force clients and customers located elsewhere in Australia and overseas.
<b>Advanced Manufacturing</b>							
<b>ANSTO Innovation Precinct</b>	In development	Lucas Heights relatively isolated, with a limited access to transport or major infrastructure	Advanced manufacturing, nuclear and isotopic technology, health, agriculture technology, industry 4.0 and food	Research, education and healthcare professional	All NSW universities	ANSTO, Australian Institute of Nuclear Science and Engineering (AINSE), Nandin incubator	This precinct is built around ANSTO's \$1.3 billion scientific infrastructure and unique capabilities in applied nuclear science and technology. The current technology park is largely occupied by ANSTO, with other tenants include the CSIRO and businesses in nuclear science and technology. ANSTO is expanding the existing technical park to house a graduate institute working with AINSE, deep technology incubator, and to accommodate new startups and businesses as proposed under a draft master plan. This precinct has been

Name	Status	Place	Technology	Skill and Training	University	Key Partner	Description
		re. GSC Collaborati on Area 2018-19	and nutrition.			and NSW Government	identified as one of the 2018-19 collaboration areas by the GSC and a Place Strategy is underdevelopment.
<b>Advanced manufacturing cluster around the UOW FIF</b>	Existing	Located within the University of Wollongong Campus	Welding, automation, electronics and communications.	Research and education	University of Wollongong and TAFE	WTIA, AMGC, Lincoln, Fronius, BOC, ABB, Bisalloy, Scott Automation	Manufacturing cluster centred on the Facility for Intelligent Fabrication (FIF), established at the University of Wollongong (UoW), which partners with TAFE NSW and the Welding Technology Institute of Australia (WTIA). The purpose is to offer research, prototyping, training and certification to local manufacturing businesses and people. The FIF also works with the Advanced Manufacturing Growth Centre (AMGC), and local industry partners including Lincoln, Fronius, BOC, ABB, Bisalloy, and Scott Automation.
<b>South Jerrabomberra Innovation Precinct</b>	In development	South Jerrabomberra Business Park	Sport science, defence and space	Research and education	Nil	Queanbeyan-Palerang Regional Council	South Jerrabomberra Innovation Precinct will transform vacant land into a 43 hectare Technology Park and a 16 hectare industrial estate, with 33 hectares allocated for a Business Incubator Hub, Regional Sports Hub, Rail Modal and a new high school. The precinct will attract businesses wanting to be close to the nation's capital along with other firms looking for more cost effective facilities, while retaining their current customer base.
<b>The End of Table</b>							

## NSW Innovation Networks Mapping

This mapping presents innovation networks (or equivalent form of virtual collaboration initiatives) supported and funded by NSW Government. These include innovation networks established by the Office of NSW Chief Scientist & Engineer (OCSE), research hubs established and knowledge hubs established by NSW Government.

Innovation networks are communities, physical and virtual spaces and/or clusters of research, development and commercialisation expertise that support and coordinate innovation. Innovation networks focus on sharing knowledge, experience and industry insights; establishing new relationships and networks; and initiating and nurturing collaborative projects in new technologies. Typically, new innovation networks are established to tackle emerging problems and provide an independent forum for capacity building and collaborative efforts. Successful innovation networks deliver tangible outputs, such as accelerating the commercialisation and uptake of innovative technologies and services, creating new partnerships between parties with shared interests, providing evidence-based and practical advice to industry and government, attracting private and public investment, and creating economic, social and environmental benefits.

### Office of NSW Chief Scientist & Engineer's Innovation Networks<sup>3</sup>

OCSE has developed and adopted the model of innovation networks in areas of strategic importance, existing research and industry strength, and with a need for greater capability in NSW. To date, OCSE has established three networks in Smart Sensing, Defence and the latest Circular Economy. All three networks have been approved successful in providing a coordinated point of contact for research collaboration and commercialisation opportunities, with some also providing leveraged seed-funding for collaborative projects between industry, government and academia.

Three established networks:

- NSW Smart Sensing Network (NSSN) is the first network established by OCSE which is a consortium of eight leading universities across NSW & the ACT. NSSN brings government, industry and academia together working on smart sensing solutions to solve economic, environmental and societal challenges across industries. Since established in 2016, NSSN is on the track of delivering 16 network commissioned research project with a total value of \$13 million. Many of these projects have potential of 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 across Australia, is in the process of commercialising project outcomes.
- Defence Innovation Network (DIN), in collaboration with Defence NSW, has been instrumental in seeding collaborations with NSW-based Defence companies and enabling them to develop new products as suppliers into the growing defence sector in Australia. The DIN has attracted federal and industry funded research to NSW. For every \$1 million of OCSE's investment, DIN has leveraged over \$15 million research funding from Commonwealth Department of Defence into the NSW ecosystem. In a recent announcement, DIN has successfully secured partnership for a \$15 million defence project that runs over five years. This project will lead by an international defence industry prime and involve local SMEs and three universities in NSW working collaboratively on defence technology translation.
- NSW Circular Economy (NSW Circular) is the latest addition to NSW innovation networks established in 2019. NSW Circular has formalised six streams of taskforces based on key challenges and opportunities in the transition to circular.

In addition to above, OCSE has established the Sydney Quantum Academy. The Academy was developed through a partnership of four NSW universities (USYD, UNSW, Macquarie University, UTS) and co-funded by NSW Government through the Quantum Computing Fund managed by OCSE, to drive skills development in quantum physics, engineering and software, as well as driving industry attraction and industrial ecosystem development.

---

<sup>3</sup> OCSE. [Innovation Networks](#).

There are two new innovation networks are under development by OCSE:

- NSW Decarbonisation Innovation Hub. The hub is a \$15 million commitment by NSW Government under the Clean Technology Innovation Program. The hub will coordinate research, government and industry efforts across three priority areas: energy systems and electrification, land and primary industries and power fuels including hydrogen.<sup>4</sup>
- Space Research Network. Work is underway to establish a new innovation for space research and industry that aims to align with initiatives in the NSW Space Industry Development Strategy, to provide connectivity and coordination between government, industry and research organisations, to leverage funding and translate valuable research to the commercial market.

### **NSW Government's Research Hubs<sup>5</sup>**

- NSW Department of Planning, Industry and Environment's Energy, Environment and Science division (formerly OEH) have funded three research hubs to partner and collaborate with universities, research centres and scientific organisations on R&D. These research hubs are:
  - o The Bushfire Risk Management Research Hub. The hub focuses on how to improve fire management strategies fire management strategies and reduce the risk bushfires pose to people, property and the environment. The hub was launched in 2018 and hosted by the University of Wollongong over five years with research experts and teams from Western Sydney University, University of New South Wales and University of Tasmania.
  - o The Energy Efficiency Research Hub. The hub is a \$600,000 investment to fund new energy and resource efficiency research in two years. The hub hosts the Energy Efficiency Decision Making Node which was established in 2017 in partnership with CRC for Low Carbon Living.
  - o NSW Adaptation Research Hub. The hub is a 5-year program on climate change and adaptation science. The hub hosts three key research nodes in priority research areas of biodiversity, coastal processes and responses and adaptive communities. The node hosts include UNSW, UTS, Macquarie University, the Sydney Institute of Marine Science and the CSIRO. A fourth research node is being established to investigate human health and social impacts.
- Transport for NSW Research Hub. The Hub fosters collaboration and information sharing between Transport for NSW (TfNSW), the tertiary sector, industry and other government agencies that are interested in transport and related research. The Research Hub outlines TfNSW Strategic Research Directions, Problem Statements and how partners can engage with us to solve some of transport's biggest challenges.

### **NSW Government's Knowledge Hubs<sup>6</sup>**

The NSW Knowledge Hubs provide the environment for knowledge sharing, problem solving and networking capabilities. These hubs are funded by NSW Government and managed by sector coordinating bodies, who work with government, industry and businesses to create new projects, improve existing processes, develop research and drive innovations to benefit the broader industry. There are six existing knowledge hubs:

- NSW Cyber Security Innovation Node. The Node is part of a national network of cyber security innovation nodes, designed to foster and accelerate cyber capability and innovation across the country. It is co-funded by the Australian Cyber Security Growth Network and the NSW Government. The Node has two primary streams of work focusing on business innovation and workforce development.

---

<sup>4</sup> NSW Government (2021). [Net Zero Industry and Innovation](#).

<sup>5</sup> NSW Department of Planning, Industry and Environment. [Research Hubs](#).

<sup>6</sup> NSW Government. [Knowledge Hubs](#).

- Energy and Resources Knowledge Hub. The hub is coordinated by the University of Newcastle's Newcastle Institute for Energy and Resources (NIER). The hub has established a few online platforms for collaboration between industry and research in energy and resources sector. The hub has established the Innovation Launchpad to provide an opportunity for scale-up SMEs to work with research.
- Financial Services Knowledge Hub. The hub is coordinated by the Committee for Sydney and was the driving force in the creation of Stone & Chalk. The hub focuses on how Sydney can compete for talent in the global marketplace to enhance Sydney's profile as a global talent hub. Working with university partners the project also examines the productive link between global talent and domestic skills.
- The Creative Industries Knowledge Hub. The hub works on projects to support the diverse community of professionals and businesses. The hub is coordinated by the University of Technology Sydney. The hub has delivered projects in creative industries including the Designers & Fleas Emerging Designer Market, Spark Festival (formerly Startup Week Sydney), exhibitions and showcase events.
- MedTech Knowledge Hub. The Hub collaborates between academia, industry and government to improve the business environment for all facets of the medical technology industry. The Hub is coordinated by the Medical Technology Association of Australia (MTAA).
- Transport and Logistics Knowledge Hub/Living Lab. The Hub is coordinated by CSIRO Data61 and it facilitates the connection of a fragmented transport and logistics industry to best-practice activities from research and industry. The Hub is an exhibition space and provides the platform for experts to meet and work together in innovative solutions.<sup>7</sup>

---

<sup>7</sup> Transport for NSW. [Research Hub TfNSW](#).