

**ACTON INSTITUTE FOR POLICY
RESEARCH AND INNOVATION**



INNOVATION, INGENUITY, AND LEADERSHIP: EVOLUTION OF THE CANBERRA AND REGION INNOVATION ECOSYSTEM

**A POLICY AND PUBLIC ADMINISTRATION
BIOGRAPHY**

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August 2018

We cannot understand why we are here unless we understand where we have come from.

John H Howard
August 2018

Table of Contents

Executive Summary	1
Purpose	1
Approach.....	1
Summary of Key Findings.....	1
Opportunities and ‘where to next’	3
1 Project requirement	6
1.1 Preamble.....	6
1.2 Project management	6
1.3 Structure of this Report.....	7
2 The Production/Economic System	8
2.1 Production system overview	8
2.2 Technological uniqueness of the production system	9
2.3 Priority sectors.....	10
2.4 Priority sectors in other jurisdictions	12
2.5 Towards a digital technology focus.....	13
2.6 Taking a value chain approach	15
2.7 Concluding comment	15
3 The Business System	16
3.1 The business landscape	16
3.2 Comprehending the business ecosystem	17
3.3 Large businesses	18
3.4 Small business.....	19
3.5 High growth firms	21
4 The Canberra and Capital Region Business Start-up Ecosystem	23
4.1 Features	23
4.2 The “Triple Helix” connection	23
4.3 Research and teaching organisation involvement.....	24
4.4 Business engagement.....	29
4.5 The ACT Government role.....	34
4.6 Technology parks, innovation districts, and precincts.....	39
4.7 Incubators, accelerators, coworking/maker spaces	43
4.8 Clusters and capability areas.....	45
4.9 Connections, connectedness, and collaboration.....	47
4.10 Access to early stage venture investment	50
4.11 Challenges and opportunities	52
4.12 Overview of Start-up ecosystem performance.....	54
4.13 Bridging the gap: science and technology translation capability	55
4.14 Concluding comment: Moving beyond incubation	55
5 Talent and Skills	57
5.1 Background	57
5.2 A unique talent pool	58
5.3 Universities	58
5.4 Vocational education and training	62
5.5 Other sources of talent	64
5.6 Skills and talent gaps	65
5.7 Concluding comment	67

6	Economic Governance	68
6.1	Policy Statements and strategies	68
6.2	Implementation measures	75
6.3	Overall assessment summary.....	76
6.4	Concluding comment	77
7	Issues for Further Consideration.....	79
7.1	A broader view of innovation - environmental, social, and community outcomes.....	79
7.2	International engagement – a unique Canberra capability	80
7.3	Connecting Art and Science – creativity and the role of cultural institutions	82
7.4	Liveability - innovation in an urban context.....	84
	Attachment 1: Discussion and Consultation	86
	Attachment 2: Success Stories.....	87
A.	Startup businesses.....	87
B.	High growth businesses.....	88
	Attachment 3: CIT Enrolment Patterns 2014-2016	94
	Attachment 4: ARC ERA data on Canberra Universities Research Strengths	96
	Attachment 5: Growth Drivers in the ACT Economy: 1987 - 2018.....	99
	Demand side drivers	99
	Supply side drivers - production, industry Gross Value Added	101
	Employment.....	103
	Comment	104
	Bibliography	105

Executive Summary

Purpose

The project sets out a Narrative of the innovation, business and economic development policy settings for the *Canberra Region* over the last 20 years - with a particular emphasis on the last 10 years. It draws attention to the growth of Canberra based start-up and new technology-based firms (NTBFs), the expansion of larger national and multinational businesses in the city, the design and delivery of innovation and enterprise development initiatives, and building effective partnership arrangements with universities and other research organisations.

Approach

The approach involved a detailed review of ACT Government plans, strategies, and studies over the 20 year period. Those references are contained in the Bibliography. Where appropriate reference was also made to similar documents from the Commonwealth over the period.

Discussion meetings were undertaken with business, government and academic leaders over the period 8 July to 14 August 2018. Discussions were recorded and transcribed. Reference was also made to transcriptions of meetings during the Review of CBRIN during January-March 2017 and the Consultations Program to assist Innovation Science Australia (ISA) prepare the 2030 Strategic Plan over the period February-June 2017 (Innovation and Science Australia, 2017a).

Where appropriate, reference was also made to transcripts of the work for ACOLA on capabilities for Australian enterprise innovation (Howard, 2016).

An extensive range of innovation and industry policy documentation was accessed, which is also referenced in the Bibliography at the end of this report. A separate Resource Document has been prepared, containing extracts from key ACT planning and strategy documents.

Summary of Key Findings

Achievements

- Over the period 1997-2018 policy emphasis has shifted from a concern with the impact of swings in public sector employment, towards a broader engagement with the innovation system, and a much more focussed industry development strategy built around sectors with strong capability and growth potential.
- The ACT Government has been able to achieve a great deal in innovation, business, and economic development with a very small amount of money. Much of this has been achieved through leadership, personal interactions, engagement of staff, continuity, and the development of mutual trust based relationships. This has enabled creation of substantial leverage in working closely with teaching and research organisations and the business community.
- The Economic Directorate has had a focus on implementation rather than high level policy. But it may have come to the time where a greater commitment to policy research, development, and a strong evidence base for interventions is required.
- The ACT Government, tertiary education institutions and business, have nurtured a robust and vibrant start up environment focused innovation ecosystem. It has a strong network organisation and is regarded by many as “benchmark”.
- Over 20 years the management of research commercialisation has become more professional, building on early successes in the life sciences at ANU, and the risk approach to investment of ANU Connect Ventures. ANU Connect ventures has emerged as a leader and model for early stage venture investments.

- The Economic Directorate has been highly innovative in drawing together a number of small grants of financial assistance into strategic ‘envelopes’ including CBRIN and the CBR Innovation Development Fund.
- Many very successful Canberra and Capital Region businesses have been built on providing products and services to Commonwealth agencies, particularly Defence and security agencies and processing and policy agencies, and have leveraged this capability into creating strong international businesses.
- University property development and campus masterplans have delivered significant economic benefits to the economy and have assisted in urban renewal and vitalization programs.
- The Canberra Institute of Technology (CIT) is working purposely to become an agile, flexible and responsive approach to meeting industry skill requirement.
- The universities and CIT have responded well to demand for education and training in public administration practice, cyber security, and developing the ‘evidence base’ for policy initiatives with the Commonwealth and other jurisdictions. They are meeting a need for a strong demand for education and training in ‘evidence based’ policy.
- As indicated by ERA assessments the ANU has built world class research capability, at level 5, in the STEM areas of Mathematics, the Physical, Earth, Environmental, Biological, Agricultural, and the Information and Computing Sciences. It also has world class capability in Clinical sciences, Neuroscience, Public health and health service. University of Canberra has world class capability in Environmental sciences.
- In the HASS area, ANU has world class capability in Applied economics, Business and management, Criminology, Policy and administration, Political science, and Law.
- The greater involvement of UNSW Canberra, in Canberra, builds research and teaching capability in Engineering, the Built Environment, some aspects of Technology, and in Creative Arts and Writing. It brings strong complementary capability in space science, cybersecurity, and ICT.
- A set of target industry segments that evolved from the 2003 *Economic White Paper* is now expressed in the 2015 *Confident & Business Ready* strategy.
- Over the last 18 months there has been strong growth in collaboration and pathway programs between universities and CIT in key priority areas.

Gaps, shortcomings, and matters for discussion

- Across Government, innovation, business and economic policy over the last 10 years has tended to become tactical and would benefit from a reset in an overall long term strategic direction – and risks missing opportunities as a result. The current total of *nine* industry target groups is probably too many for each to receive sufficient policy attention. However, as communication and ‘capability statements’ designed to retain and attract investment, they perform a useful purpose¹.
- The industry sector focus that has been adopted may have created another problem - with multiple plans, strategies, and actions that do not connect into driving an overall purpose for the future of Canberra and the Capital Region. It would be desirable, for example, for the plans to be connected in a way that delivers a vision around economic and social well-being, inclusiveness, sustainability, and Canberra’ place in the world.
- There has not been a strong focus of attention, at least publicly, in building strong capability in *cross-cutting enabling technologies*, such as: micro/nanoelectronics, nanotechnology, industrial biotechnology, advanced materials, photonics, and advanced manufacturing technologies². Running through all of these are ‘digital technologies’ - *computing, analytics and*

¹ Industry definitions and boundaries are porous and fluid. The validity of industries being defined by international statistical conventions, in terms of their ‘principal product’ that can be isolated from others, is becoming less relevant in the 21st century.

²https://ec.europa.eu/growth/industry/policy/key-enabling-technologies/description_en

data science – which are likely to be the basis for innovation and industry development now and into the future³.

However, the capacity and resourcing available to the ACT Government to initiate policy and an intervention program along these lines, is severely constrained. It is important, therefore to tap into national agendas.

Nonetheless, it is absolutely vital that a close link between digital strategy and economic development strategy is established and maintained⁴.

- There is an apparent shortage of ICT skills that should be addressed through a long term cross institutional education and training strategy.
- There is a disjuncture between innovations that address economic opportunities and broader concepts of innovation covering sustainability, health and well-being, social inclusion, and urban design and development.
- There is a major opportunity to connect Canberra’s national assets in art and cultural institutions with the broader innovation system. The connection between Art and Science is well known as an enabler of innovation. Much more can be done in Canberra to build these connections from a national and international perspective.
- Unlike other ‘company towns’ around the world, the Commonwealth Government does not engage effectively with its constituency: the Commonwealth does not have a ‘Canberra and Capital Region’ policy. With Canberra’s international role and connections around art, science and innovation, this is a major shortcoming and an opportunity to be explored.
- Several segments of the Canberra and Capital Region community still tend to be inwardly focused and parochial – reflecting a legacy of a somewhat isolated “bush capital” rather than as an internationally prominent player exploiting a unique Southern Hemisphere location.

Opportunities and ‘where to next’

The Australian Capital Territory is both a State, in terms of jurisdictional roles and responsibilities, and part of a socio-economic Region that sits within a much larger economy. The economic demand that has been driven by the Commonwealth Government and the rapidly growing ACT population has been a major driver of business development in Canberra and has had a major spillover impacts into the into the Region.

Government and household demand has driven substantial output growth in the ANZSIC defined industry sectors of Public Administration and safety, Health and social assistance, Professional, scientific, and technical services, Information, media and telecommunications, and Construction. By the same token, Agriculture, forestry and fishing is a major industry within the region.

While the *population of both the ACT and the Capital Region* has been growing substantially, the *employment and investment growth* has been concentrated within the city of Canberra, reflecting the well-known agglomeration and clustering effects of contemporary urban growth in a knowledge and technology intensive ecosystem. The three universities with a substantial presence in Canberra, and the Canberra Institute of Technology, have played a major role in building a strong regional talent pool.

The delivery of technical skills and talent in the ACT has been a major strength and competitive advantage as other States have run down their TAFE systems.

Economic and business development opportunities for the ACT cannot be seen in isolation from its regional influence and impact. But unlike other States, the ACT Government does not have a treasure chest of funds, generated from asset sales, to invest in further technology and infrastructure development opportunities.

³ Digital technologies are the foundation for other technologies such as animation, augmented and virtual reality, artificial intelligence, robotics and mechatronics, machine learning, and biometrics. These technologies that are fundamental to industries located, or potentially located in Canberra and the Capital Region, from Defence and cyber security to Creative. They are relevant to the new agriculture, covering Food and Agribusiness (AI, VR, AR, Analytics, Bioinformatics, and ICT generally, are ubiquitous across all industries.

⁴ There is an extensive corporate literature about the downside of Boards failing to see the potential and opportunities around digital disruption, and the risks of failing to build digital disruption into strategy. MIT research indicates that many corporations have a poor commitment to implementing digital strategies.

As indicated under *Achievements* above, the ACT economic and business development Narrative points to a capacity on the part of the ACT Government to make judicious use of very small amounts of funding to stimulate initiatives from within the business and academic communities. This constrained fiscal context has encouraged innovation, ingenuity, and collaboration in policy interventions and programs to chart a successful economic and business development trajectory.

The Narrative points to the leadership (as well as the small amounts of money) that has come from the ACT Government economic development agency. It has occurred in an environment built around personal communication and trust – not seen, or possible, in larger metropolitan jurisdictions. It follows that there is much to be gained from continuing with the present governance and leadership framework, but with some greater focus and tightening.

The following matters are put forward for consideration

- Continue to develop strong links with innovation hubs and districts across southern NSW and into Sydney.

This is essential for the purpose of building scale, skills, and collaboration in supporting the development and growth of new businesses, access to risk capital, and focusing on global opportunities rather than non-value adding internal/interstate competition.

- Consideration be given to the “industry sector” focus to concentrate on developing employment, investment, income growth, and exports in *five* areas:
 1. Health and Life Sciences – substantial capability at JCSMR and UC, generous funding through NH&MRC, MRTF, the Medical Frontiers Project, philanthropy, and internationally. There is a gap in scale up facilities in Canberra.
 2. Defence, Space, and Cyber Security – a substantial growth sector and where ACT and Region has very substantial capability. There are many substantial businesses in Canberra already in this sector, and a strong commitment by CIT and UNSW.
 3. Agriculture, AgTech, Genetics, and related technologies (eg. Phenomics) – the sector is undergoing transformation and disruption, increases in global demand, and opportunities are created in the move away from a commodity to a GVC/blockchain focus. Big CSIRO, and ANU role in Food and Agribusiness. Good regional connections (e.g. NSW DPI at Orange and Wagga Wagga. GRDC based in Canberra and Agrifutures at Wagga Wagga).
 4. Renewable energy, Sustainability, and a healthy community – areas where the ACT Government has marked out national leadership and continues to lead in the development of policy and implementation.
 5. The adoption and application of enabling and digital technologies across all industry sectors – essential for capturing benefits from data and analytics, introducing innovative products and services, creating new business models, and lifting productivity and performance.

A more targeted approach will make better use of the resources of time, knowledge and expertise to assemble evidence of competitive advantage, establish and articulate distinctiveness, and develop agreed “road maps” across business, government and research/teaching organisations

- Adopt a broader view of innovation as encompassing creativity, human centred design, and a strong link to the arts, culture, and a freethinking lifestyle.

There is a growing international appreciation among policy makers and the community that innovation involves much more than exploitation of advances in science and technology.

For innovation to deliver economic, social, and environmental outcomes it must be seen as inclusive and representative of the diverse constituencies in Canberra and the Capital Region. Innovation as “ideas successfully applied” has been an integral aspect of business, economic and social development for centuries. But unless this message is conveyed effectively, and action and implementation is apparent, it can be dismissed as a “fad” or a buzzword .

- Develop an encompassing innovation and industry five year Strategic Plan, encompassing a ‘three horizon’ approach, and which engages research and teaching organisations, business and industry, and Government in Canberra and the Capital Region, and connects with the Commonwealth Government.

The history of global economic development indicates that a political model rather than an 'economic model' per se provides the catalyst for effective innovation. It follows that the future for Canberra and the Capital Region lies in a strengthened sense of purpose and identity with a long-term time horizon. A start has been made with the Canberra Statement of Ambition (ACT Government & Williams, 2016). The enduring three horizon approach provides a framework for developing such a plan. In summary form this covers –

Horizon 1: Improving performance in relation to current activities and interventions – can we do better?.

Horizon 2: Addressing and assessing known emerging opportunities in terms of potential for value creation – should or could we be doing this?

Horizon 3: Ideas for growth down the road, informed by research and foresight – what should we be thinking about for the next generation.

In developing the Strategic Plan it is important not to conflate horizon elements. The Plan should be updated (not redone) on an annual basis.

- In the area of supporting new and emerging startup businesses, actively promote and advocate, with other regional innovation hubs and districts, a Regional Innovation Investment Fund (RIIF) along the lines of the successful IIFs established in 1997⁵ and the continued in *Powering Ideas* in 2009. Consider entering into a new commitment with the ANU for a follow on fund from the now closed ANU Connect Ventures.

This is recognised as a major gap in supporting new business opportunities. Success is likely to be enhanced through a collaborative approach across regional innovation hubs.

- Develop and promote a new over-arching strategic direction for Canberra's science and innovation stance based on the 'Unique Selling Proposition' (USP) that stems from its role as the capital city of the 'science power' of the southern hemisphere.

This USP would shape both international connectivity and soft power and, via this outward role, further strengthen and build upon what is already a prominent national role in innovation and economic development. Canberra is unique in the southern hemisphere in the way that it combines world-class national government, public interest research and innovation capability⁶.

- Consider extending the role of the *Vice-Chancellor's Forum* into a statutory *Canberra and Capital Region Innovation Council* with a task to support innovation in business, government, and the education and research sector, in order to stimulate industry development and economic growth.

In addition to the Vice-Chancellors, the Council would include successful business leaders, CEOs of ACT government agencies connected with innovation, the Canberra Region Joint Organisation, and the Commonwealth. The Council should establish a working relationship with the NSW Innovation and Productivity Council.

⁵ The IIF program was found by evaluations and reviews to have been largely successful – see, for example, <https://ore.exeter.ac.uk/repository/bitstream/handle/10036/3175/IndependentEconometricAnalysisofIIF.pdf?sequence=2&isAllowed=y>. It was abolished in the 2014 austerity Budget, following recommendations of the National Commission of Audit. As reflected in the 2018 budget, the present Government continues on a path of cutting funds for innovation.

⁶ Thus USP not available to Sydney or other State Capitals

1 Project requirement

The project brief required “a narrative describing and reflecting on the development of the ACT Innovation System over the past 20 years, with a particular emphasis on the last 10 years, drawing attention to the growth of Canberra based start-up and new technology-based firms (NTBFs), expansion of larger national and multinational businesses in the city, the design and delivery of enterprise development programs, and building partnership arrangements with universities and other research organisations”.

1.1 Preamble

The project brief provided the following background:

The ACT Government is regarded as a leader in the development and implementation of innovation policy through successful strategies and programs over the last 20 years. The Canberra Innovation System is regarded by many as “benchmark” for other regions in Australia and around the world. This position has been achieved with judicious application of public sector resources and in a partnered way with the major innovation centric institutions.

This project seeks to tell a story about the drivers of success. These would cover factors such as institutional stability, long term commitment, a low public profile (getting on with the job) and creating effective engagement and high levels of trust with leaders in research and education institutions, business, and the broader community. The story also extends to the strategic interventions made by the ACT Government over the period under review.

The ACT has been able to capture opportunities that arose with the emergence of innovation systems thinking in the late 1990s, aligning with national policy initiatives, the design and delivery of effective enterprise development programs, and working with research organisations in strategies for the commercialisation of research, including strategic investments with public venture capital – particularly for seed and start-up investments.

Several businesses have grown into global operations based on building relationships with some of Canberra’s largest enterprises (Defence, ATO, CentreLink, Health, Immigration and Border Protection) and building relationships and niche positions in global value chains. Others have grown by marketing a consistent, high quality product, that meets demand, such as Food and Wine.

In comparison with other states, ACT Government investments have been small – but it may well have been that this stringency encouraged policy makers to think carefully how very scarce resources could be leveraged to achieve the greatest impact.

The narrative will provide signals about “where to next”. This *may*, for example, include some observations about the integration of innovation policy with a broader industrial strategy for the ACT, as is occurring in the UK and elsewhere. It will also give policy guidance on how to address ideas and initiatives that emerge from the ACT innovation system and its players, and reflection on the appropriate role of ACT Government in how those ideas move forward.

The narrative which follows provides context, support, and some qualification about the observations in the preamble. The narrative draws on an economic development framework that has been used to explain the ‘economic miracles’ in other parts of the world and particularly in the recent work by Michael Best in *How Growth Really Happens* (Best, 2018) and his earlier work *The New Competitive Advantage* (Best, 2001)⁷.

1.2 Project management

The project commenced in mid-June 2018 and was completed in early August.

Discussion meetings were undertaken with business, government and academic leaders over the period July-August 2018. Discussions were recorded and transcribed. Reference was also made to transcriptions of meetings during the Review of CBRIN during January-March 2017 and the Consultations Program to assist innovation Science Australia prepare the 2030 Strategic Plan over the period February-June 2017 (Innovation and Science Australia, 2017a).

⁷ Michael Best is professor emeritus of economics at the University of Massachusetts, where he was coordinator of the Centre for Industrial Competitiveness. He has participated in development projects with the UN, World Bank and governments in more than 20 countries.

Reference was also made to transcripts of the work for ACOLA on capabilities for Australian enterprise innovation (Howard, 2016). An extensive range of documentation was accessed, which is referenced in the Bibliography at the end of this report.

The project has a particular emphasis on the last 10 years, drawing attention to the growth of Canberra based start-up and new technology-based firms (NTBFs), expansion of larger national and multinational businesses in the city (including government businesses – Defence, Home Affairs, ATO, CentreLink - the design and delivery of enterprise development programs, and building partnership arrangements with universities and other research organisations.

1.3 Structure of this Report

This Report is presented in a number of Sections. These cover -

- The evolution of the *Production/economic* system over the period since 1997 in terms of the industry structure, its technological characteristics, priority sectors and emerging trends.
- The *Business structure*, covering large businesses, both publicly and privately owned, high growth new technology businesses, and small businesses.
- The *Business startup* ecosystem
- Capacity and capability in the development of *Talent and skills*
- *Economic governance* drawing attention to policies, organisation and delivery of economic and business development programs.
- A discussion about broadening the boundaries of innovation, creativity, and building Canberra as an international science engagement.

There are also a number of attachments that are included as background to the Narrative.

2 The Production/Economic System

The ACT is predominantly a *services* economy with economic activity dominated by production in the Public Administration and safety industry. Since 1997, with the Howard Government public service employment cuts, ACT Government policies have sought to diversify the economy away from a reliance on the public sector. Approaches have tended to have a strong production centric (output) focus rather than a market centric (enabling) emphasis.

2.1 Production system overview

Canberra *is* unique. It is Australia's *only* national capital, and as such it presents a unique production ecosystem setting.

ACT industry production is highly service intensive, concentrated particularly in public administration and safety (including defence and security), Professional, scientific and technical services, Health care and social assistance, Construction, and Education. These industry sectors also tend to be dominated by public sector production, although the private sector has important roles.

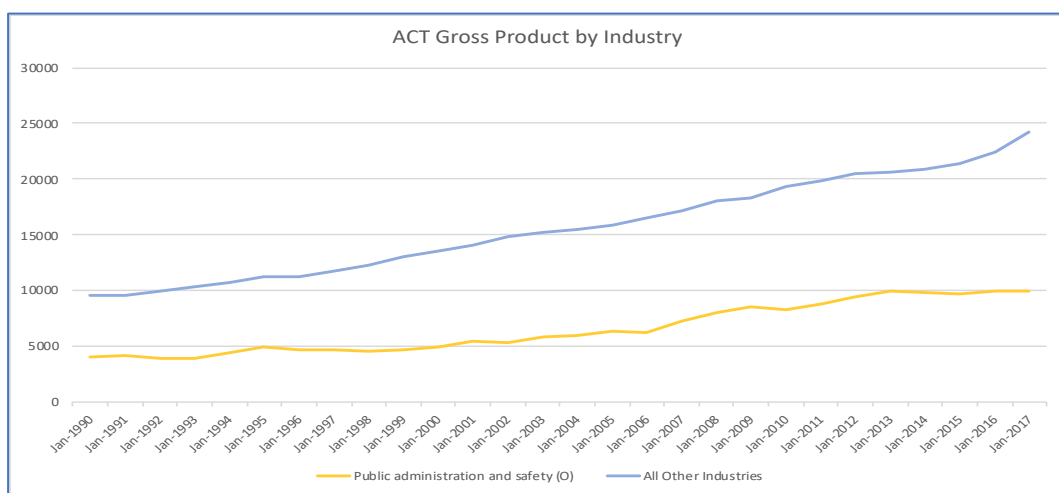
Service sector industries create value just as much, and sometimes more so, than industries associated with making physical objects or “things”. The delivery of professional services to a customer creates value in terms improved business performance and outputs through greater economy, efficiency, effectiveness, and quality of delivery.

Just as in manufacturing, service value is created by bringing new knowledge and innovations to production, processes and ways of doing business (the underling business model)

Public administration and safety is by far the largest “industry”. It also connects with many other “industries” and spills over into the surrounding region. Similarly, Agriculture, fisheries and forestry, is a significant industry in the Region, as is the food processing component of Manufacturing (for example, dairy, meat, fruit and vegetable and wine production). The region also hosts a light manufacturing sector that services the ACT economy. These interactions point to an important “hub and spoke” characteristic of the ACT and Capital Region industrial structure.

The proportion of production in Public Administration has fallen substantially since 1995, preceding the Howard Government fiscal austerity cuts of 1997. The falls reflect more the impact of privatisation, corporatisation and outsourcing initiatives by the Commonwealth associated with the adoption of thinking relating to the “new public management” (Osborne & Gaebler, 1992). The continued dominance of the public sector is illustrated in Figure 1 below.

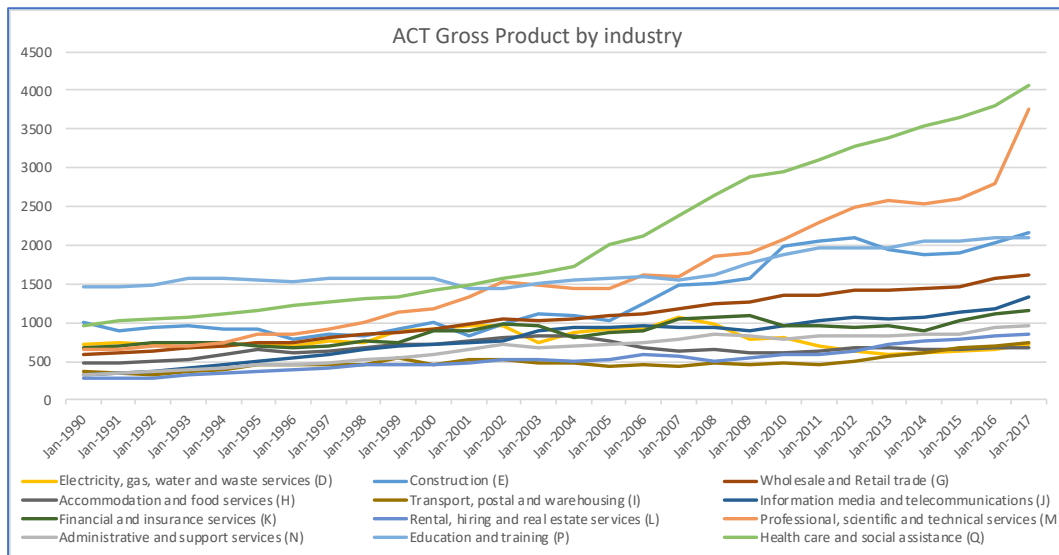
Figure 1: ACT Gross Product by Industry Public Administration and Safety and all Other 1990-2017 (chain volume measures)



It is clear however, that the public sector has been growing at a slower rate than other sectors.

The growth in all other sectors is represented in Figure 2. It shows that growth has been strongest in Health care and social assistance (also dominated by public businesses) and in the knowledge intensive industries including Professional, scientific and technical services and in Information, media and telecommunications.

Figure 2: ACT Gross Product by Industry - Other Industries - 1990-2017 (chain volume measures)



2.2 Technological uniqueness of the production system

Much of the growth in the ACT production sectors can be attributed to Government demand, commencing with the outsourcing strategies of the 1990s and growth in household demand. A more detailed analysis of demand side drivers is contained in Attachment 5.

Although outsourcing represented an industry growth swap with Public administration and safety, competition between providers had nonetheless stimulated a growth in expertise and capability and a commitment among national and global firms to locate and position themselves in the Canberra market place.

For example, privatising the business units in the former Department of Administrative Services in the 1990s, stimulated a demand for private sector architects, engineers, planners, quantity surveyors, developers – and printers (closure of the Government Printing Office). Public sector demand for services in media, communications, and public relations generated a very large growth in private sector providers of these services. Economic and capability considerations meant that there is little sense in developing this capability in house.

The growing demand for expert professional capability reflects what economic geographers refer to as an agglomeration effect as competing firms with specialised capabilities locate in close proximity to compete for business and talent (Fujita & Thisse, 2002; McCann & Ortega-Argilés, 2013). Professional services firms, with national and international connections, have also become significant service providers in the startup ecosystem.

The Professional, scientific and technical services sector currently makes up 10.3 per cent of the economy, with Health care and social assistance constituting 10.6 per cent, and Education and training making up 5.6 per cent. The Construction sector continues to be a major contributor to the economy (6.0 per cent), reflecting Canberra’s continuing growth characteristic as a ‘frontier’ economy.

Unlike other parts of the country, there has not been a ‘disruptive’ shift from agriculture, manufacturing and mining to services. The services economy has always been a feature of the ACT economy.

Although the industry profile within services has changed relatively little, there have been substantial changes and some 'disruptions' *within* industries enabled by technological change and the adoption of new technologies.

Over the 1997-2017 period there has also been a substantial growth in the size and scope of education businesses, particularly universities, driven by demand from international students, the "demand driven" funding system and requirements for higher level of education in the professions. CIT has been meeting a demand for technical skills in 'new economy' industries. CIT is the only TAFE in the country to have increased enrolments over the last several years. Universities and CIT draw a substantial proportion of domestic enrolments from the broader Capital Region.

Universities have also grown in Canberra through demand from government for education, training, and research services as their internal capability is reduced, eliminated, outdated, or simply not available. There has, for example, been a recent surge in demand for training in digital technologies, data science (analytics) and cybersecurity and policy development, review and evaluation. In addition to public providers, private RTOs have a growing role in this market.

Universities have also become significant property developers as they invest in masterplans and cater for increasing student numbers, and seek to engage more with their communities and build supplementary revenue streams.

Consistent with international trends, universities have also become substantial property developers and leaders in urban renewal, revitalisation, and redevelopment.

This is in evidence with ANU Exchange (from 2003) and development of the UC Bruce campus (from 2010). This would continue with the foreshadowed UNSW development at Reid, adjacent to CIT.

Unlike other states, Canberra organisations, public and private, recruit nationally and do not necessarily give local preference. This creates an imperative for Canberra education and training providers to build relevance, excellence, and capacity for innovation as a preferred recruitment source, and offer continuing education and training platform for the emerging needs of Government and business. The public sector generates a very strong demand for post graduate certificates, diplomas and masters degrees.

In the light of the importance of construction to the economy, Canberra could be a national champion of innovation in planning, architecture, design and engineering. Over many decades Canberra exhibited a 'commodity' construction culture. Yet the industry is approaching major disruption in methods, materials, and responses to climate change. The Canberra Airport has achieved a high level of environment and sustainability. The Nishi Building in New Acton is also an exemplar, and university buildings funded under the Innovation Investment Fund (IIF) reflect innovation in design.

2.3 Priority sectors

Innovation and industry policy can be directed towards supporting the development of clusters or hubs, or take a more generic approach to cover all sectors, and avoid criticism of "picking winners". Over the last 20 years Canberra has had elements of both approaches. Economists tend to argue for policies that do not differentiate between sectors, whilst people with an understanding of business strategy argue for targeted programs that build on existing and potential distinctive capabilities.

Distinctive capabilities become magnets for firms to relocate and stay. This is a message from a great deal of contemporary interest in regional innovation ecosystems, innovation districts and clusters (Agtmael & Bakker, 2016; Katz & Wagner, 2014; KPMG, 2014; Leon, 2008; OECD, 2012; Porter, 2005; Singtel Optus, 2017; Wessner et al., 2011).

Even in the absence of specific policy action there have been, within Canberra and Region, production framework *knowledge and technology nodes, hubs and clusters* that have strength in technologies that give elements of the system these distinctive capabilities – capabilities that other regions are unable to develop or find difficult to replicate. The capacity to create *distinctive capabilities, to innovate*, and

mark out a *reputation* in areas such as quality, service, and excellence, provide the essential elements of regional competitive advantage (Kay, 1995, 2003).

The 2003 *Economic White Paper* identified several production areas that would be the focus of policy attention:

- Information and communication technology
- Space sciences
- Biotechnology
- Public administration
- Environmental industries
- Creative industries
- Sport science and administration
- Education
- Defence

In 2015, the policy paper, *Confident & Business Ready* (ACT Government, 2015b), the ACT Government confirmed a production focussed approach to economic and industry growth by announcing a focus on the development of capability in eight areas, as follows:

- Defence and cybersecurity
- ICT and e government
- Space and spatial science
- Health and sports science
- Renewable energy
- Tourism
- Education exports
- Creative Canberra

These are the areas where Government considered that increases in employment, incomes, investment, and exports are most likely to occur, and efforts should be made 'to nudge them along'. Two areas *not in the 2003* economy strategy were tourism and education exports. However, over the period, tourism, has been a strong driver of growth, and education exports have grown substantially since 2008 from a virtually non-existent base in 1998⁸. The potential in 2003 would not have been recognised. Creative Canberra might be expected to deliver a range of *non-economic* benefits that are important in supporting a vibrant innovation ecosystem.

Canberra has also developed strength in the Film and Multimedia sector (encapsulated in Creative Canberra) led by AIE and a booming gaming sector around AR and VR, and strong involvement of CIT (a capability that also transfers to defence in the form of war games). *Confident & Business Ready* (ACT Government, 2015b) provides support for ScreenCanberra for co-funding development of feature films or mini-series through the CBR Innovation Fund. [ScreenAccelerate](#) has been a very successful incubator initiative.

Although the link between art, design and technological innovation has been recognised internationally for many years, the link is now being addressed again in Canberra (ACT Government, 2015a; ACT Government & Williams, 2016) with greater involvement of the design faculties at UC and CIT and recent Budget announcement of the ScreenCanberra Fund, which aims to attract productions which highlight the nation's capital and which build local capacity.

Not included in the *Confident & Business Ready*, but included in the 2003 *Economic White Paper* is a priority for *Public Administration* (although it is covered to some extent in Defence and cybersecurity). Canberra is Australia's hub for public policy and it has been a major industry growth area, and entry into it is becoming more contestible. It involves officials, industry and professional organisations, thinktanks, consultants, advocates (lobbyists), numerus bloggers, and journalists⁹. It employs many thousands of professionals in and around Parliament House.

Growth is stimulated by a demand for a stronger "evidence" base for policy as well as more scientific approaches to assessing outcomes and impact. This creates a requirement for educated and trained graduates to push for, develop, deliver, and review policy and programs, as well as *implement*.

Capacity for policy implementation has been recognised as a major gap in Public administration capability. Universities and particularly the CIT are responding well to this demand for knowledge and skills.

⁸ International students made up around four per cent of university commencements in 1998 (check), but they now amount to 33 per cent.

⁹ There are 4000 to 5000 people working *in* the Parliament House building on sitting days, including: members of parliament and their staff.

Capabilities and opportunities in the nominated sectors also form a foundation for the current *International Engagement Strategy* released following *Confident & Business Ready* (ACT Government, 2016d). Additional strategies have been released for *Education Exports* (ACT Government, 2016a), *Digital* (ACT Government, 2016b) and *Defence* (ACT Government, 2016d).

Not included in either the 2003 *White Paper* or *Confident & Business Ready* is a production focus on *Food and Agribusiness*, although this is currently seen nationally as a major growth opportunity as one of the six national industry growth centres (Department of Industry and Science, 2015). It is sometimes overlooked that Canberra and the Capital Region contains a robust Food and Agribusiness sector covering R&D, farm based production, processing (manufacturing), branding and market positioning, and export through Global Value Chains.

The Food and Agribusiness sector is undergoing transformation through the wide application of digital and genetic technologies, startup businesses, global venture investment, and changing business models (National Primary Industries Research and Innovation Committee, 2018).

To capture opportunities in Food and Agribusiness requires a more holistic 'regional' approach to innovation and economic development

2.4 Priority sectors in other jurisdictions

In 2015 the Commonwealth Government identified industry sector priorities under the [Growth Centres](#) initiative. The sectors are: [Advanced Manufacturing](#) (AMCG), [Cyber Security](#) (AustCyber), [Food and Agribusiness](#) (FIAL), [Medical Technologies and Pharmaceuticals](#) (MTP Connect), [Mining Equipment, Technology and Services](#) (METS Ignited), and [Oil, Gas and Energy Resources](#) (NERA)¹⁰. This initiative builds on the Gillard/Rudd initiative on Precincts, announced in 2013. However, Centres receive very little Government funding support and are expected to be self-sustaining.

Several of these sector priorities currently, or potentially, should coincide with Canberra and Capital Region priorities: Advanced Manufacturing (defence equipment), Cyber Security, Food and Agribusiness, Medical Technologies, and Mining Equipment and Technologies. Lithicon, an ANU start up was linked to the oil and gas sector.

Lithicon

Lithicon, which was acquired by FEI in 2014 for \$76m, and previously known as Digitalcore, was originally set up in 2009 by ANU scientists in collaboration with colleagues at UNSW to develop an advanced computational approach to rapidly solving fluid behaviour in oil reservoirs. The basis of this approach is a revolutionary high-resolution 3D imaging technique. FEI also plans to develop new markets outside oil and gas using this imaging technology.

Working closely with some of the world's biggest resources companies, the technology produces digital 3D images and simulations of fluids in rock samples, giving companies crucial information to help them work out the best way to extract oil and gas.

Prior to the start-up, researchers at ANU and UNSW created a research consortium with 14 multi-national oil and gas companies to prove and develop this emerging technology. The industry engagement allowed the concept to be market tested. This demonstrates that the Australian Capital Territory can foster high-technology start-ups from fundamental research through technology transfer.

"The Lithicon story is one of taking world-class research from two of Australia's best universities and turning it into a growing business. In the process we have created a whole new industry segment based on high-value, intensive, knowledge-based services. It's exactly the sort of thing we should be doing in Australia and we need more of it," said Lithicon General Manager, Dr Victor Pantano.

<http://www.anu.edu.au/research/innovation/all-stories/76-million-startup-sale>

Other States have identified priority industries and sectors. For example -

- NSW has identified "industry opportunities" in: Advanced manufacturing; Advanced technologies; Agribusiness and food; Arts, culture and creative; Defence NSW; Education; Financial and professional services; Infrastructure and construction; Mining and resources; Renewable energy and sustainability; Tourism. The Department of Industry has developed strategies and action plans in a number of these areas.

¹⁰ Growth Centres are not-for-profit organisations, each led by a board of industry experts, and required to build capability and collaborative networks, industry sectors, and be able to build stronger futures for themselves.

- Queensland has identified Advanced manufacturing, Aerospace, Biofutures, Biomedical, Defence, METS.
- Victoria has identified priority sectors *around technologies*: Construction technologies, Creative industries, Defence technologies, Digital technologies, Food and fibre, International education, Medical technologies and pharmaceuticals, Professional services, Retail, transport, distribution and logistics, and postal, Space technologies, Transport technologies, Visitor economy.

The development of the priority industries and sectors by the Commonwealth and across States creates an imperative for Canberra and the Region to develop strong, articulate, and implementable and investible sector strategies.

This requires the development and articulation of accurate and reliable sector narratives that reflect foundations, genuine achievement, ongoing commitment, realistic and realisable goals, and opportunities for national and international collaboration. They should not be publicity or promotional documents but stories about people, leaders, and aspirations.

The Canberra industry development narrative should be built around no more than four story lines. Too many means dissipating focus and creating confusion about which sectors are really important for policy and taking the economy into the future.

2.5 Towards a digital technology focus

Other States and international organisations have taken a *technology focus* towards industry development. , with attention being given to enabling technologies that are ubiquitous across industry classifications. *Computing, analytics and data science* – digital technologies - will be the basis for industry development now and into the future. Availability of talent in these areas is becoming vital for business and industry growth, and the capacity to attract businesses into Canberra and the Capital Region.

Digital technologies are the foundation for other technologies such as animation, augmented and virtual reality, artificial intelligence, robotics, machine learning, and biometrics. These technologies are central to industries located, or potentially located in Canberra and the Capital Region, from Defence and Cyber security to Creative. They are relevant to the new agriculture, covering Food and Agribusiness (National Primary Industries Research and Innovation Committee, 2018).

Data is the raw material of the industrial age (Ross, 2016)

Combined with Building Information Modelling (BIM) these technologies are also potentially of major importance to Canberra for innovation in the built environment sector and human centred urban design (city analytics). The building industry in particular is being impacted by digital technologies in methods, materials, and responses to climate change.

Canberra is rich in data. What is known as “big data” has transitioned over a few short years from a tool primarily for targeted advertising, to a technology with profound applications for diverse government and corporate sectors and addressing chronic social problems (Ross, 2016). *Data science and analytics are technologies that Canberra should seek to capitalise on in an industry and urban development strategy by ensuring a commitment in education and training across education and training institutions.*

Analytics and data science provides for multiple innovation and business development opportunities for startup and potential high growth firms. They are becoming core competencies for businesses in both the public and private sectors. Canberra currently hosts a number of large scale commercial data centres that provide secure services to the Australian Government

Canberra Data Centres

CDC is a state of the art Data Centre colocation provider delivering world class enterprise facilities and services. Since its creation, CDC has built two data centre campuses consisting of four independent data centre buildings to support our client's growing needs and demand.

CDC is based out of Canberra in the ACT and is now the largest owner and operator of data centre capacity in Australia, and the only commercial data centre facilities in Australia to be accredited as 'Secret' by defence.

CDC currently operates four data centres – Fyshwick 1, and Hume 1, 2 and 3 with Fyshwick 2 expected for completion in September 2018. Each is custom designed to CDC's demanding structural, environmental, ascetic and operational requirements to meet the highest standards for data centres.

The level of achievement is demonstrated by CDC winning the Frost and Sullivan Australian Data Centre Provider of the Year Award in 2015.

<https://canberradc.com.au/content/cdc-company>

For 20 years ICT policy and the Digital Economy was a bit of a 'black hole' in Australian innovation policy, caught between portfolio interests in the manufacturing centric Department of Industry, and the broad scope of the Department of Information Technology and the Arts, and the connection of ICT with the Cultural and Creative Industries in an effort to demonstrate their economic significance (Australia. Department of Communications Information Technology and the Arts & National Office of the Information Economy, 2002; Cunningham, 2004).

There was a good start with publication of *Australia's Information and Communications Technology (ICT) Research Base: Driving the New Economy* (PMSEIC, 2000) and the formation of the National Office of the Information Economy in 2001¹¹. Digital transformation *in Government* is now being addressed by the Commonwealth [Digital Transformation Agency](#), although it has had a rather rocky road, and in the [Digital NSW](#) initiative. But the link between innovation and industry policy and digital transformation is not close.

Data, digital technology investment to lead to \$315 billion GDP win: Data61

Financial Review 31 July 2018

Data61 chief executive Adrian Turner says if Australia can catch up to its OECD peers, it will have a \$315 billion boost ...

Australia stands to benefit from a \$315 billion windfall to its gross domestic product over the next decade if it can boost its ability to use technology for productivity gains.

Data61 chief executive Adrian Turner said the country also needed to invest in digital capital, create more domestic industries using data and digital technologies and create new globally relevant, scalable export industries.

Speaking at *The Australian Financial Review* Innovation Summit, Mr Turner called on the private sector to significantly increase its investment in research and development, saying business should not be lulled into a "false sense of security" by looking at OECD averages.

"It's an unprecedented moment in history in terms of the opportunity. Tech is accessible, global markets are accessible... we have a strong and robust ASX and we have great work going on in areas such as understanding consumer data rights.

Mr Turner said that 11 per cent of global GDP was now directly attributable to digital technologies, but Australia was coming into the digital economy from a disadvantage, having missed out on the benefits of the last technology revolutions.

"Our investment in R&D and digital technologies is falling even further behind from an industry point of view. This is a problem, a big problem, and we're seeing the ramifications of that with businesses struggling."

Mr Turner said more global giants like Amazon would come to Australia and local businesses would be vulnerable.

"More international companies are going to enter the Australian market and leverage their scale advantages.

"You think about Amazon, which can use data from its global footprint to run concurrent experiments around the world in customer conversion. It has five times the customer conversion rate of Australian online retailers. How do you compete with that?"

Data61 has pinpointed precision health care, digital agriculture, data-driven urban management, cyber-physical security, supply chain integrity, proactive government, legal informatics and smart explorations and production as fields where Australia can have an "unfair competitive advantage".

Mr Turner said Australia needed to play to these strengths in order to be globally competitive, since the country's relatively small size meant it would not be possible to outspend the likes of the US or China in R&D.

"Often times we have multinationals that don't do primary R&D and product development in Australia, they use Australia as a sales and marketing arm," he said.

"What we need to do is get more organised as a country and do a better job of communicating the incredible intellectual horse power we have as a country and develop products and services and primary R&D that can be taken to the world."

<https://www.afr.com/technology/data-digital-technology-investment-to-lead-to-15-billion-gdp-win-data61-20180731-h13cv2?btis>

¹¹ At around that time there was a fulsome debate about the connection between ICT and national productivity growth. This is canvassed in the paper *Digital Factories* prepared for the Department of Communications, Information Technology and the Arts (Howard Partners, 2005) and Australian Productivity Commission study *ICT Use and Productivity* (Australia. Productivity Commission, 2004).

Through ACTEW, the ACT took an early initiative with the digital economy with investment in TransACT¹² but more recently the approach is heavily oriented towards Government (ACT Government, 2016b).

2.6 Taking a value chain approach

In looking at industry structure and production systems it is vital to look at the totality of value creation from all of the activities required to deliver value to an end user – or the *whole value chain*. A value chain may connect with other firms in the city, the region, nationally and internationally.

A contemporary view is that

A fully entrepreneurial industrial district is one in which associations of firms along the value chain can collectively and simultaneously redesign products and services. This requires close consultation and collaboration along the value chain – regionally, nationally, and globally. In this context, a fully developed industrial district would behave like a collective entrepreneur: it would possess the capacity to redesign process and organisation as well as product (Best, 2018)

In a global context this means that the level of value added and hence (in general terms) productivity and employment, is driven by “upstream” and “downstream” linkages. This means that innovations that facilitate stronger GVC participation will help to lift value added and, in so doing, generate useful knock-on economic benefits.

The potential to increase the economic contribution of an industrial sector rests, in part, upon finding ways to increase GVC participation – there is a limit to domestic final and intermediate demand relative to global demand.

This observation is particularly relevant to Canberra and the Region – with a population base in the order of 600,000.

This link between an industry and business perspective provides an important foundation for looking at the business system in the next Section.

2.7 Concluding comment

The ACT Government has developed an approach to industry and economic development around *nine* ‘sectors’. In the contemporary policy environment they are connected through the development and application of enabling technologies, and particularly, digital technologies.

While nine focus areas looks inclusive, it can distract attention from what the Government considers to be fundamentally important for industry and economic development and job creation. For a small jurisdiction five high priority sectors should be identified.

Canberra is rich in data, and the focus of operations across traditional state-local government divide creates an opportunity to set up a distinctive capability in “city analytics”. Formation of a Centre/Institute for City Analytics” was canvassed during consultations.

¹² TransACT was launched in 1996 by a small team comprising Robin Eckermann (Chief Architect), Joe Ceccato, Robert Clarke and Jane Taylor, working under the guidance of ACTEW Executive Neville Smith. The company adopted an Open Access Network (OAN) business model, separating the wholesale and retail businesses. The company has an extensive fibre network in the ACT. SDH, ATM and IP/MPLS Metro Ethernet technologies are used to deliver services via dedicated hubs or gateways that are built around the region. Services are delivered to various businesses, government departments and residential customers via a diverse range of access networks. The first broadband platform rolled out, Phase 1 network was based on FTTC (fibre to the curb) design with nodes being placed within 300 metres of premises. SDH backbone is used to transport voice, data and video whereas VDSL technology is used as the access network to get customers connected to TransACT's high-speed broadband and digital TV services. TransACT was the first telco in Australia to implement this particular high-speed broadband technology - much superior to ADSL, which was prominent throughout the country at that time. TransACT remains as the only telco to support VDSL and the products are still actively sold with network reach-ability to over 55,000 homes in the ACT.

3 The Business System

The ACT has a somewhat unique business structure, with some of the largest businesses and organisation in the country¹³ (including, for example, Department of Defence, Australian Tax Office, Centrelink, Department of Home Affairs¹⁴, the ANU, and ACT Health). These organisations are substantial employers and increasingly acquire production and service capability, knowledge, and innovation from specialised businesses (professional and technical services businesses), smaller businesses, universities (technology transfer, collaboration), and other research organisations.

A brief overview of the business landscape, and changes over the last 10 years, is provided below.

3.1 The business landscape

The ACT, or more specifically Canberra (as a city state) can be regarded as hub in a broader regional economic ecosystem that encompasses the surrounding LGAs of Goulburn, Yass, Queanbeyan and Snowy Mountains, and South Coast. From a business analysis perspective it makes no sense to think that Canberra business activity is suspended when it reaches the constitutionally defined borders. Spokes also extend into Shoalhaven and Southern Highlands.

Data in Table 1 below indicates that the scope of business activity expanded significantly in the Canberra and the Capital Region between the years 2009 to 2016.

Table 1: Canberra Capital and Region - Business activity indicators 2009-2016

Business activity Indicators	2009			2016			Change 2009-2016		
	Capital	Region	Capital Region	Capital	Region	Capital Region	Capital	Region	Capital Region
New business entries	3,592	3,661	7,253	6,157	3,610	9,767	70.1%	-1.4%	34.7%
New business entries (per 10,000 residents)	2,086	661	2,746	8,111	603	8,714	912.2%	-8.6%	217.3%
Business Research and Development Expenditure (\$'000) – 2009-2015	66,503	31,928	98,431	134,142	603	134,143	211.8%	-100.0%	36.3%
Labour force (total) - 2010-2016	213,106	172,876	385,982	221,843	172,763	394,606	5.1%	0.1%	2.2%
Unemployed (total) – 2010-2016	7,1700	9,119	16,289	8,509	8,591	17,100	14.7%	-5.1%	5.0%
Unemployment rate	3.4%	5.3%	4.2%	3.8%	5.0%	4.3%	0.4%	-0.3%	0.1%

Source: <https://data.gov.au/dataset/sa3-region-innovation-data/resource/7bf68430-ebc1-44cd-a2b1-efc81954f7b3>

The data indicates that Canberra businesses activity (new business entries) in the Region increased after the GFC. The movements in the indicators (new business creation, employment, R&D) suggest that Canberra is very much the driver of overall regional development.

The business profile in Canberra and the Region points to the significance of businesses in Agriculture, forestry and fishing (trends are for smaller but larger and more technology intensive rural enterprises), Construction, Financial services, Health care and social assistance, and Professional, scientific and technical services sectors. This is reflected in Table 2.

Table 2: Count of businesses in the Canberra and the Capital Region, by across broad industry classifications 2009-2016

	2009			2016			Change 2009-2016		
	Capital	Region	Capital Region	Capital	Region	Capital Region	Capital	Region	Capital Region
Accommodation and Food Services	1,000	1,653	2,653	1,418	1,721	3,139	25.3%	4.1%	18.3%
Administrative and Support Services	972	976	1,948	1,148	1,026	2,174	18.0%	5.1%	11.6%
Agriculture, Forestry and Fishing	547	6,184	6,731	418	6,012	6,430	-2.1%	-2.8%	-4.5%
Arts and Recreation Services	361	475	836	403	440	843	8.8%	-7.4%	0.8%
Construction	4,409	6,060	10,469	5,035	6,007	11,042	10.3%	-0.9%	5.5%
Education and Training	499	365	864	496	370	866	-0.8%	1.4%	0.2%
Electricity, Gas, Water and Waste Services	57	105	162	57	101	158	0.0%	-3.8%	-2.5%
Financial and Insurance Services	1,448	1,368	2,816	2,053	1,830	3,883	44.2%	33.8%	37.9%
Health Care and Social Assistance	1,399	1,193	2,592	1,900	1,360	3,260	42.0%	14.0%	25.8%
Information Media and Telecommunications	195	193	388	295	179	474	51.8%	-7.3%	22.2%
Manufacturing	644	1,274	1,918	585	1,181	1,766	-4.6%	-7.3%	-7.9%
Mining	39	69	108	25	76	101	-20.3%	10.1%	-6.5%
Professional, Scientific and Technical Services	4,382	2,704	7,086	4,790	2,917	7,707	15.1%	7.9%	8.8%
Public Administration and Safety	126	93	219	134	85	219	8.6%	-8.6%	0.0%
Rental, Hiring and Real Estate Services	2,340	2,613	4,953	2,693	2,702	5,395	13.5%	3.4%	8.9%
Retail Trade	1,463	2,626	4,089	1,402	2,213	3,615	-2.3%	-15.7%	-11.6%

¹³ In this context a 'business' refers to an organisation that produces goods and services – whether in the public or private sector. Size is indicated by sales, or revenues, that may come directly from customers or from taxpayers in the case of non-trading government businesses.

¹⁴ The Department brings together Australia's federal law enforcement, national and transport security, criminal justice, emergency management, multicultural affairs and immigration and border-related functions and agencies.

	2009			2016			Change 2009-2016		
	Capital	Region	Capital Region	Capital	Region	Capital Region	Capital	Region	Capital Region
Transport, Postal and Warehousing	1,256	1,793	3,049	1,265	1,721	2,986	0.5%	-4.0%	-2.1%
Wholesale Trade	451	813	1,264	456	770	1,226	0.6%	-5.3%	-3.0%
	21,588	30,557	52,145	24,573	30,711	55,284	13.8%	0.5%	6.1%

Source: <https://data.gov.au/dataset/sa3-region-innovation-data/resource/7bf68430-ebc1-44cd-a2b1-efc81954f7b3>

The very rapid growth in businesses around professional services activity includes not only those categorised as Professional, scientific and technical services (for example, research, engineering, instrumentation, architecture), but also covers Health (allied health services generally run as small businesses¹⁵) and Finance and insurance (accountants, advisers and brokers). These businesses tend to be extremely “knowledge intensive” and are reflective of high levels of attainment in academic, professional, and technical education and training.

Numbers of people identified by level of education attainment in 2016 are listed in Table 3. Comparative data for previous years is not provided in the dataset, but data from elsewhere indicates that university graduate rates increased substantially following the announcement of the demand driven funding system in 2009.

Table 3: Canberra and Region – Educational Attainment, 2016

Indicator	Capital	Region	Capital Region
Postgraduate Degree Level (total, 2016)	34,790	9,594	44,384
Graduate Diploma and Graduate Certificate Level (total, 2016)	13,400	5,883	19,283
Bachelor Degree Level (total, 2016)	71,608	31,996	103,604
Advanced Diploma and Diploma Level (total, 2016)	29,716	26,858	56,574
Certificate Level (total, 2016)	35,166	59,208	94,374
Year 12 or equivalent (total, 2016)	223,750	122,712	346,462
Did not go to school (total, 2016)	1,406	978	2,384

Source: <https://data.gov.au/dataset/sa3-region-innovation-data/resource/7bf68430-ebc1-44cd-a2b1-efc81954f7b3>

Table 3 points to a very high number of Bachelor degree holders and above in the Capital, but interestingly, points to a very high number of Certificate Level holders in the region. The region has been well served through the Canberra, Illawarra and Riverina TAFEs.

Businesses may be formed and operate through a variety of models including a “startup” trajectory or as a more traditional “organic” growth pattern. The Capital and the Region can point to exemplars in both categories. Within the portfolio of 55,284 businesses there are also many “high potential growth” SMEs that have yet to realise their full potential. There are also many single contractor and lifestyle businesses as well.

Innovation policy at the Commonwealth level is increasingly focussing attention on potential high growth firms (HGFs), such as through the 2030 Innovation Strategy (Innovation and Science Australia, 2017a) and the industry growth centres initiative (Department of Industry and Science, 2015). But there are gaps, particularly in access to expansion and growth capital.

3.2 Comprehending the business ecosystem

An important aspect of Canberra’s business uniqueness is that many production activities occur in government agencies and enterprises that require an increasingly specialised and complex range of service inputs. This processes commenced in earnest during the 1990s with the privatisation and corporatisation agendas but has accelerated as the business of government itself has become more knowledge and technology intensive.

The complexity and knowledge intensity of current government product and service production also means that government increasingly calls on other elements in the business system to meet its requirements. However, only in more recent years has government embraced a strategy of *outsourcing innovation*. As discussed in the *Australia 2030 Strategy* (Innovation and Science Australia, 2017b), procurement policies and strategies still constitute a major brake on government innovation.

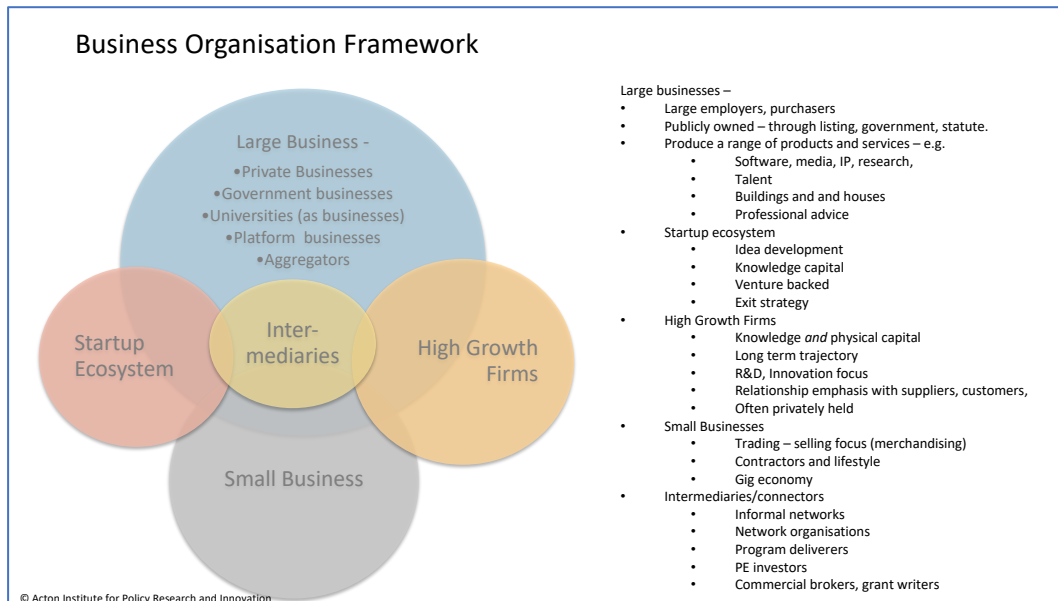
The Canberra business ecosystem consists of four elements:

- A large business system dominated by government business operations and large businesses that specialise in meeting their requirements

¹⁵ The NDIS has stimulated new business development and has encouraged firms to develop capability around assistive technologies.

- A startup ecosystem build around a venture capital investing model
- A high business growth sector built around the exploitation of technology and technology opportunities
- A small business system characterised by owner operators, freelancers and contractors.

Figure 3: The Business Ecosystem



Each segment will be addressed in Sections 4.3 to 4.5 below. The startup ecosystem is addressed separately in Section 5. Brief comments on the overall business landscape follow.

3.3 Large businesses

Like Silicon Valley, some the largest businesses in Canberra are *government businesses*, including the Defence Department, the national security and law enforcement agencies, and the massive data processing agencies (ATO, Centrelink, ABS). These businesses are substantial investors in cyber crime/security capability/research.

Over the last 20 years, and notwithstanding the frequent Commonwealth fiscal austerity measures, these businesses have grown substantially, generating a very significant demand for goods and services, only part of which can be met by other Canberra based businesses. As these businesses continue to outsource their R&D activities and engage in open innovation approaches, opportunities are presented to the startup business ecosystem and high growth businesses (referred to below).

It is also often overlooked that Universities are in fact also businesses with substantial revenue sources and demand for services – either directly through their own budgets, or indirectly through the expenditures of students.

Over the last 20 years there has also been substantial growth in the number and size of large businesses in the Technical and professional services industry, particularly accounting, legal, engineering, advanced manufacturing, and data management businesses providing services to government. Many of these businesses have grown into global operations based on their experience in working with government.

The demand for production and service capability from large business in Canberra creates major opportunities for the development and growth of startup and smaller businesses in Canberra and Region.

Administrative reform, budget austerity, and changing ideas about the role of the public sector has meant that government and public organisations must acquire an increasing range of services externally. It follows that government is demanding an ever increasing range of capability from outside

providers. This, in turn, created new business opportunities for the private providers who are able to meet both Australian government requirements as well as offer capability to other businesses in Australia and internationally.

In addition to outsourcing 'non-core' functions, large businesses have for many years been outsourcing innovation, under a strategy of "open innovation" (Chesbrough, 2003a, 2003b; Linder et al., 2003a, 2003b). In a world of "stage gate" (Cooper, 2001; Hamel, 2000) approaches to research, development and innovation – ideas-experiments-ventures - it makes sense to source ideas externally through "maker spaces", crowdsourcing or ideas and solutions, and formation of innovation hubs – a modern day form of building R&D capability.

Businesses as well as governments have been "hollowing out" over the last 20 years at least.

Large businesses – public and private are establishing innovation hubs – particularly to encourage startups to develop ideas around their platforms – Microsoft, Hewlett Packard, Amazon, Google, IBM. For example. The APS has also created an innovation hub.

These developments have created immense opportunities for new and emerging technology based firms in Canberra. The Canberra Innovation Network has a role to stimulate this aspect of innovation by building stronger connections with large corporate and government innovation hubs and platforms to inform potential startup and new technology businesses seeking opportunities.

3.4 Small business

Canberra the Capital Region has a vibrant small business system. Business assistance and support is provided by the Canberra Business Chamber, and its predecessor organisations, to its small business members. Much of this assistance, for example, workplace relations advice, is provided as part of membership packages or on a cost recovery basis.

The small business system covers many categories, such as trades contracting businesses, creative business, personal service businesses, and retail, food service, and lifestyle businesses. While many receive funding from bank loans and so forth, their ability to pay that back and build scale is very different. Most rely on cash flow to grow their operations. These business categories tend to be the targets of government enterprise development programs designed to support the SME sector. The main focus is on job creation (subsidy) rather than technology development.

It was observed during consultations that small business and their advocacy organisations tend to get a bit annoyed when they think they might have been forgotten. Small business *is* important in the innovation ecosystem, but it has a different role to play. For example, small creative agencies, with 30 people, should be seen as supporters of the startup and high growth ecosystem considered in the next Section. Venture capital backed startups outsource 90 per cent of their work, and probably 70 of that work is done locally¹⁶.

As our startups increase there's more and more work going to local small businesses and medium businesses. That's a new important part of the narrative, and is relevant to the growth of the freelance economy.

In the early part of the period under review, the ACT Government supported *small business maintenance* through initiatives such as Canberra BusinessPoint, with a strong focus on business fundamentals, the Small Business Innovation Partnerships Program, and various microbusiness programs. The Government has now largely withdrawn from the delivery of form of support, in favour of system and enabler support, and focussing on high growth potential SMEs.

¹⁶ Interview discussion with Monica Wulf

There are also many private sector business development and capability programs run through RTOs, including AIM programs, and on-line offerings. Several professional services firms and associations have established their own RTOs.

In 2007 the Government initiated the formation of *Canberra BusinessPoint*, as a rationalisation and reform of business programs and the way in which business and industry development would be pursued. It was an extension of the former CanBAS service with significant additional funding. The new service went through a procurement process which commenced in October 2006. It was first delivered by Deloitte Australia, and subsequently, the Canberra Business Council.

Canberra BusinessPoint

Whereas the CanBAS model was principally about providing baseline advice to start-ups and micro entry-level firms, BusinessPoint was to be about capturing that CanBAS delivery content and taking it some steps further into commercialisation and innovation. There was also to be mentoring and advisory support around entrepreneurship—working one on one with companies and their managers to develop and assist them through growth phases or particular plateaus in that company's development.

Formation was also prompted by the 2006-07 budget that removed the two major grants programs that the government ran—the Knowledge Fund and the Export Growth Program. The policy philosophy was to move from a grant-based or individual relationship based form of support for businesses to a more general service provision based around information mentoring and advisory services.

The ACT Government was aware that most of the other states and territories have some degree of service offering in that high-growth entrepreneurship area.

The ACT Government terminated funding for BusinessPoint with the formation of CBRIN in 2015. The Canberra Business Chamber now runs Canberra BusinessPoint as a Chamber Program¹⁷.

A Canberra Partnership Program was announced in the 2003-04 Budget. The aim was to bring business and institutions together through Government and “focus on developing existing businesses and encouraging the establishment of new ones”.

A key task of The Canberra Partnership will be to create business-to-business linkages between the ACT business community, and key cities and regions around the world.

The Canberra Partnership will be supported by a dedicated Government agency. The agency will have the authority to direct the implementation of Government endorsed economic development and promotion programs and will advise the Government on the full range of related policies, including regulatory reform.

The Canberra Partnership will report directly to the Minister for Economic Development, Business and Tourism and will replace the Business Canberra and Knowledge Based Economy Boards.

Also in 2003, the Government appointed a Small Business Commissioner as a statutory authority, to:

- promote informed decision making by small business;
- mediate disputes between small and large businesses and government agencies;
- develop and monitor small business service charters within government agencies; and
- report to the Minister for Economic Development, Business and Tourism on legislation or market practices that adversely impact small businesses.

These early initiatives did not survive the test of time, being casualties of the policy changes following the 2006 *Functional Review*.

In 2015 the Government introduced a Small Business Partnerships Program (SBIP) which aims to connect the ACT Government with small-medium enterprises (SMEs) to deliver innovative solutions to complex government problems, and at the same time providing opportunities for businesses to develop and showcase their IP. Each project begins with a project owner within government with a problem to solve, who is open to considering a range of potential solutions, and has funding to enable the development of at least a prototype solution¹⁸.

¹⁷ <https://www.canberrabusiness.com/business-support-programs/canberra-businesspoint/>

¹⁸ <https://www.cmtedd.act.gov.au/sbip/about-the-program>

3.5 High growth firms

Companies that fall into this category tend to follow an evolutionary growth trajectory. Research indicates that most noteworthy businesses have “quite unremarkable” beginnings (Bhidé, 2000). In the US most of the *Inc 500* companies bootstrapped their ventures, with modest funds provided from credit cards, mortgages and other loans. Only five per cent of *Inc 500* companies raised funds from professional venture capitalists.

High growth evolutionary businesses tend to exhibit the following characteristics (Bhidé, 2000) :

- They replicated or modified an idea they encountered through previous employment – or by accident – as did Hewlett Packard, Dell (in the US) and Tower Computing, CEA, Aspen, in Canberra.
- Did not spend much time searching for opportunities, doing market research, or writing business plans – they learnt by doing, made mistakes, but generally got on with the job
- They adapted to unexpected opportunities and problems – in the absence of a strategy, or even a goal
- They undertook most of the critical functions and recruited whomever they could for the tasks – if they were too stretched to do it themselves
- There were initially inexperienced, but enthusiastic in business and management practice.

Few of these businesses were originally housed in coworking spaces, incubators or accelerators. They tended to be located in industrial suburbs where rents were cheap. If they were engaged in manufacturing, planning laws would require it. They may have used serviced offices¹⁹ or commercial co-working spaces²⁰ as a way of conserving accommodation and overhead costs.

CEA Technologies
<p>CEA Technologies was established in 1983 by two former Naval Officers with a goal of creating a centre of excellence for the design and support of systems for the Australian Defence Force. From the outset, CEA Technologies was based on the provision of uncompromising design principles and robust through life system support, this philosophy became an enduring driver of CEA's business.</p> <p>"Solutions with Commitment" was established as a pivotal tenet of CEA practices and remains the company's primary driver in business conduct ensuring that the company continues to be at the forefront of innovation. Throughout its brief history CEA's achievements have continued to accumulate resulting in the company growing to become an internationally recognised, world-leading radar and communication systems supplier.</p> <p>The company continually endeavours to expand its reach into the international market and successfully exports to the USA, Europe, the Middle East and Pacific countries. A steady and continuous corporate growth has resulted in a corporate staff of almost 400 people located across its four facilities in Australia (Adelaide, Canberra [HQ], Melbourne and Perth) and one in the USA.</p> <p>One of the company's greatest achievements came about in November 2010 when CEA delivered to the Royal Australian Navy (RAN) a world first - the first fourth generation Active Phased Array Radar (PAR) System to be brought into service anywhere in the world.</p> <p>https://www.cea.com.au/!Global/Directory.php?Location=CompanyProfile:CompanyProfile</p>

The story of CEA is documented in an Australian Strategic Policy Institute monograph, *Rearming the Anzacs* (Macklin, 2017).

The ACT Government has supported businesses with high growth potential through initiatives such as:

- Innovation Connect started in 2008-09
- Lighthouse Business Innovation Centre
- Exporters Network
- The Entrepreneur Development Fund
- CBRIN and sub programs such as the SME Growth Program, KILN Incubator, and Griffin Accelerator.

Commonwealth Government support is provided through the R&D Tax incentive, Commercialisation Australia Grants, and grants under the Entrepreneurs Program.

¹⁹ For example, Servcorp at the Realm and Nishi Building - <http://www.servcorp.com.au/en/office-finder/>

²⁰ WeWork, for example, <https://www.wework.com/>

Aspen Medical

Founded in 2003 by Glenn Keys, a former ADF Colonel, and Dr Andrew Walker, Aspen Medical is an Australian-owned, multi award-winning, global provider of guaranteed and innovative healthcare solutions across a diverse range of sectors and clients including Defence, Mining & Resources, Oil & Gas, Government and Humanitarian.

In just over a decade it has become the world leader in the delivery of healthcare solutions in any setting, particularly those that are remote, challenging or under-resourced. We offer our clients a tailored and flexible service wherever it is needed, from a single paramedic to a full spectrum solution.

“Our competitive advantage lies in superior project management and the quality of our team. We pride ourselves on a customer-centric approach and a 'can do' attitude”.

Today, Aspen operates across Australia, the Pacific, Africa, the Gulf region, the UK and the USA, and we employ more than 2,500 dedicated, experienced and highly-trained professionals.

<https://www.aspenmedical.com/aspen-medical>

There's a place to play in the startup innovation ecosystems for both venture backed and evolutionary technology businesses. One is not better than the other. At that early stage they have very different mechanisms for growth and for potential. But it would be a mistake to focus support for new venture firms solely on venture backed startups. Venture backed businesses, are a special category of high growth firms, and will be considered in the next Section.

Intelledox

Intelledox Pty Ltd (formally DPM Consulting) is a software development company that specializes in business process digitalization. Founded in 1992, Intelledox began as a consulting business and soon evolved into a software company, developing software products such as learning management system Capabiliti LMS and Intelledox Infiniti. It is an Australian company headquartered in Canberra with offices in Sydney, Singapore, New York, Dallas, and London.[11][12]

Intelledox Infiniti was developed to address the market requirement for software specifically to assist with the construction of repetitive documents (document automation/ECM). Intelledox allows non-technical users to implement common Microsoft Word skills, to create reusable document components in a central repository, without the requirement of macros or coding.

Intelledox's software products help government and enterprises around the world to digitalize their business processes. Intelledox Infiniti customers use the software to produce documents such as licence applications, statements of work, financial advice, contracts, tenders, insurance forms, customer correspondence and technical manuals. These documents can be delivered in the form of a Word or PDF document, XML file, PowerPoint presentation, Excel spreadsheet, email, SMS and more.

Intelledox Infiniti is a mobile-ready business process digitalization platform built on Microsoft technology. It seamlessly integrates with other line of business applications such as Sharepoint, TRIM, and Microsoft Dynamics. By using Microsoft Word as the document designer, users have the ability to publish templates and centralise the automation and generation of documents with no scripting (IT) requirements.

Intelledox provides a user-friendly, browser-based, front-end Wizard, which allows non-technical users to create any type of standards-compliant document.

Intelledox was awarded the Telstra 2014 ACT Business of the Year Award, which celebrates Australian entrepreneurs and innovators. It was a finalist in the 2013 Telstra ACT Business Awards, was recognised on Anthill Magazine's 2013 Smart 100 List and made the BRW Fast 100 list in 2010 and 2011.

Intelledox partners with industry leaders in information management, including Microsoft (Gold level partner), Oracle (Gold level partner), Fujitsu, Sitecore and Avanade. In June 2014, Intelledox announced a new partnership with Fuji Xerox Asia Pacific, whereby Fuji Xerox will act as an authorized reseller of Intelledox Infiniti to offer cloud-based eform and business transformation solutions in the Asia-Pacific market.

In September 2014, Intelledox co-founders Phillip Williamson and Michelle Melbourne donated Intelledox's Infiniti software to the Australian National University to help the University streamline its complex administration processes. The gift is estimated to be worth more than \$10 million, and has been described as “one of the most exciting, innovative, and useful gifts” ever given to an Australian university. The first application of the software will be to improve travel bookings for staff and students, an administrative process currently estimated to cost \$2 million a year.[28]

<https://en.wikipedia.org/wiki/Intelledox>

Other case examples are provided in Attachment 2 B.

4 The Canberra and Capital Region Business Start-up Ecosystem

The ACT Government, tertiary education, business organisations, together with some NGO initiatives have been instrumental in building a flourishing Canberra and Capital Region startup ecosystem. The ecosystem extends beyond Canberra into surrounding areas with active involvement in Wollongong, Orange, Wagga Wagga, and Sydney.

4.1 Features

The focus of startup ecosystems is identifying, nurturing and growing early-stage businesses with, potentially, a large addressable market that they're able to capture quickly, utilising technology. The main components that are relevant for venture backed startups is utilisation of technology and speed of scale, and magnitude of scale (Bhidé, 2000). Professional venture capitalists invest in these *knowledge capital* businesses, rather than in those that require tangible assets such as physical capital and land.

A startup ecosystem has an orientation towards new businesses being able to secure later stage venture capital private equity investment. But not all startups will ever receive venture capital investment. The ones that do have some specific characteristics:

- Their founders have exceptional qualifications and ideas, which allows them to raise more capital than other potential growth businesses - between \$2m and \$5m
- They pursue opportunities with greater investment and less uncertainty, rely more on anticipation and planning and less on improvisation and adaptation and use different strategies for securing resources.
- They face extensive scrutiny of plans and monitoring of performance. Canberra Business Angels has performed important roles in this regard.
- Business incubators and accelerators, such as E29, Griffin and KILN, recently brought together under CBRIN, have performed a vitally important role in this dimension.

These are not the general characteristics of the vast majority of new growth businesses.

The prototypical start-up that flourishes in the venture capital setting has a technological solution to a mass problem – or opportunity. It produces something that has a high selling price, high margins and an expectation of being profitable in two to three years.

Nonetheless, people care about startups because of the potential impact they can make in terms of exports, and investment, and job creation. As one player in the Sydney startup ecosystem observed -

If you define a venture backed startup as a company that has the potential for a large outcome quickly, It takes away some of the pixie dust of innovation. They're getting more and more boring. For example, one came into Fishburners with an idea to sell mattresses. A different kind of mattress online. I was falling asleep in the pitch, then I thought, "Okay, large, large market, and you've got a kind of innovation in the process that you're using to address that market," and they did 17 million in the first year of sales, and now they're going into China and Japan, and a few other markets. Not interesting technology, but executed incredibly well. At the end of the day, if we have 10,000 of those companies, wonderful.

To achieve those results, it is often necessary for startups to engage with the global platform companies and aggregators such as Amazon, Google, Alibaba, etc. Many of these businesses have their own strategies for identifying and nurturing startups that will work around their platforms.

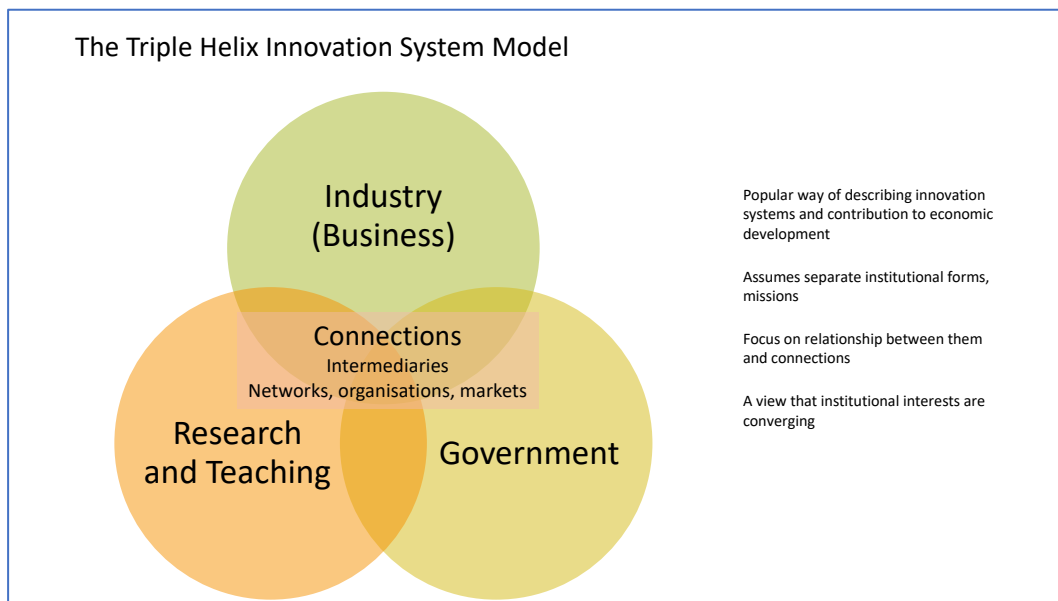
These factors reflect the emergence of network and supply chain characteristic of venture investing and start-up growth. In this context, a critical capability among venture capital investors is an ability to maintain networks and relationships with research organisations, investment banks, and corporations in the industry. In a regional location like Canberra this presents particular challenges.

4.2 The “Triple Helix” connection

The Canberra and Capital Region reflects the operation of a the “triple helix” (TH) innovation system perspective. The TH framework is a well-established theoretical concept and a basis for portraying patterns of industry-science-government interactions (Etzkowitz, 2002, 2008; Etzkowitz & Leydesdorff, 1997; Leydesdorff & Etzkowitz, 1998; Viale & Etzkowitz, 2010). It provides a useful depiction and description of what might take place in what are described as ‘regional innovation ecosystems’. There

is a presumption that interactions will evolve around the convergence of missions concerning creation and utilisation of knowledge, regional networks, government regulation and venture finance, and decisions of multinational corporations and international organisations.

Figure 4: The Triple Helix Framework for Innovation Systems



Although conceptually credible, the TH model offers little in the way of practical guidance about *how* interactions can be nurtured and developed, what and where new public and private innovation investments should be made, the most appropriate way to go about building and strengthening engagement between institutions to achieve innovation outcomes, and most significantly, the governance and intermediary arrangements appropriate to guide planning, budgeting and resource allocation at a regional level.

The EU has taken the TH framework further by adding a strategy dimension through the *Regional Smart Specialisation Strategies* (RS3) approach to address those investment, engagement and governance issues (Foray, 2015; Morgan, 2015). It is a bottom up “entrepreneurial discovery” methodology. Two regions in Australia have taken up the Smart Specialisation approach – the Hunter (RDA Hunter, 2016) and Gippsland²¹.

The TH framework is a useful way to describe the interacting roles of Research organisations, businesses, and the ACT Government in the evolving Canberra and Capital Region startup business ecosystem.

4.3 Research and teaching organisation involvement

The ANU has always been conscious that it is a big fish in a small town, although the “town” is now much bigger. There was always a strong commitment from Vice-Chancellor Chubb (2001-2011) and now by Brian Schmidt (2016-) The University considers that it must be part of the community. The ANU, since 2003 and UC from 2008, has articulated a major commitment to the business, economic, and social development of Canberra and the Capital Region.

From 2007, with the appointment of Vice-Chancellor Stephen Parker, the University of Canberra defined itself as the university *for* Canberra. This continues with the present Vice Chancellor, Deep Sani.

In 2001, ANU joined ATP Innovations, a collaboration with The University of Sydney, University of Technology Sydney, and the The University of New South Wales. ATP Innovations, now Cicada Innovations, has been awarded Incubator of the Year on several occasions. Involvement is a way of

²¹ <https://lva.vic.gov.au/gippslands-smart-specialisation-strategy/> and <http://s3platform.jrc.ec.europa.eu/s3-platform>

ensuring, in part, that ANU does not become too detached from the Sydney startup ecosystem. The relationship blossomed during the 2005-2016 period, with incumbent CEO Hamish Hawthorne²².

ANU took a lead role in the renewal of the City West Precinct through the ANU Exchange Master Plan under a Deed of Agreement with the ACT Government in 2005. The ANU Exchange vision was to create a “vibrant mix of university, arts, scientific, educational, residential, and community facilities unique in Australia”. It preceded by many years precinct initiatives underway in other parts of Australia.

The ANU was a major instigator of the Space focus in the ACT through its work after the fires in rebuilding ARTC and its record of research excellence in astrophysics.

We do things with a view that hopefully it will create a bigger imperative within the city for it.

In the late 1990s there was a widely held view that universities were not good at research commercialisation. It was a mantra developed, largely driven by the Australian Institute for Commercialisation. However, practice at the ANU (and UniQuest at The University of Queensland), demonstrated otherwise. This was reflected in the Australian study, *Best Practices in University Research Commercialisation*. (Johnston et al., 2003).

4.3.1 Commercialisation and leadership in life sciences

The ANU, through the John Curtin School of Medical Research (JCSMR) has been a leader in life sciences and biotechnology commercialisation for over 20 years. For example (Dawson, 2014):

- [Pharmaxis](#), was formed in 1998 by JCSMR scientists Brett Charlton and Bill Cowden, and David Willenborg from Canberra Hospital. It is now one of Australia’s largest pharmaceutical companies. It received its first seed funding in 1999. It also benefitted from the R&D Syndication arrangements.
- [Biotron](#) was founded in 1999 by Peter Cage also from the JCSMR. An early investor was the Canberra Business Development Fund, managed by Australian Capital Ventures Limited.
- [Lipotek](#) was founded in 2001, and received funding from the Knowledge Fund
- Phenomix, started in 2001, raised \$US35m in startup capital in 2002. The headquarters were at ANU, with venture capitalists and drug development taking place in San Diego. But, it became a casualty of the GFC.

Phenomix: How Everything Right Can Go So Wrong

BioWorld Insight Contributing Writer, Nov 15, 2010

Phenomix was founded in 2001 as a platform company that used mouse models to determine whether sequence variations introduced into the genome would yield new drug targets. The company spent its first few years working on the technology, and formed a collaboration with Genentech Inc. to identify targets in immune disease. (See BioWorld Today, July 13, 2004.)

In October 2008, Phenomix Corp. seemed to be on top of the biotech world. After raising \$165 million in venture capital to develop its Type II diabetes compound, dutogliptin, the San Diego start-up scored a development deal with Forest Laboratories Inc. potentially worth \$340 million.

Less than two years later, Forest pulled out of the deal despite good Phase III data with dipeptidyl peptidase-4 (DPP-4) inhibitor dutogliptin. Phenomix had no choice but to cease operations’.

"Given that our next product was fairly early [in development], it made the most sense to take our remaining cash and make a distribution to our investors," Shawver told BioWorld Insight. The biotech shut its doors in October.

At first glance, Phenomix's demise may seem surprising. But peel back the layers of this saga, and it becomes clear how regulatory and financial circumstances – some of which are uncontrollable – can destroy a promising experimental drug. The tale is likely to spook other companies developing new therapies to treat metabolic diseases.

Phenomix stepped away from the platform strategy in 2005, and instead focused on developing a DPP-4 inhibitor that it had identified while working with its mouse models. Phenomix was far from the first company to identify DPP-4 as a promising lead; Merck & Co. Inc., Novartis AG and several other companies were far into their DPP-4 programs already.

In December 2008, the FDA released new guidelines for all Type II diabetes drugs, demanding that cardiovascular-outcome studies be added to Phase II and III programs. The impact on Phenomix would be devastating. "It meant we had to track a large number of patients for two years or more," CEO Laura Shawver said. "We thought the clinical studies alone would cost \$350 million to \$400 million. That was quite different from our original estimate of \$150 million."

Then there was the commercial risk. The added cost of the Phase III program, plus the expected marketing expense, made the whole project untenable, Shawver said. "With the marketing costs of detailing a primary care product, the later you are to the market the more risky it becomes to try to recoup the investment.

²² Hamish is now COO of UpGuard, he first digital resilience platform for the cloud and the data center - <https://www.upguard.com/>

In retrospect there isn't much more Phenomix's executives and investors could have done to stay alive. Had the funding environment been better, the company might have taken two or three pipeline candidates forward in parallel, Shawver said. But by the time the company filed for an \$86 million initial public offering in January 2008, investors had lost interest in biotech. Phenomix cancelled the offering.

Shawver's advice for biotech start-ups interested in the Type II diabetes space is sobering. "What the guidelines mean is there will only be room for one or two drugs in each class," she said. "Perhaps smaller companies would be better off focusing on another disease, where the regulatory environment is not so burdensome."

<http://www.bioworld.com/content/phenomix-how-everything-right-can-go-so-wrong>

- [Beta Therapeutics](#), formed in 2011, supported by ANU bringing finance and investment from ANU Connect Ventures
- [Gamma Vaccines](#), formed in 2009, to take JCSMR discoveries from the laboratory bench through a program of trials to validate and confirm efficacy for human or animal use.

A key area of ANU strength relates to its investment in phenomics, a capability applicable to human and animal health. The *Australian Phenomics Facility* is a component of Australia's National Research Infrastructure and brings together expertise for the creation, characterisation and cryopreservation of mouse models of human disease.

The Australian Phenomics Facility

Established in 2004, the facility receives funding from the Australian Government's NCRIS, Super Science and previously from CRIS through the Australian Phenomics Network and contributions from the Australian National University. The Animal Services Division receives funding support from JCSMR and the office of the DVCR.

The Facility has an experienced genomics and bioinformatics capability focussed on the identification of single nucleotide polymorphisms and the phenotyping capability to make the biological associations with probable human disease traits. Our goals are to firstly derive the underlying genetic mechanisms, and then look to extend this across the population and better understand cohort differences and responses.

It has an open access policy and support academic and corporate research programmes in Australia and internationally. The facility is equipped with up to date technology ensuring the highest quality in all aspects of our work.

All services are compliant with relevant legislation including those governed by the Office of the Gene Technology Registrar (OGTR), Animal Experimentation Ethics Committee (AEEC), Department of Agriculture and other relevant legislative authorities.

<http://www.apf.edu.au/about-us>

4.3.2 ANU Connect Ventures

From the early stages in the formation of the startup ecosystem the ANU engaged with the ACT Government and brought ideas to it. One was [ANU Connect Ventures](#), formed in 2005 as a collaboration between ANU and MTAA Super. The objective was to invest in unique ideas coming from the ANU and region. The ACT Government subsequently became involved. As a result, a \$30m Fund was created.

The ACT Government commitment involved a long negotiation between the Minister for Economic Development (Ted Quinlan), the ANU Vice-Chancellor, the Deputy Vice-Chancellor (Research), and Government officers. In Consultations the current Pro Vice-Chancellor Innovation observed:

When ANU set up [ANU Connect Ventures] it was going to go on its own. The MTAA put in \$20 million, and the Government put \$10 million in at the front end. There is a view that "if we hadn't had ANU Connect Ventures in this town, a lot of the stuff we're talking about would not be here".

In 2011 \$3m from the fund was used to create the Discovery Translation Fund (DTF). This fund has been used to bridge the gap between research and commercialisation. Grants can be awarded up to \$50,000 per project, with funding above \$50,000 considered for projects of exceptional commercial potential. There have now been three iterations of the DTF (2011-2014; 2014-2017 and 2018-2021). The fund has assessed and supported over 250 projects from the ANU, University of Canberra and more recently CSU, bringing together many ANU initiatives and activities

ANU Connect Ventures has become a major strength in the Canberra and Region Innovation System.

The \$27 million [Seed Investment](#) Fund invested in promising commercial opportunities arising out of the ANU research, other ACT-based research institutions and local R&D companies. ANU advised during

consultations that the Fund has invested in businesses that other early stage funds would have found too risky²³. The Seed Investment Fund is closed, and is being divested.

ANU Connect Ventures has invested in local research or spin-outs. The investments, in turn, also attracted additional investment through, for example:

- Matching funding from the Commonwealth Accelerating Commercialisation program (e.g Liquid Instruments / InterfereX)
- NHMRC Funding (e.g EpiAxis Therapeutics)
- Syndicated Investments (Instaclustr, Liquid Instruments, Seeing Machines)
- Contract research back to Universities e.g. Liquid Instruments / EpiAxis Therapeutics / Beta Therapeutics)

There is also the benefit of staff being employed in the ACT (Seeing Machines, over 200 local staff; Instaclustr over 50, based at University of Canberra). Many of these companies are also now at a scale that they are paying payroll tax – an immediate financial return for the ACT government.

In 2015 ANU led the formation of the National Universities Innovation Group (NUIG) syndicate which includes the Group of Eight universities and Auckland University. Since then ANU has been working with NUIG and UK-based IP Group towards a collaborative commercialisation funding model to support and create high growth companies from IP rich universities

ANU Leads \$200 million Venture Capital landmark deal with IP Group plc

In May 2017 following extensive negotiation, NUIG formally reached agreement with the IP Group regarding the new Investment vehicle and mode of operations. All nine universities in the syndicate (the Go8 plus Auckland) have now signed a Principle Framework Agreement with IP Group.

IP Group has committed to invest at least \$200 million over a 10-year period to find and develop spin-out companies from the intellectual property (IP) developed by academics at the nine NUIG universities.

The establishment of IP Group Australia represents major international recognition of the strength of the Go8 universities in research and commercialisation and places Australia at the Asia apex of IP Group’s international strategy alongside the UK and US. The IP Group believes that the nine universities represent a significant source of world-class and potentially disruptive research.

<http://www.anu.edu.au/files/review/ANUAnnualReport2017web.pdf> p.22

In May 2016 The ANU and Hindmarsh launched *Significant Capital Ventures*, a new venture capital investment vehicle to “drive innovation in Canberra and build investment links between business and research. The ACT Government provided funding to support establishment costs, but has not commitment to providing capital.

ANU-Hindmarsh launch innovation investment fund

ANU Press Release, 24 May 2016

ACT Chief Minister Andrew Barr MLA officially launched Significant Capital Ventures, which is a conditionally registered early stage venture capital limited partnership.

The ACT Government kick started the enterprise with \$50,000 to support establishment costs. The Canberra Innovation Development Fund also contributed \$50,000 to support capital raising.

The new fund is expected to have a size of between \$10 million and \$30 million and will invest in early stage innovative startups in order to help them become sustainable businesses and industries of the future.

In addition to ANU and Hindmarsh, Significant Capital Ventures is supported by the University of Canberra in raising capital for the fund.

ANU and Hindmarsh have a proven track record in investing and supporting startups. ANU helped start up ANU Connect Ventures in 2005 and Hindmarsh helped establish its associated entity Australian Capital Ventures Limited (ACVL) in 2000 to manage three funds, including the Canberra Business Development Fund with the ACT government.

Through those entities, the partners have so far helped more than 30 startup businesses, including companies now listed on the ASX and the London Stock Exchange AIM, such as Seeing Machines Limited.

<http://www.anu.edu.au/news/all-news/anu-hindmarsh-launch-innovation-investment-fund>

In 2018 ANU Connect Ventures secured an additional \$10m from MTAA Super for follow-on investments in the top performing companies in the portfolio.

4.3.3 Innovation ACT

ANU supported the formation of [InnovationACT](#) (IACT) in 2008. It was established by a group of PhD students, with the aim to teach entrepreneurship to people from different disciplines, it is now Canberra’s largest entrepreneurship program. Since its inception, IACT has expanded to include all

²³ This partnership has created a number of local successes. These include ANU spinout Digital Core Labs (Lithicon), which was sold to NASDAQ listed FEI in 2014 for A\$76m. The fund invested in NICTA spinout InterfereX in 2014, sold to a large listed US Technology company in March 2018. Other significant success stories include Instaclustr, Liquid Instruments, EpiAxis Therapeutics and Beta Therapeutics.

major tertiary institutions in Canberra, and supports hundreds of entrepreneurs each year. Initial funding was provided by the ANU and University of Canberra with finding support now provided from the ACT Government.

4.3.4 CSIRO

CSIRO involvement in the ecosystem has been through NICTA/Data 61 and the ON Accelerator Program. CSIRO is considering appointing a dedicated client manager to coordinate its involvement in the ecosystem.

4.3.5 University of Canberra

UC involvement in the ecosystem, which began in earnest in 2007, has recently been formalised through UC Engage. UC has nurtured a number of startups, including [Auraya](#)²⁴ speech recognition and [EpiAxis Therapeutics](#).

Establishment Of EpiAxis Therapeutics Approved By ACT Government

On the 1 February this year the ACT Government approved the establishment of Epi Axis Therapeutics. Epi Axis was established to commercialise the innovative therapy developed by University of Canberra Professor in Molecular and Cellular Biology Dr Sudha Rao that aims to prevent breast cancer metastasis.

Dr Rao and her team were the first to identify the key role played by the enzyme lysine specific demethylase (LSD1). They further identified the role the enzyme plays in the proliferation of cancer stem cells, which they now know to be a major contributor to the recurrence of cancer following initial treatment.

The team has since focused on testing whether inhibitors to the LSD1 target can prevent the recurrence of metastasis by prolonging tumour remission.

In addition to support from the ACT Government, Epi Axis has received financial backing from ANU Connect Ventures, the University and two local private investors.

The company is based at the University of Canberra and will collaborate closely with clinicians at the Canberra Regional Cancer Centre and the Canberra Hospital throughout the pre-clinical and clinical development process.

Dr Rao has also developed a blood test for earlier detection of cancer stem cells, for which there is no comprehensive test at present.

This test can be used to identify whether cancer stem cells are still present after cancer treatment, enabling early intervention, even before cancer has spread.

<http://www.epiaxistherapeutics.com/sas/>

4.3.6 Canberra Institute of Technology

The involvement of the Canberra Institute of Technology (CIT) in the ecosystem can be overlooked but it plays a role in both incubating, and seeding, innovation. Two start-ups, *Tools By Hollie* and *The Creative Element*, are examples of the role played by CIT.

TOOLS BY HOLLIE

Entrepreneur Hollie Bell mills objects made from plastic, poly-carbonate, resin, foam and wood using her own Frogmill four-axis computer numerical control milling machine (CNC). Hollie's focus is on creating polystyrene life size human torsos to assist dressmakers and the filming industry, worldwide. Through a hand-held 3D scanner, an underwear-clad body is scanned and the 3D image fed into the CNC software, capturing each detail from between the neck and thighs.

Through personal experiment of scanning her own body to produce a torso mannequin of herself, Hollie is able to match bodies perfectly through the 3D scanning system, and replicate a polystyrene dummy ideally used for dress fittings. Hollie has already received orders from over 20 dressmakers who have purchased personalised 'dummies' from around the world, under the brand 'Tools By Hollie'²⁵.

When looking for suitable space to "house" her sizable machine, Hollie made contact with the Canberra Institute of Technology, which was eager to help. In return for space (previously used for sewing classes) CIT has access to the CNC machine (valued at \$180,000) which can be used by CIT students to create and carve objects to a desired shape and size. In addition to use of the CNC machine, CIT students are able to collaborate with Hollie on issues relating to her business and work with her to identify solutions.

As an example, CIT students are currently working with Hollie on designing packaging for her latest tool, which needs to double as packaging suitable for mailing. Students also have access to Hollie's practical experience in turning an idea into reality: in addition to her current venture, Hollie has also invented a balcony safety tool (Anti Grabbity for which she received an Innovation Connect grant in 2015-16)²⁶ and an online mortgage calculator (BizzTools).

Hollie is positive about her collaboration with CIT and being in an environment where those who have the brains to think differently are given the practical skills to do it.

<http://toolsbyhollie.com/>; <https://www.facebook.com/toolsbyhollie/>; <https://www.canberratimes.com.au/national/act/fancy-owning-your-own-torso-made-from-polystyrene-tools-by-hollie-can-help-20180209-h0vtom.html>; <https://www.antigrabbity.com/#intro>; <https://www.bizztools.net/index.html>

²⁴ Formed in 1998.

²⁵ https://cit.edu.au/news/tools_by_hollie accessed 16 August 2018

²⁶ https://www.business.act.gov.au/_data/assets/pdf_file/0013/1217011/Innovation-Connect-Grant-Recipients-Full-List-2018.pdf accessed 17 august 2018

The Creative Element is a startup based in Canberra, Australia. The business offers training and events, consulting, prototyping, and light manufacturing services. It also operates community events, including the popular adults-only ‘Pretty Dangerous Science’ series. The Creative Element operates the Maker’s Space facility at Moore Street on behalf of the CBR Innovation Network. The Creative Element’s services, combined with the Maker’s Space facility, provides critical services that help other entrepreneurs to make improvements on their designs before larger-scale manufacturing begins²⁷.

THE CREATIVE ELEMENT

Erica Hediger from The Creative Element also works out of CIT, receiving physical space and access to a cohort of interested students, who are given the opportunity to work on “real world” projects whilst studying. Students can come from any faculty within CIT, emphasising the benefits available from cross industry collaboration. In addition to the array of technology available in Erica’s workshop (including: 3D printers, computer assisted drawing (CAD), laser cutters, various software programs, computer game design, robotics, induction moulding and resin and cold casting²⁸) students have access to Erica’s experience in startups. Working with Erica (who acknowledges that most entrepreneurs have one or two failures before they are successful) allows CIT students to try (and possibly fail) before they graduate or as Erica states, “don’t wait ‘til you graduate”.

The Creative Element is one of the sponsors (the other two are CBR Innovation Network and the Department of Industry, Innovation and Science) of the STEMSELLS program, which encourages young women in years 7-9 to pursue STEM subjects. Students attend workshops (including in Erica’s workshop at CIT) as part of a 10-week after school program. In addition to practical exposure to STEM subjects, students are supported in the development of their leadership and business skills, mentored by industry and business experts and local innovators and tech startups, including Erica²⁹.

Erica is also looking to develop “the Bunker” in the CIT library: a Maker Space facility open to not only CIT students, but the ACT community as a whole. This differs from Maker Space facilities elsewhere in that access is open to anyone with an idea or just an interest: the Bunker will allow members of the ACT community to learn how to use a 3D printer, or try out a new software program right through to developing a startup proposal and working with Erica to get their innovation off the ground.

<http://thecreativeelement.com.au/>; <https://www.facebook.com/InventCreatePlay/>;
<http://www.canberraentrepreneur.com/technology/the-creative-element/>; <http://stemsells.com.au>

4.4 Business engagement

With the strong support of the ACT Government, business has a major role in the establishing the Canberra and Capital Region ecosystem. The Canberra Association for Regional Development (CARD) was an early initiative among developers to ‘lobby government’. It grew into the Canberra Business Council.

Canberra is a relatively small community with strong ties among business leaders who are also strongly committed to Canberra. Many have done well through business ventures and are keen to contribute back through investing in startup and potential growth companies. They are also well connected with Government.

4.4.1 Early stage venture investment

Local businessman John Hindmarsh instigated the formation of Australian Capital Ventures Limited (ACVL) in 2000. It is the venture capital arm of Hindmarsh Group specialising in investments in companies in the seed, early, and expansion stages. It seeks, specifically, to invest in the Australian Capital Territory. ACVL is the manager for the Canberra Business Development Fund (CBDF), which is now going through divestment. CBDF invested in [Biotron](#), [BarleyMax](#), [Intology](#), Perpetual Water, Ringwood Superabrasives, and [Seeing Machines](#)

²⁷ <http://thecreativeelement.com.au/> accessed 16 August 2018

²⁸ <http://www.canberraentrepreneur.com/technology/the-creative-element/> accessed 17 August 2018

²⁹ <http://stemsells.com.au/#services> accessed 17 August 2018

BARLEYmax: the grain that is better for you

In a joint venture with Australian Capital Ventures Ltd, CSIRO bred the new BARLEYmax™ grain, then worked with food manufacturers to create products containing BARLEYmax™, including breakfast cereals, food wraps, rice mixes and bread. Consumers have been able to enjoy the benefits of foods containing BARLEYmax™ since August 2009.

CSIRO has long been interested in barley as a grain with human health benefits. One particular barley grain emerged from research as having higher fibre content and enhanced nutritional benefits compared with regular barley. A program of conventional plant breeding led to the development of BARLEYmax™, a high fibre wholegrain with high levels of resistant starch.

BARLEYmax is high in fibre, particularly resistant starch.

An extensive program of experimental studies, including a number of human trials, showed that a range of foods produced with BARLEYmax™ as their key ingredient had a low glycemic index and also produced positive changes in a range of biomarkers of bowel health.

BARLEYmax™ is now licensed to a CSIRO spin-off company, The Healthy Grain.

<https://www.csiro.au/en/Research/AF/Areas/Plant-Science/Wheat-barley/BARLEYmax>

With a \$30,000 grant from the ACT Government, which also provided insights from the US Kauffman Foundation, a group of business people formed a loose association in 2005 as Canberra [Capital Angels](#). It is a corporation that “provides a forum for qualified high-net worth individuals to proactively support Capital Region entrepreneurs through both investment and direct activities supporting the companies”. To qualify for membership, invitations are extended by current CA members who:

- have a proven a track record managing and building successful companies either as an entrepreneur or operating executive
- experienced in angel investing, leading due diligence, structuring investments, and coaching entrepreneurs
- knowledgeable and brings an extensive peer network of domain expertise
- connected with contacts for subsequent funding, talent and technology
- involved and able to dedicate time and effort to CA activities, including attendance at dinner meetings and screening sessions, mentoring entrepreneurs.

4.4.2 Business networks

[CollabIT](#), formed in 2006, was initiated by Michelle Melbourne (Intellex) and Microsoft. The seed of the idea came from a \$10,000 grant from Microsoft to be given to a Canberra-based .net user group. Their motive was to protect the vendor software market against open source. It was said that Microsoft wanted to shore up some of the cluster for the Microsoft development ecosystem in Canberra.

The Canberra Business Council gave initial support to CollabIT. It was subsequently decided that the program should be run by the peak industry body, which is the AIIA (the Australian Information Industry Association). It was said in Consultations that CollabIT worked hard to showcase to the government that it actually had direct benefit to the innovation ecosystem in Canberra. For many years CollabIT was supported by an annual \$100,000 grant.

CollabIT is a good example of an effective engagement vehicle, but it has been very reliant on ACT Government support.

4.4.3 Co-working and maker spaces

[Entry 29](#), a co-working space for start-ups and entrepreneurs in Canberra, was established by Rory Ford, Anna Pino, and Nick McNaughton and incorporated as a proprietary company in November 2012. Entry 29 has grown into a booming ecosystem of entrepreneurs.

Entry 29 was initially supported by the provision of free space at the ANU and a small establishment grant from the ACT Government. The ACT Government also negotiated to provide Entry 29 with space in the CBRIN lease arrangement.

Entry 29@UC connects students to a flourishing start up community. Uniquely positioned to grow the innovation community at the University of Canberra, it is seen as much more than a co-working space and is open to all technology startups that want to work from the University Campus.

4.4.4 The Griffin accelerator

In 2013, at the instigation of Nick McNaughton, Canberra’s entrepreneurs got together and initiated the [Griffin Accelerator](#). Sylvia Tulloch, one of the founders, commented

... it seemed to me and to the others a very good thing to do and so critical to that is to have a few people who've actually been founders and made some money out of what they've been doing. I mean none of this works if that doesn't happen, I don't think. And are then willing to work as—invest in and mentors to the next generation. And so we were lucky it was a good group of people. We get on very well.

The program was launched by the Chief Minister (Katy Gallagher) in March 2014 at the ANU Connect Ventures Innovation Showcase. Focussing on 'Servicing Government', the accelerator began with collaboration with the Ignition Labs part of ATP Innovations which had "extensive experience in running accelerator programs in technology, health and energy sectors". Leveraging ATP capability and expertise to launch other regional programs was considered to be of significant interest.

Essentially, the accelerator was aimed at attracting teams to Canberra in a cohort so there'd be five or six teams and they would spend six months in intensive mentoring and training together and work with each other as well as the mentors to develop their ideas. The entrepreneurs got together and mostly raised somewhere between two and three hundred thousand dollars a year to just basically do a startup investment in the startups that were chosen.

During the launch the Chief Minister announced a \$70,000 grant to assist with the running of the program. The Chief Minister said

The GRIFFIN Accelerator is a program that delivers on the objectives of the 'Invest Canberra' initiative bringing smart people and investment dollars into our city. All of the research institutions involved in this program contributes expertise, people and resources to the program participants. In addition we have some of the largest customers for these products in services right here in Canberra.

McNaughton added:

The program's focus is unique to Australia and leverages the city's strengths. We are so much more than a politics, public service and tax town. We have a huge customer on our door step (the Federal Government) and we have significant research and domain expertise in the themes selected for this year's program.

Our objective is to create industry building capability outside of our current pillars of industry and generate new industries for the decades to come

The program has broad support from a wide variety of organisations including: ANU Connect Ventures, ATP Innovations, The Australian National University, Australian Capital Ventures Limited, Capital Angels, CollabIT, CSIRO, eGov Cluster, Entry 29, Lighthouse, NICTA and the University of Canberra.

Both E29 and Griffin accelerator continue to receive ACT Government support, now provided through CBRIN.

4.4.5 Film, television and multimedia – a highlight in the creative industries³⁰

Around the world it is well understood that the 'creative industries' are as much a part of an innovation system as are the more 'hard wired' utilitarian industries. There is, of course a connecting thread between the two, particularly around digital technology, software, and ingenuity³¹.

Unknown to many, Canberra has a burgeoning film, television, and multimedia production industry – with a particular strength in non-fiction and documentary films – with substantial potential to grow further. The computer games industry has national and international recognition and is generating significant export earnings. This capacity in screen, animation, virtual and augmented reality has spinoffs to other sectors, such as defence, education, as well as marketing, communication and public

³⁰ The creative industries, making up what many writers have referred to as 'the creative economy' variously comprises advertising, architecture, art, crafts, design (product, graphic, fashion), film, music, performing arts, photography, publishing, R&D, software, toys and games, TV and radio, and video games. Reference is often made to the 'cultural industries'. Some scholars consider that education industry, including public and private services, is forming a part of creative industry. The creative industries have been seen to become increasingly important to economic well-being, proponents suggesting that "human creativity is the ultimate economic resource" (Florida, 2002) and that "the industries of the twenty-first century will depend increasingly on the generation of knowledge through creativity and innovation" (Charles Landry)

³¹ Interestingly, many writers on the creative industries include ICT and software development with the scope of the 'creative industries'.

relations. An interviewee observed that *seventy per cent of public communication now occurs visually*, although there is some swing back to high quality print material.

Gaming is a massive market and is now the largest entertainment vertical. It's bigger than film, it's biggest than TV. A lot of people don't realise that.

ScreenCanberra (the ACT Office of Film, Television and Digital Media), was established in 2001 and is responsible for screen industry development initiatives. It is managed by the ACT Screen Industry Association (ACTSIA), a not-for-profit membership based organisation that is governed by a board of highly diverse and influential people in the Australian Film Industry. The ACT Government has funded the Office over many years. It currently stands at \$350,000 per annum.

ScreenCanberra delivers the *CBR Screen Fund*, with a remit is to support and grow the local Australian Capital Territory (ACT) screen industry. The ACT Government made an initial investment of \$1.5m, and in June 2018 announced a further \$5m investment³².

The Fund partners on the development, production and marketing of high quality feature films, television series and other screen projects from ACT practitioners or interstate/international practitioners that have significant Canberra elements and benefit, are capable of reaching local and international audiences and delivering commercial success.

ScreenCanberra invested in the highly successful TV series *Secret City* in 2016 and has supported a second series in 2018. It has also invested in *Ripe Tide* (2017), *The Code* (2016, 2014), and *Canberra Confidential* (2013).

With technology the cost of entry onto the film industry is quite low. "People just go out with cameras now. The cost of production is so much lower. They do it on their iPhone. They do it on a GoPro and on their computer ... Editing software is accessible ... There's nothing stopping you from being a filmmaker now". Just as in the broader technology sector, this disruption creates a different dynamic for the development of film enterprises and film making skills. ScreenCanberra has responded well to this challenge.

ScreenCanberra delivers the highly innovative and unique *Accelerator Pod*, which brings screen writers together with the aim of "accelerating" projects towards production and distribution. Accelerator Pod is a series of workshops that are open to everyone, no matter what level in a screen career (emerging or experienced) or location. The Pod's take place in Canberra but attendees have also come from Adelaide, Sydney and Melbourne and regional NSW.

Screen Accelerator Pod

From *Mad Men* to *Breaking Bad*, to more recent Australian examples *The Code* and *The Kettering Incident*, the TV series is going through a revolution in terms of popularity, creativity and sales. The industry is constantly searching for new talent capable of creating original and engaging content to meet this growing demand, and Accelerator TV POD offers you an opportunity to learn how to bring high-concept, serialised storytelling to the screen.

The 5-month course employs the Accelerator model Screen Canberra successfully developed for low-budget feature films and apply it to TV writing and producing. Delivered through a series of workshops facilitated by story developer Karel Segers, participants will learn how to develop, write and pitch projects for a range of genres and formats using different methodologies including the writers' room model.

Workshops are complemented by discussions and networking events with top industry players who share their understanding of markets, audiences and broadcasters. Speakers include Matchbox Pictures (*Glitch*, *Nowhere Boys*, *Secret City*) and Goalpost Pictures (*Cleverman*, *Lockie Leonard*). Participants are able to access multiple opportunities to pitch their projects one-on-one to top TV professionals.

At the end of the program participants will have a pilot episode and a project bible – a detailed document outlining the premise of a series, descriptions of the main characters, story arcs, breakdowns of episodes and outlines for future seasons. Participants will also have the opportunity to apply for one of two paid writers attachments to work with a top-level production company (available to ACT-based residents only).

Screen Canberra will also look at other career pathway opportunities for participants who complete the program, and will help facilitate potential attachments for interstate writers through their respective state agencies.

<https://www.screencanberra.com.au/accelerator-pod/>

In July 2018 ScreenCanberra went to Singapore to develop a relationship with Screen Singapore, which apparently went very well. A mini pod was delivered. The CEO commented on a conversation with a leader in Screen Singapore –

³² The investment covers a gap of three years in ACT film industry investment.

So I was talking to him about what if you were to be involved in the pods that we do in Australia with the idea that your filmmakers are learning to collaborate across different cultures but also opening up to new opportunities and with a very innovative approach to feature film and TV development, where we really connect them up with the market very early up. And they loved that ... but it's really our development initiative. I came up with the idea because it's almost like you've got all these little seeds. You've put them in a protective environment. And it's a protective environment for growth, basically, and development with the idea that not all the seeds will take root. Some of them will, some of them won't. And those that do take root, you give further support to.

ScreenCanberra is also focussed on Wellington to create 'the southern arc of innovation'.

Like many organisations in the Canberra and Capital Region innovation system, it has been built on very modest amounts of government funding. By comparison, Screenwest in Western Australia, receives \$14 million from the government. Accordingly, ScreenCanberra had to find something unique and distinct. Part of that uniqueness is also its governance and leadership.

They used to say audience is king. Now, audience is emperor because, not only do they tell you what they want to watch, they tell you how they want to watch it, when they want to watch it. So you really need to know something about it. And just saying, "Oh, everyone's going to love my project." No, they're not. Not everybody loves thrillers. I don't like horror. Not everyone likes romantic comedies, so you have to be very specific about your audience, so we do a lot of training around that. So the whole idea was to that makes us different is our connection to market.

And normally what happens is the state agencies bring in market at the end of the process. We bring it in at the beginning, first day. So you'd be sitting down and you'd be pitching your project, which is just like a log line, nothing else, and the sales agent will go, "No. There's no market for that. What else have you got?" And people are like, "But that's my dream project." "Well, it might be your dream, but it's not the investor's dream." You know, because when you're talking about a low-budget feature film being \$1.5 dollars.

So this is not an art form. This is a commercial proposition wherever possible, and that's what we're really pushing, and that's what we're pushing with the fund as well.

ScreenCanberra is an excelled story of innovation and an exemplar across the innovation system. It provides an exemplar of Government support for the film industry

ScreenCanberra is also well connected in the Canberra and Capital Region innovation networks. It is also connected with [The Film Distillery](#), an independent organization that does the low-budget features, and mature Canberra born film business such as [Ronin Films](#) and [Bearcage](#) production (now wildbear entertainment) and [Silversun pictures](#). There are numerous small production houses that cater for the Canberra communication market.

Canberra's interest in film is indicated by the long running industry and community support for the [Canberra International Film Festival](#).

4.4.6 Building connections

By 2015 it had become apparent to the universities that they needed to be a greater connection within the innovation ecosystem. During Consultations, the CEO of ANU Connect Ventures commented:

Over time, we knew we needed to be part of some of these endeavours which would create an ecosystem that sat round the university. Part of it was actually positioning us so we could get our ideas out and the funding would come back in for our research. There's always a mutual benefit. That was reinforced, and that was part of the reason we put a White Paper together in 2015.

The reality is for a university to do what it needs to do in the innovation space, it needs a very healthy ecosystem that sits round it. So unless you can positively engage with that, you're never going to get to that point where that's going to occur.

In Sydney and Melbourne and other places, because they're so big, it just happens. In this town, we have to prod, positively drive it, otherwise it won't happen. I think that's where its waxed and waned

over the years. Sometimes people have been here to drive it, others haven't. Over the last ten years or so, we've consistently done that. I think there's parallels there.

If you look at what Stanford did its early years, it was pushing that hard. There comes a tipping point where you can sit back because the ecosystem is there and self-sustaining and all you do then is license your technology out. We are a ways off that at the moment.

It's not only us. We should work in collaboration with CSIRO, UC, UNSW. In this small town we've actually got to work together for the town, which will benefit us, rather than try and compete against each other. Again, that often waxes and wanes as people come in and out, but I still think that's an underpinning thing we've got to maintain.

What was really the glue is that the ACT government has a role to play to make sure we all work together.

In this regard, ANU Connect Ventures was a major supporter of the formation of CBRIN. CBRIN has, of course, grown into much more than a coordinating point for ACT government financial support. It is an active intermediary and provides leadership in Canberra and Capital Region startup ecosystem. It is considered to be "benchmark" among innovation ecosystem network organisations.

4.5 The ACT Government role

The ACT Government has had a key role in the development of the Canberra and Capital region startup ecosystem.

Over the 1997-2018 period the ACT Government has made a number of major financial commitments to support startup business innovation. These include investments in:

- Epicorp, 2001, a program under the Commonwealth ICT Incubator program
- National ICT Australia (NICTA), \$42m since 2001.
- The Knowledge Fund, 2003-2006, \$13.1m (for projects valued at \$76m)
- ANU Connect Ventures, \$10m and Canberra Capital Ventures
- Innovation Connect
- ScreenCanberra, supported since 2001.

These investments have, and will, stimulate further, external and independent investments.

4.5.1 Context

Leading up to the turn of the century, through conferences and reports there was an awareness of the venture capital investment influence of the Bayh Dole Act. The Innovation Investment Fund (IIF) program was announced by the Prime Minister in the *More Time for Business* statement of March 1997³³ (Australia. Prime Minister, 1997). The program was designed to help redress the low level of provision in Australia of high risk venture capital for small new technology-based companies commercialising research and development.

The National Innovation Summit was held in 2000 and reports from the Chief Scientist and PMSEIC (Australia. Chief Scientist (Dr Robin Batterham), 2000) raised concerns about the low level of university research commercialisation. In a study for the Australian Research Council on the prospects for greater commercialisation of university research (Howard Partners, 2001), it was reported:

Since the mid 1990s a key policy objective for the Commonwealth and the ARC was to see the results of publicly funded research harnessed more efficiently and effectively through commercial activity in order to support enterprise formation and development, employment growth, wealth creation and enhancements to the quality of life.

Many barriers to the efficient and effective commercialisation of research are recognised. One of those barriers was the gap which occurs as the result of a lack of available capital at a stage in the innovation process prior to that at which venture capitalists are normally prepared to invest in commercialisation. There was evidence that greater private investment at earlier stages of the innovation process can be encouraged if the risk to venture capitalists can be reduced by lowering

³³ The program was titled the Small Business Innovation Fund (SBIF) in the statement. It was renamed the Innovation Investment Fund in August 1997.

their costs and making available to them better information as a basis for their business decision making.

Traditionally, universities have licensed technologies to established businesses who wish to acquire the technology for new product development or improvement. This is still the most common form of commercialisation. However, the other forms of commercialisation are becoming more important, particularly in relation to the new technologies (particularly biotechnology, information technology).

While venture capitalist investors have a high profile in investing in start-up companies, large corporations have an interest in university research through their technology acquisition strategies as do growing small to medium enterprises (SMEs). However, the role of private equity, as a relatively new financial asset class, in facilitating development and application of university research has had a major impact on the nature of the transfer process and the system of university-business relationships.

4.5.2 ACT Government leadership

From the early days the ACT Government was interested and involved in this agenda. Leadership was provided by the Government's business development agency, under its various names and titles, and it has always endeavoured to leverage and work collaboratively. There has been long term continuity in this involvement – enabling investments and guidance, and evolution of programs and approaches.

It is understood that connections were made with San Diego based "[Connect](#)". The story of San Diego has been documented in an influential study published in 1995, *Knowledge Without Boundaries: What America's Research Universities Can Do for the Economy, the Workplace, and the Community* (Walshok, 1995)³⁴

San Diego CONNECT

CONNECT was founded by UC San Diego as an internal department when the City of San Diego was at a crossroads. Regional leaders were searching for a path to economic renewal and sustained growth; innovative high-tech and life sciences companies, such as Cubic Corporation, Linkabit (predecessor of Qualcomm), SAIC, and Hybritech, were in the early stages of development; and the Torrey Pines Mesa was a growing hotbed of research.

Amidst this convergence of factors UC San Diego, in partnership with the San Diego Regional EDC and private sector businesses, recognized this as an opportunity to establish an organization to transform San Diego's growing research capabilities into an economic driver to increase the prosperity of the region. Thus, in 1985-1986, CONNECT, one of the nation's first start-up accelerators, was born.

Core to CONNECT's growth and development is a culture of collaboration, fostered by CONNECT's first director, Bill Otterson. Over the last thirty years CONNECT has assisted developing groups around specific innovation clusters and, as they become large and deep enough, spun them out as stand-alone organizations.

CONNECT has assisted in fostering many organizations in San Diego over the years including BIOCUM, The San Diego Telecom Council (known today as EvoNexus/CommNexus), Athena San Diego, CleanTECH San Diego, The Wireless Life Sciences Alliance, and San Diego Sport Innovators (SDSI). CONNECT has also been recognized as a breakthrough organization by The New York Times, as well as Inc., Time, and Entrepreneur magazines.

<https://www.connect.org/about-connect>

4.5.3 Epicorp, 2001

The ACT Government investment in [Epicorp](#) in 2001 was significant, and after 15 years, has yielded some impressive returns. It was formed with a \$4.57m ITC incubator program (ICTIP) grant from the Commonwealth, a supporting grant from the ACT Government, and the provision of buildings by CSIRO.

Epicorp

Epicorp was established in response to a perceived "market failure" affecting the commercialisation of Australian innovation both from the IT and Communications industry and also from the nation's centres of research. Specifically, a funding gap at the "seed" or "early-stage" level existed where opportunities that had already leveraged grant funding along with sweat equity, but that were not yet on the radar of traditional venture finance were falling through the cracks.

This gap was further compounded by limited access to international capital and partnership opportunities, an immature Angel finance network and difficulties in creating the necessary industry linkages needed for successful institutional commercialisation. Epicorp responded to that challenge by focussing its attention in the high-risk "gap" area with much-needed finance and also by serving as a gateway between the nation's premier research institutions and the target market of their innovation.

Epicorp involved the initial commitment of the ACT Government, CSIRO, and the University of Canberra. ANU joined later.

<http://www.epicorp.com.au/index/aboutepicorp.html>

³⁴ From the Flyer: Using case studies and examples from such distinguished research universities as Johns Hopkins, the University of Chicago, and the University of California, Walshok details how institutions are creating knowledge linkages between their academic resources and constituencies as diverse as parents, social agencies, and corporations.

The Epicorp portfolio covers to following companies:

GPSports Systems; Epitactix; Amethon Solutions; Locata Corporation; Simmersion Holdings; Cohda Wireless; Windlab Systems; Mediaware International; Hatrix; Edentiti; Newton. Several of these companies have yielded very substantial returns.

4.5.4 The Knowledge Fund, 2003

The Knowledge Fund was established in 2003 as “the corner piece of the ACT Government’s vision for a thriving and globally competitive knowledge based economy where the production, distribution and use of knowledge creates competitive advantage across all industry sectors”. The Fund was specifically focussed on commercially exploiting the ACT’s knowledge assets.

The Fund sought to address the multifaceted and dynamic nature of a knowledge based economy through five components. These were proof of concept grants, commercialisation grants, equity investment, industry development grants, and funding for strengthening the management of high technology start-ups.

Excluding equity investment, a total of \$13m was provided in grants. Of this \$7.9m or 60 percent has been for commercialisation purposes. Approximately one quarter (25.6 percent) has been for proof of concept. This reflected a ‘balanced portfolio’, as indicated in Table 4 below.

Table 4: ACT Knowledge Fund - Disbursements

Grant Category	Funds Provided \$m	Project Cost \$m
Proof of concept	3,354.4	16,525.5
Commercialisation	7,944.7	42,833.8
Industry development	1,373.2	15,249.4
Collaboration	400.0	1427.8
	13,072.3	76,036.5

A substantial proportion of proof of concept funding was allocated to the ANU or to companies associated or linked in some way to the University.

Although the Fund ceased operation in 2006, an evaluation indicated that it had been successful in creating value for companies and the ACT community (Howard Partners, 2006).

4.5.5 Canberra Business Development Fund, 2005

The Canberra Business Development Fund (CBDF) was an early stage venture capital fund set up in 2005 by the ACT Government and managed by Capital Venture Partners. CBDF was one of the earlier backers of ANU Spinout Seeing Machines. The company now has a market capitalisation of \$250m and employs 260 people globally.

Seeing Machines

Seeing Machines is a world leader in driver-machine interaction. We harness human factors science to create artificial intelligence (AI) technology that observes the driver’s attention – reliably, unobtrusively, and in real time – and intervenes seamlessly when necessary. The company specialises in computer vision algorithms that precisely track eye gaze, head position and pupil size, and our state-of-the-art AI technology analyses the data to quickly and accurately detect driver drowsiness, distraction and microsleep events.

Seeing Machines, uses big data to develop an understanding of the real-world safety behaviours of drivers, and designs human sensing technology to address these behaviours in order to help make the world a safer, smarter place for drivers and the wider community.

Currently applied in driver monitoring systems (DMS) for cars and fleet trucks – DMS being increasingly regarded as crucial to automotive safety technology and autonomous driver assistance systems (ADAS) for autonomous vehicles – as well as in tram, rail and aviation scenarios, Seeing Machines’ core technology can be used for a range of mission critical safety applications, even in extreme environments.

From its base in Canberra, Australia, Seeing Machines serves a growing market in Europe, North America, Latin America, the Middle East and Asia Pacific, and counts Caterpillar, General Motors, Emirates, Bosch, Progress Rail, Coach USA and Transport for London among its major clients.

<http://www.seeingmachines.com/about/>

Seeing Machines raised \$60m in January 2018 for further global expansion. CBDF was also an early investor in Instaclustr (now 70 staff globally) and Liquid Instruments. It also backed CSIRO spinout, The Healthy Grain/Barley Max. The company secured an \$8m investment in December 2016 from a large Japanese food conglomerate. Noteworthy Knowledge Fund and Canberra Business Development Fund (CBDF) investments are listed in Table 5 below. Many of the companies that received funding have grown into substantial businesses.

On 22 August 2018 Instclustr closed a \$20.8 million investment round and is positioned to trigger global growth³⁵. Launched in 2013, originally as a data marketplace, Instaclustr evolved into a Software-as-a-Service platform to support the technologies required for managing data, after the founders realised there was no such service for them.

Table 5: Knowledge Fund and CBDF Investments

<ul style="list-style-type: none"> AMS Australia – Microswitch box security products (KF) Biotron – non invasive tests for the presence of cancer (CBDF) Barley Max – non genetically modified barley (CBDF) CommsNet Group – MyndIT – security systems and incident management (KF) DDW Consulting - Resolve Incident Management System (KF) Diamit Australia - Digital Asset Management Services (KF) Ealaco – composite materials (KF) Earthshine – spatial data products (KF) Hatrix – medication management software (KF, Epicorp) ICT Systems – wireless sensory networking (KF) iGognition – Electronic Document and Records Management System (KF) 	<ul style="list-style-type: none"> Intology – business intelligence software and services (KF, CBDF) ITL Limited – medical devices (CBDF) Miralite – Flexirib solar concentrator (KF) Perpetual Water – Active Absorption Filtration technology (KF, CBDF) Prophecy Games – game development (KF) Ringwood Superabrasives – hard products for application in manufacturing, research, medical devices and consumer products (CBDF) Seeing Machines – vision based human interfaces for vision research (CBDF) Softlaw Corporation – RuleBurst – methods for Rapid Legal Analysis and Legislative Quality Assurance (KF) Software Improvements- eVACS® electronic voting and counting (KF) Soltex – catalyst technology (KF)
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4.5.6 Lighthouse innovations, 2008

Epicorp's ICT *Commercialisation Incubator*, which became Lighthouse Innovations in 2008 as a public-private joint venture, was established to provide focussed support for start-up technology based businesses, particularly those based in the ACT. In 2014, Lighthouse became fully independent and is now servicing clients all around Australia.

<p>History of Lighthouse Innovations</p> <p>The ACT Government saw Lighthouse as a crucial link in its innovation system, which was then spread across a number of initiatives. Between 2008 and 2011, the number of initiatives available to start up enterprises decreased and Lighthouse became more involved in the development and delivery of programs on behalf of the ACT Government.</p> <p>Lighthouse original charter was to continue the heavy lifting activities conducted successfully by Epicorp to both encourage new business ventures and to support established ventures in the 'technology enabled' industries and services in the ACT and surrounding region. To achieve this, Lighthouse was to provide a range of business programs.</p> <p>Between 2001 and 2014, Lighthouse's focus on facilitating relationships, providing access to support and funding, targeted mentoring and broad based business development and educational activities at all stages of business development grew rapidly. As a small, flexible organisation whose KPI's where not tied to investment return, Lighthouse was able to respond to changing market needs in a responsive and fluid manner.</p> <p>From 2008 to 2014 Lighthouse worked with over 2500 unique individuals or enterprises). These enterprises represent well over 5000 unique opportunities or activities. With an additional 3000 participants attending educational events – Lighthouse far surpassed everyone's expectation in relation to service delivery.</p> <p>https://www.lighthouseinnovation.com.au/about/our-history.html</p>
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In 2014, the ACT Government changed its policy direction and channelled its business development funds through CBRIN. However, Lighthouse had established its brand and credibility and was on the path to becoming a self-sustaining enterprise. On 1 July 2014, LHInnovation Pty Ltd, a company owned by the key Lighthouse staff, acquired Lighthouse.

Lighthouse continues to grow and provide unique free and for fee services focusing on capability building; providing support and assistance to business; and providing expert skills in a range of management services.

³⁵ See <https://www.smartcompany.com.au/startupsmart/news-analysis/canberra-startup-instaclustr-closes-20-8-million-raise-to-take-its-data-tech-solution-to-the-states/>

4.5.7 Innovation Connect (ICON), 2008

Innovation Connect commenced in the 2008–09 financial year. It provides competitive grants of between \$5,000 to \$30,000 for proof of concept (e.g. developing a prototype or market testing solution). The program's aim was to accelerate the creation of investment ready companies and entities.

ICON has been designed to assist companies that need support in the early stages of taking an innovative product or service to investment readiness or commercialisation. It is aimed at “evolutionary growth” businesses by building capabilities.

The program currently has two categories:

- Proof of Technology
- Renewable Energy

The program continues to this day.

4.5.8 CBR Innovation Development Fund, 2015

The CBR Innovation Development Fund was announced as part of *Confident & Business Ready* in May 2015. The Fund was a program response to the strategy's major policy pillar of accelerating innovation to create wealth and jobs in Canberra.

The Fund has two components: one that provides base funding for major commitments such as the CBR Innovation Network and the Innovation Connect Program; the other for competitive grants for initiatives that develop the capability and investment in the ACT's innovation ecosystem, enhancing collaboration, and broadening access to services and resources in the ecosystem.

CBR Innovation Development Fund

A CBR Innovation Development Fund will be established from 2015–16 to bring together all ACT Government funding for business innovation. The Fund will foster an integrated innovation ecosystem that supports the various stages of entrepreneurship and innovation and builds capacity and capability in the knowledge economy. This will create greater synergy within the program funding environment to establish a system where programs can transition and adapt. It also addresses new priorities and opportunities in a more agile way. In addition, we will achieve greater efficiencies and more connectedness in program delivery.

The CBR Innovation Network will receive \$1.1 million in operational funding each year in addition to the office space currently provided at no cost by the ACT Government.

Through the formal Annual Activity Plan development process with the Government, the CBR Innovation Network shapes its work on an annual basis. In broad terms, the CBR Innovation Network is required to identify and address gaps in the innovation ecosystem. It will also deliver STEM initiatives including National Science Week and the Inspiring Australia ACT program.

Innovation Connect, which provides co-investment grants for small innovation-focused companies, will continue to receive funding. It will, however, be delivered in partnership with the *Discovery Translation Fund* – the innovation acceleration and proof of concept fund jointly funded by the ANU and UC. This will draw together funding streams for early stage innovators and create greater synergy and visibility across the innovation ecosystem.

The CBR Innovation Development Fund will also fund activities that build capability and contribute to the innovation ecosystem, and that significantly impact on the ACT's economy.

In 2015-16, the fund will continue to support CollabIT, ScreenACT, Screen Investment funding and the Digital Canberra Challenge. In addition, funding of \$700,000 will be available to fund new activities that contribute to capability development.

From 2016–17, or as existing delivery contracts cease, funding of \$1.45 million will be provided on a competitive basis for activities that build capability within the innovation ecosystem.

<https://www.business.act.gov.au/grants-and-assistance/grants/cbr-innovation-development-fund>

Only projects that will deliver benefits primarily to the ACT ecosystem as a whole, rather than the individual applicants, are considered. The competitive grants are not intended to fund ‘business as usual’ or assist businesses to commercialise new products or services. The priority for this fund is projects that deliver new resources, services or new technology/ equipment to cover identified gaps within the innovation ecosystem.

One important focus of ACT Government business development initiatives has been getting new and established businesses ready to access the larger Commonwealth programs, like (the former) Innovation Investment Fund (IIF), R&D Tax Incentive, to be “investment ready” for early stage venture capital investors, and facilitate access to grants under the Entrepreneurs Program.

4.6 Technology parks, innovation districts, and precincts

The potential merits of geographical proximity were identified by early classical economists, and picked up by economic geographers, sociologists/social commentators (Florida, 2002), and strategy economists (Porter, 1999, 2005). More recently, potential merits have also been advocated by policy think tanks (Agtmael & Bakker, 2016; Katz & Wagner, 2014) and consultants (KPMG, 2014).

An important aspect of the advocacy is to link science, technology, and innovation in spaces that reflect commercial as well as strong ‘human centred’ interactions in a creative, artistic and cultural context. Around the world, and in Australia State and City Governments have been supporting major investments in these sort of initiatives, although the connection to cultural institutions is not always clear.

Over the last few years most State Governments, universities, and property developers have invested in the formation of science and technology parks and precincts as a way of building university-industry and government linkages³⁶. The Commonwealth has a small program to support regional innovation precincts. Fortunately, the ACT Government has been moving cautiously in this direction³⁷.

There are several technology, arts and cultural precincts that have evolved in Canberra over the last 20 years. Brief comments in each are provided below. There are also a number of innovation ‘hotspots’ across Canberra and the Capital Region.

4.6.1 The Canberra Technology Park

The Canberra Technology Park site in the norther suburb of Watson is a former high school (1965 to 1988). In 1991 the Canberra Institute of Technology (CIT) took over the site. The Academy for Interactive Entertainment (AIE), a private educator for the 3D animation, game development and visual effects industries has been one of the main tenants since³⁸.

In 2014, the AIE made a submission to the Government to transform Watson into a major education precinct over 20 years. The AIE would contribute a further \$35 million to expand its operations in Sydney and Melbourne, and planned to establish a campus in Adelaide by the end of the year.

The two-phase plan for the 5.74-hectare site involves transforming the existing buildings – which the AIE has occupied since 1996 – into a modern, technologically innovative learning environment. The fit out would include \$5 million in asbestos removal, \$2 million to construct a sound stage for film animation and production, and \$12 million to modernise existing buildings.

The proposal is currently under review by the ACT Government.

Canberra Technology Park

In about 1991, the CIT Faculty of Applied Design was relocated to the former Watson High School site.

In 1996 Computer game developer [Micro Forté](#) Pty Ltd. established the Academy of Interactive Entertainment (AIE) to run a course in computer game development in partnership with CIT. The then Chief Minister Kate Carnell believed in the future potential of the AIE and how it could help grow the Australian computer games development industry.

In 2000, AIE became a non-profit registered training organisation (RTO) and introduced the first of its own independently run courses.

In 2001 CIT’s faculty of Applied Design moved out of the Watson Campus. The AIE secured a licence to stay on and manage the site and work commenced to re-brand the campus to Canberra Technology Park (CTP). In 2002, the Park was officially opened by the then Chief Minister, John Stanhope. AIE still maintains a close relationship with CIT and jointly delivers a Bachelor of Games and Virtual Worlds Degree.

In 2003, the AIE began expanding nationally into Melbourne, followed by Sydney in 2009 and Adelaide in 2015. In 2011 the AIE opened its first USA campus in Seattle (right next to the iconic Space Needle), which was closely followed by the establishment of a second smaller campus in Lafayette, Louisiana.

Not only has AIE been a leader in the field of education, their visionary approach to industry development has spurred on the growth of the Australian computer games industry, with AIE’s Founder and Chairman also founding the Game Developer’s Association of Australia (GDAA), the Australian Game Developer’s Conference (AGDC), computer game developer Micro Forté and middle-ware developer BigWorld Pty Ltd.

<http://canberratechpark.com.au/about/our-history/>

³⁶ The US National Research Council Committee on Comparative National Innovation Policies concluded that “the proliferation of research parks, and the sheer scale of those being built abroad, highlights the need for U.S. policy makers to better understand the role of such parks in a nation’s innovation system” and “the ways in which successful parks are structured, financed, and operated. The Chinese model is seen to have important implications for the competitiveness of the U.S. and other nations in a 21st century global economy (Wessner & National Research Council (U.S.) Advisory Committee on Technology Innovation, 2012).

³⁷ Experience demonstrated that the ‘build it and they will come’ approach does not always work – as the Monarto initiative in South Australia demonstrates.

³⁸ Current tenants are listed at <http://canberratechpark.com.au/tenants/>

4.6.2 ANU Campus - City West Precinct – ANU Exchange

In 2006 the ACT Government agreed to the ANU City West Precinct Master Plan and Implementation Plan, known as ANU Exchange. The Exchange vision was for a

... vibrant mix of university, arts, scientific, educational, residential and community facilities, unique Australia, that will significantly enhance Canberra’s attractiveness as a city and as a seat of learning, and will operate as a valuable generator of new economic, cultural and community development for the Australian Capital Territory in an environmentally sustainable manner (ACT Land Authority, 2006)”

The plan included specific connections to the Canberra Spatial Plan, the 2003 *Economic White Paper*, the Sustainable Transport Plan, and the City West Master Plan. The Exchange is largely in place and substantially reflects the Exchange vision. The precinct includes four student accommodation villages, an office tower, car park and municipal infrastructure.

The integrated precinct development strategy involved securing institutional partnerships, a structured finance approach to the delivery infrastructure which enabled full private sector funding without recourse to ANU or the City of Canberra.

Further development is underway with the current iteration of the ANU Masterplan and the commencing work of the City Renewal Authority Planning Strategy.

4.6.3 University of Canberra Campus

The current University of Canberra Master Plan 2012, covering an area of 124 hectares, aims to engage and connect with the surrounding neighbourhoods, the Belconnen Town Centre and Lake Ginninderra, and provide a 24/7 campus with active mixed-use development.

The University of Canberra Urban Plan, 2015-2030, envisages that “in 2030 the UC campus in Bruce will be an extraordinary place. People from around the world will visit it and witness a new-model community in action: a community from young to old living an educated life”. Work began on the initiative seven years previously, formalised by the designation of the campus as a “major project” by the then Chief Minister on 28 April 2008 (University of Canberra, 2015).

The Plan envisaged that by 2030 the campus would include (University of Canberra, 2015):

- A Health precinct that would include public and private hospitals, aged care facilities, numerous specialist clinics and research enterprises such that UC has become a regional health hub with one of the largest Health faculties in the country.
- An Innovation Park that will be a thriving eco-system of research and development in biomedicine, biotechnology, sports technology, materials fabrication and IT solutions.
- A Campus Community of over 3000 residences will offer the choice for staff, alumni and members of the public to live in housing topographies co-designed by leading architects, and staff and students of the University.

Many of these initiatives are in place, including the UC Hospital. The campus is emerging into a vibrant innovation precinct. It is embedded in the current University Strategic Plan, *Distinctive by Design* (University of Canberra, 2017). The Plan indicates that UC will “leverage government, business and innovation networks, including opportunities afforded by the development of the campus, to build excellence in teaching, research and entrepreneurship capability within the University”.

4.6.4 CSIRO Natural and Environmental Sciences Precinct

CSIRO has committed to the development of a Canberra Research Precinct that will be built on deep collaboration between CSIRO, the Australian National University (ANU) and other allied partners in the plant and environmental sciences. It is known as the Natural and Environmental Sciences Precinct (NAESP)

CSIRO Natural and Environmental Sciences Precinct

The Canberra precinct will drive iterative and integrative biology across the scales from genetics to global landscapes, connecting data to advanced modelling and simulation in order to achieve maximum plant yield and productivity, food security and economic growth whilst maintaining our natural resources and biodiversity.

Canberra's Global Research Precinct will grow around its scientific, education government and policy interfaces and become globally recognised for its scale and the integration of academic and applied research institutions with government and industry needs.

The twenty year vision for the Natural and Environmental Sciences Precinct (NAESP) is to bring together the best brains from research, government and industry to provide transformational solutions for food security, natural resource management and the bioeconomy.

The 2013-14 Federal Budget included provision for CSIRO to redevelop its presence at the Black Mountain site including the construction of new facilities to support excellence in science and consolidation of CSIRO's presence from four other locations in the ACT.

The redevelopment will include a new life sciences building, analytical services, refurbished laboratories and new administrative and executive accommodation.

<https://www.csiro.au/en/About/Strategy-structure/Global-precincts/Natural-and-Enviromental-Sciences>

The Canberra Precinct received funds of \$18M from the Science and Industry Endowment Fund (SIEF) for an ANU/CSIRO Centre for Genomics, Metabolomics and Bioinformatics (CGMB) collaborative facility and to assist in development of a new life sciences building.

It is intended that the CGMB will provide an integrated digital approach to plant breeding and resource management by completing the data pipeline that connects gene discovery to commercial crops and environmental management.

4.6.5 CIT-UNSW Canberra

In December 2017 a Memorandum of Understanding was signed by UNSW and the ACT Government to University of New South Wales Canberra (UNSW Canberra) as a foundation for developing a city campus. The MOU involved the ACT Government and UNSW working together on feasibility studies and setting out a framework for each party to develop a business case for the proposed campus.

The business cases would allow the university to put forward a formal proposal for the academic precinct to be built in Reid and Parkes.

The current UNSW [Strategic Plan](#) canvasses a greater role for the University in Canberra. It provides:

Our Canberra campus and each of our Faculties of Medicine, Science, Engineering, Business, Built Environment, Law, Arts & Social Sciences and Art & Design have a key role to play in the future of UNSW. Faculty and School activities will be key to our success in implementing the UNSW 2025 Strategy

This involvement may fill gaps currently being experienced in Canberra in research focus and across a number of fields of education. A comparison of research capability areas across the four universities with a substantial Canberra presence, indicated by 2015 Excellence in Research Australia (ERA) assessments, is at Attachment 4.

4.6.6 Canberra Airport Precinct

Capital Airport Group Pty. Ltd purchased Canberra Airport from the Commonwealth Government in May 1998. The development philosophy reflects a view that “airports say a lot about a place because they are both a city’s business card and its handshake: they tell us what a community yearns to be as well as what it really is.”³⁹

Canberra Airport precinct now comprises the terminal and Fairbairn RAAF base, as well as Brindabella Business Park and Majura Park, all of which have undergone extensive development. With the opening of the new terminal on March 13, 2013, Canberra Airport represents one of the most significant private infrastructure projects for the ACT and surrounding region, with a growing role as a national transportation hub, commercial business park and retail destination.

Brindabella Business Park is a working environment located adjacent to Canberra’s new Airport Terminal. It was designed with an extremely high level of amenity, culture, architectural design and

³⁹ <https://www.canberraairport.com.au/corporate/about/about/>

cutting-edge sustainability. The aim was to create a sense of community and achieve that all important balance between work, health and lifestyle⁴⁰.

The Park accommodates approximately 7,000 workers and 46 businesses, all residing in 19 A-grade commercial buildings totalling 100,000m² NLA, with a further 45,000m² either under construction or in the planning stage. Current tenants include: Australian Research Council, Cisco, Defence Innovation Hub, Deloitte, DXC Technology, General Dynamics Mediatech, KPMG, Nextgen Networks, Orima Research, QinetiQ, Raytheon, Schneider Electric, and numerous cafes.

The Park is emerging as a major resource in the Canberra and capital Region Innovation ecosystem.

4.6.7 Kingston Arts Precinct

Under development as a renewal project it is envisaged that the Kingston Arts Precinct will “transform the five-hectare site near the Canberra Glassworks into Canberra’s creative arts hub”. The plan is to -

relocate Canberra Contemporary Art Space, Craft ACT, Photo Access, Art Sound FM, M16 and parts of the Canberra Potters' Society to the site, where they will join the Canberra Glassworks and Megalo print studio⁴¹.

This project has been in evolution for more than 10 years.

4.6.8 Civic Arts and Cultural Precinct

There is a new arts and cultural precinct being developed that will include: Civic Square, the Canberra Theatre, The Canberra Museum and Art Gallery, the ACT Legislative Assembly, a new Government office building and a future land release⁴². Given the importance of library resources to creativity and innovation, there may be an opportunity to include the Canberra Library within the Precinct.

4.6.9 National Capital Art and Cultural precinct

Within the Parliamentary Triangle, on the western side of Lake Burley Griffin, there are several buildings that loosely constitute an Art and Cultural Precinct: the National Gallery of Australia, the National Library, Questacon, the National Portrait Gallery, and the Museum of Australian Democracy, the National Archives. The National Museum of Australia is isolated on the other side of the Lake. The National Film and Sound Archive is adjacent to the ANU campus in Acton.

These are highly valuable research and innovation assets available to residents of Canberra and the Capital Region. But unlike Washington or London, there is an important deficiency in relation to the absence of a Museum of Technological Arts and Sciences.

Unlike many other great national capitals, Australia does not have a national museum of Arts and Sciences that would cover the intersection between technology and design. From an innovation perspective, this is a significant gap.

4.6.10 Linking the innovation precincts

During consultations many suggestions were made to better ‘link’ the innovation precincts through enhanced physical access. As the precincts have different areas of focus and specialisation, better connections can stimulate innovation. Connections (hub and spoke models) can work as a proxy for co-location where costs of new infrastructure make an investible business case difficult to mount.

Location based policy initiatives are concerned with generating *knowledge spillovers*. From an *innovation effectiveness* perspective, *knowledge spill-overs* explain both why geographical clusters of

⁴⁰ <https://www.canberraairport.com.au/corporate/property/brindabella-business-park/>

⁴¹ <https://www.canberratimes.com.au/national/act/geoconled-group-wins-tender-to-develop-kingston-arts-precinct-20170208-gu84y6.html>

⁴² www.cityrenewalCBR.com.au

firms and innovative activity exist. Co-location allows these spill-overs to be exploited and the extent of those spillovers explains why some clusters perform better than others (Matthews & Lacy, 2017).

For example, a start-up firm in a cluster with strong knowledge spill-overs is more likely to succeed commercially than one located in a weaker cluster. This is because better face-to-face advice is available to help start-ups avoid the myriad of risks confronted. This advice is based on previous local experience, i.e. geographically specific and therefore particularly valuable.

This perspective can explain why the ‘serial entrepreneurs’ found in high-performing innovation clusters play such an important role helping to spot new business opportunities and in driving down the investment risks faced when innovating (Matthews & Lacy, 2017). The business advice is most often sourced from independent, experienced, and trusted mentors and intermediaries. The availability of this capability is an essential ingredient in incubators and co-working spaces located in cluster arrangements (Howard, 2015, 2017a).

During consultations for this study there were strong representations made for building better physical connections between the precincts to encourage better social interaction and knowledge spillovers.

Further discussion of these issues is contained in a research paper prepared for Innovation and Science Australia, *Towards the Development of an Innovation Ecosystem Policy* (Howard, 2017b)

4.7 Incubators, accelerators, coworking/maker spaces

Over the last 20 years, since the collapse of the tech boom in 2000, the ACT Government, as well as business leaders, and universities have given a great deal of attention to nurturing and building a strong startup ecosystem through initiatives listed in Table 6.

Table 6: Canberra based Incubators, Accelerators, Co-working Spaces

<ul style="list-style-type: none"> • Agrihack • ANU Connect Ventures – Discovery Translation Fund, ANU-MTAA Capital Partnership • Canberra Business Development Fund (operated by Australian Capital Ventures, now ANU Connect) • Several schools based initiatives, including Canberra Grammar School • Capital Angels • CIT Maker Space, Product Innovation Fund, Pitch Night • CollabIT • CSIRO ON program • Department of Industry Innovation and Science BizLab • Department of Human Services Technology Innovation Centre • Design Canberra Festival • DFAT InnovationXchange • DST Innovation Hub • Entry 29 • Epicorp Seed Fund • Griffin Accelerator • Hackathon 	<ul style="list-style-type: none"> • GovHack ACT • Gravity Consulting • Innovation ACT • Innovation ANU (the ANU Technogym transfer organisation) • Innovation Connect (student led innovation contest) • Inspiring the ACT • Kingston Arts Hub • Lighthouse innovations • Lighthouse Festival of Ambitious Ideas • KILN Incubator • Microsoft BizSpark* • Mill House social enterprise accelerator • OK RDY – a matchmaking, connection and collaboration initiative • UC Innovation and Strategy (Engage UC) • Renewables Innovation Hub – coworking/maker space • Ribit • Screen Accelerate • Stir • Thinkplace
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* Microsoft is committing \$US500m over the next two years to offer joint sales engagements with startups, along with access to its technology, and new community spaces that promote collaboration across local and global ecosystems. See <https://startups.microsoft.com/en-us/>. Google and other platform technology companies have similar arrangements.

These initiatives have delivered some impressive results which are discussed elsewhere in this Report. As indicated in Figure 5, many of these initiatives are brought together under the Canberra Innovation Network umbrella.

Figure 5: Canberra Innovation Network (CBRIN) Portfolio

CONNECT
You can connect with like-minded innovators.

- Validate your innovative business idea**
Lean Innovation Workshops
Learn and practice essential innovation skills:
 - Customer Validation
 - Business Model Generation
 - Product Development
 - Pitching
- Grow your innovative business idea**
Advanced Startup Workshops
Master critical startup growth skills in these advanced workshops relevant to even experienced entrepreneurs:
 - Selling to Grow
 - Finding Investors
 - Negotiating Terms
- Host your next event**
Hire the space at the CBR Innovation Network. Talk to us >>> events@cbrin.com.au

COLLABORATE
You can make an impact.

- Work with other businesses to solve industry challenges innovatively**
Collaborative Innovation Lab
Identify, develop and facilitate opportunities by bringing together local businesses to solve innovation challenges.
- Find your next superstar employee**
Ribit
Connecting university students with internship opportunities in innovative startups, SMEs and larger organisations.
- Get your creative project out in the public**
Stir
This crowd voting platform is a starting point for people from creative backgrounds to develop an entrepreneurial mindset, helping them engage with the economy in a meaningful and rewarding way.
- Help foster STEM and entrepreneurship**
Inspiring the ACT
This is a national program that helps build connections between scientists, organisations, businesses and students to foster public participation in science, technology, engineering and maths (STEM).
- Encourage young girls to continue their passion for STEM**
STEM Sells
An after school program that hosts a series of fun and engaging workshops dedicated to inspire young women into pursuing their interests in STEM and entrepreneurship.

GROW
You can grow your startup.

- Join a co-working space**
Entry 29
This is a co-working space for entrepreneurs and startups who are interested in being surrounded by a passionate, supported and connected community.
- Talk to one of our advisors about your innovative business idea**
Launchpad
Coaching that empowers entrepreneurs by setting challenges to advance their skills, focusing on refining value proposition and developing the right prototype.
- Find investors to help your startup grow**
GRIFFIN Accelerator
Three months of intensive mentoring and \$25,000 from successful entrepreneurs to help ambitious startups raise angel investment and get on a high growth path.
- Make social impact with your startup**
Mill House Social Enterprise Accelerator
An intensive business advisory and investment program for ventures trading for social, cultural, economic or environmental purpose.
- Get support to scale up your business**
KILL Incubator
An in-depth program that supports early stage technology startups as well as high growth innovative SMEs to raise capital and scale-up into national and global markets.
- Get free expert business advice**
Experts in Residence
Free initial appointments with selected strategic and professional experts to ask in depth business questions.
- Accelerate your business growth**
SME Growth Program
For access to expert business support and foundation member capabilities, participate in a program designed to help established SMEs identify and execute opportunities to grow the business rapidly.

FOUNDATION MEMBERS: Australian National University, ANU, DATA 181, CSIRO, UNIVERSITY OF CANBERRA, UNSW Canberra

GOLD PARTNERS: KINGWILD MALLEONS, pwc, OPTUS

SUPPORTED BY: ACT

Our vision is for Canberra to be recognised globally as a clever, connected and creative city fuelled by excellence in research, innovation and entrepreneurship.

Get support to start, grow and scale up your business.
Talk to us to find out how we can help.
Email us at: enquiries@cbrin.com.au
Call us at: +61 2 6162 1149
Book a consultation: cbrin.com.au/book

Not included in the list are enterprise development, maintenance, and advice programs such as [Canberra Business Point](#) operated by the Canberra Business Chamber.

Further afield, Canberra has connections with other incubators, accelerators, maker spaces and early stage seed and startup funds, including those listed in Table 7.

Table 7: Capital Region and beyond Incubators, Accelerators, Co-working Spaces

<ul style="list-style-type: none"> • AgriTech Incubator, located at CSU at Wagga Wagga • Blackbird Ventures, an early stage start up investor • Cicada Innovations, and Cicada Grow Lab (supported by the Meat Donor Corporation), Sydney • CSIRO Innovation Fund - Main Sequence Ventures, targeted on commercialisation of CSIRO research. • iAccelerate, University of Wollongong • Incubate@35Degrees • Fishburners, startup incubator/accelerator, coworking/maker space, Sydney • Michael Crouch Innovation Centre, UNSW – events, design, maker space • Microsoft Scaleup, Sydney – based at the Sydney Startup Hub, accelerator with mentoring and expert advice, access to technology tools, and global networks. 	<ul style="list-style-type: none"> • Sparklabs Cultiv8 – a collaboration with NSW DPI, located at Orange within the Global AgTech Ecosystem (GATE) and CSU Regional Pitchfest • Slingshot, with a mission to connect startups with Corporates • Startmate, connections to successful startup founders, including Atlassian • SproutX, start up and seed investor, with connections to the National Farmers Federation) • The Hatchery, UTS – incubator, accelerator, maker space • Stone and Chalk, FinTech Hub, accelerator, Sydney and Melbourne • UNE Smart Farms – AgTech innovation • UNE Smart Region Incubator – incubation, technology access, coworking/maker space • Working Spaces – Wagga Wagga – coworking/maker space • Western Sydney University Launchpad – maker space, Start-up SydWest accelerator, coworking
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International connections have also been made and a great deal of effort has been applied to creating connections with potential investors in Singapore.

CBRIN also has an important role in providing ‘back office’ support for managing funding programs and other aspects of corporate support for many of the entities involved. It has a key role in supporting the

research oriented cluster initiatives announced in *Confident and Business Ready*⁴³. CBRIN staffing now stands at 12.

KILN Incubator

The KILN Incubator, created in 2015, was brought about by a partnership between the CBR Innovation Network, the Griffin Accelerator program and ATP Innovations, with the support of the ACT Government.

The KILN Incubator is a business program, supporting high-growth potential entrepreneurial ventures in the ACT. The business founders and entrepreneurs who participate in the KILN Incubator business growth program will receive various forms of support and services.

The KILN Incubator will deliver services tailored to the client-company business stage, and the respective needs of individual companies. The KILN Incubator will work with clients for up to eighteen months. An equity for services business model will be extended to high growth potential start-ups. A fees for services model will be extended to established companies that have ambitions to scale to national and international markets.

CBRIN and ACT Government support is complemented by support from private sector sponsors, including PwC, King & Wood Mallesons.

<http://www.kilnincubator.com/>

There are a number of corporate innovation hubs across the country operated by technology intensive businesses. Accenture recently opened a Defence Innovation Hub in Canberra.

Accenture launches defence innovation hub in Canberra

George Nott (Computerworld) 02 August, 2018 13:01

Accenture has opened an ‘innovation hub’ in Canberra, to serve as a co-design space for the Department of Defence and security organisations.

The new office space has capacity for 100 employees, and is set-up to give demonstrations of blockchain, artificial intelligence, internet of things, robotics and advanced analytics, the professional services firm said.

“Defence organisations need to increase their resilience to emerging threats and require secure, innovative and flexible delivery capabilities, often on tight turnaround,” said Accenture’s defence and national security lead for Australia and New Zealand, Matt Gollings.

“Through on-site demonstrations of how innovative and often disruptive digital technologies can enhance mission readiness, deliver better operational outcomes and ultimately help deliver mission success, our innovation hub addresses this need while maximising innovation and delivering the defence agency of the future,” he added.

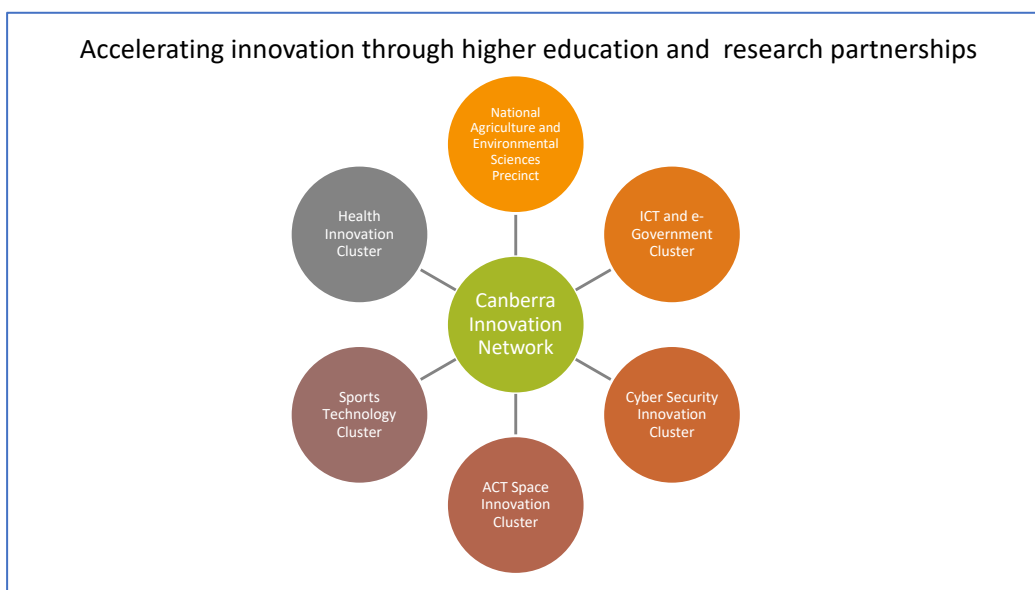
<https://www.computerworld.com.au/article/print/644686/accelture-launches-defence-innovation-hub-canberra/>

4.8 Clusters and capability areas

There have been recent initiative around building greater collaboration in university-government commitment to grow the ecosystem through support for research clusters and precincts.

Confident & Business Ready provides that the Government will, “in partnership with the higher education and research sector, continue to maximise economic development and business outcomes in a number of key capability areas. The Canberra Innovation Network will have a coordinating role”. This would be around six capability areas, as indicated in Figure 6 below.

Figure 6: Higher Education Precincts and Clusters



⁴³ The National Agriculture and Environmental Sciences Precinct; The ICT and e-Government Cluster; The Cyber Security Innovation Cluster; The ACT Space Innovation Cluster; The Sports Technology Cluster; and The Health Innovation Cluster.

Several of these research partnerships link with recently released, or forthcoming, industry development strategies covered in *Confident & Business Ready*. Some of these priorities also match with university research and innovation priorities. Interestingly, however, the focus is on government-university collaboration, but omits discussion of ‘industry/business’ as the third sphere in the Triple Helix Innovation System representation.

The Current ANU Research Strategy	
Research priority areas:	
1.	Culture, creativity & societies - Understanding cultures and the complex relationships in societies. Priority areas of research: Humanities; Indigenous studies; Social sciences; Social structures & processes; The arts
2.	Environment & sustainability - Sustainable use of resources in Australia and the world. Priority areas of research: Biodiversity; Climate change; Earth & environmental sciences; Energy alternatives; Resource & environmental management
3.	Future security - A secure, stable and equitable world for all people. Priority areas of research: Food security; Resilience & adaptation; Secure networks; Security policy; Strategy & defence.
4.	Health & medicine - Better health for our people, our nation and our world. Priority areas of research: Combating diseases & conditions; Health policy; Mental health & cognition; Population health
5.	Regional & global context - Engagement and influence in the Asia-Pacific region and beyond. Priority areas of research: Asia & Pacific countries; Economic growth & wellbeing; International studies; Northern Australia; Political sciences; Prosperity in our region; Regulation, justice & law
6.	Science & innovative technology - Solving deep problems through blue-sky and applied scientific research. Priority areas of research: Earth sciences; Enabling science; Information age; New materials & processes; Physics & engineering; Space sciences.
http://www.anu.edu.au/research/our-researchPriorities	

Both blue sky and applied research have strong connections to innovations. Companies are attracted to regions with universities that have strength in basic/blue sky/discovery research.

The 2017 ANU *Annual Report* identifies a number of performance criteria for the University:

- 2.1. We will embed public servants at ANU and our academics within government, emphasising co-creation of policy and broadening policy related research.
- 2.2 We will build the nation’s leading policy incubator by harnessing the research breadth of ANU, offering solutions to complex policy issues confronting the nation and our region.
- 2.3. We will define our relationship with CSIRO focussed on an integrated precinct connected to the local and national innovation ecosystems.

Crawford School of Public Policy, ANU	
Crawford School of Public Policy at The Australian National University is Asia and the Pacific’s leading graduate public policy school. Staff and students at the School play an essential role in shaping public policy through research, education and policy engagement.	
Crawford School is home to some of the region’s most important researchers and many staff are active on government committees and in key advisory roles across government, business and civil society. Students at the School are valued members of the region’s leading public policy community and contribute actively to the impact being made on the world’s challenges surrounding such issues as water, food, energy, economic development, the environment, and governance.	
Crawford School offers graduate degrees and executive programs in areas that include public policy, applied economics, public administration, and environmental management.	
Crawford School is home to influential publications including the journal Asia and the Pacific Policy Studies , and publications such as East Asia Forum , Dev Policy Blog , Policy Forum , Solutions , and Advance .	
https://crawford.anu.edu.au/about-us	

The ACT Government has recently recognised the important AgTech dimension, with support for the National Agricultural and Environmental Sciences Precinct (NAESP) – an ANU and CSIRO collaboration for a globally significant research and innovation sciences precinct in Canberra. The Government has also supported the Centre for Entrepreneurial Agri-Technology (CEAT). There is also a CSIRO Boorowa Agricultural Research Station (BARS), 100km northwest of Canberra⁴⁴.

CSIRO Interest is reflected in *Food and agribusiness: a roadmap for unlocking value-added growth opportunities for Australia* (CSIRO Futures, 2017) and the earlier *National food and nutrition research and development and technology transfer strategy* (CSIRO et al., 2013).

⁴⁴ See <https://www.csiro.au/en/Research/AF/Areas/Boorowa-Agricultural-Research-Station>. BARS replaces CSIRO’s Ginninderra Experimental Station, which was established just outside of Canberra in 1958 and originally had a focus on pasture and animal research but more recently on grains crops. The new facility provides a fresh opportunity to study a broad and integrated range of agricultural sciences. BARS will feature the latest digital agriculture technologies such as precision agriculture, and remote and non-destructive phenomic crop monitoring. It will also continue CSIRO’s long history in agricultural breeding and genetics.

Globally, Agtech is one of the fastest growth areas for venture capital investment (KPMG, 2018)

Agriculture has become a destination for VC investing due largely to the advancements in technology that help farmers better predict, manage and boost crop production. Traditionally, agriculture has been seen as a volatile industry, given the unpredictability factors such as, of the weather, pest and disease outbreaks and regularly fluctuating commodity markets.

Companies that offer technology that helps to smooth out the food production process — from field and soil to the supermarket — are considered attractive. Technologies that also help to boost production and increase crop yields, while reducing financial and environmental costs, are also in favour in today's AgTech market. VCs are excited by Agriculture 4.0 and a range of technologies being developed and refined including crop sensors, satellite imagery, the IoT, blockchain, swarm robotics, automation and data analytics, to name a few examples.

For instance, distributed ledger technology [blockchain] is helping to trace the physical product through the supply chain. This is important for efficiencies, but also meets a growing demand among consumers to source where their food comes from. Another example is AI, which is helping farmers better analyse animal behaviour, as well as identify and track potential ailments. Meantime, predictive analytics is being used to assess moisture levels in a field, which helps growers ensure their crops received the appropriate amount of water and better predict growth curves, yields and harvest dates.

Developments in AgTech present major opportunities for Canberra and the Region. It is an opportunity recognised in the NSW Government *A 20-year Economic Vision for Regional NSW* for the Capital Region (NSW Government, 2018).

4.9 Connections, connectedness, and collaboration

Canberra is a highly networked City, with strong relationships among the business community, the universities and research organisations, and the ACT Government. These connections have evolved and strengthened over the last 10 years. Because of its relatively small size, there is a high degree of trust that has built up between business, government and the universities. Universities, in particular, have become more active in their relationships with business and in articulating their support for the development of the Canberra region.

Over the period the ACT Government has allocated a substantial amount of effort to building relationships with the universities through Memoranda of Understanding, collaborations and partnerships. This is reflected in the recent International Education Strategy and other collaborations in the development of research and industry focussed capability areas.

4.9.1 The Canberra Innovation Network (CBRIN)

In 2015 the ACT Government supported the formation of the Canberra Innovation Network (CBRIN) as an aggregated approach for innovation programs and resourcing. The logic was that the Government has available a total annual appropriation of about \$1m and if that could be brought together it could provide certainty going forward—for at least four years.

There were a number of leaders in the ecosystem community who also had a vision of doing things on a bigger scale. The Government was able to bring all the program decisions together around renewal of the funding, and establish governance arrangements as the Canberra Innovation Network (CBRIN) — which also provided a basis for involving the universities.

Confident & Business Ready, 2015, set out a vision CBRIN in the following terms.

CBRIN Vision

The long-term vision is to develop a vibrant innovation ecosystem that builds on existing activity and the depth of capability of the Foundation Members.

It will attract entrepreneurs, graduates, investors and large and small companies. It will be well known and respected internationally. In two years, the CBR Innovation Network will be a thriving physical hub of entrepreneurship, having supported the development of an incubator and seen significant growth of both Entry 29 and the GRIFFIN accelerator such that new larger premises will be required.

The Government, through the funding arrangement, has asked the CBR Innovation Network to identify gaps in the innovation ecosystem and, in partnership with the innovation community and service providers, put in place strategies to ensure that services necessary to accelerate innovation are available and accessible for start-up entrepreneurs and existing businesses wishing to grow and develop.

The CBR Innovation Network will develop on a hub and spoke model to ensure its services are available to all entrepreneurs and potential high growth businesses wherever they are located in the ACT.

It will also play a crucial role in supporting the entrepreneurs and businesses associated with the emerging key capability areas. It will provide programs that connect businesses to the key capability areas, including 'sandpit' programs to enable these organisations to test ideas with entrepreneurial companies and to collaborate with each other. The targets will be larger SMEs already well-established on their innovation path, Canberra and region companies (using the Canberra Business Chamber to promote the service) and multinational corporations with an innovation capability in Canberra.

The Board of CBRIN has a strong representation of senior executives in universities and research organisations and from business with a strong commitment to further development and extension of the innovation ecosystem. This is reflected in the CBRIN constitution and the most recent strategic plan.

The primary object of the company is to:

1. provide a network linking businesses and entrepreneurs to services, facilities and stakeholders that accelerate innovation and growth
2. promote a culture of innovation and entrepreneurship in the ACT
3. take a central role in growing the innovation ecosystem ACT and building individual and corporate capability
4. Develop innovative approaches to provide services that support the growth and diversity of the ACT economy.

This inclusive approach and the resilient personal connectivity in the system has obviated the need to set up government structures for implementation – a feature of innovation program delivery in the Commonwealth and other States. The current CBRIN portfolio is illustrated in Figure 5 above.

By 2018, it is clear that the formation CBRIN has been a major catalyst in building connections across the *Canberra and Capital Region* innovation and economic system. It connects with all startups and more mature technology intensive businesses across the ecosystem - not just those who have been through formal CBRIN sponsored programs. It provides an exceptionally valuable networking capability.

The Canberra Innovation Network (CBRIN) has had a major role in providing leadership in the ecosystem and facilitating and strengthening connections with elements of the Canberra and Region ecosystem and beyond – to Sydney, and globally.

CBRIN has evolved into an innovative approach to innovation governance and a model for ecosystem governance in other places. It has also developed an international role through establishing links with international early stage investors and has become an important adjunct to the ACT International Engagement Strategy.

A CBRIN Investment Showcase in Singapore in July 2018 was regarded as very successful. Investment pitches were made by [Ecospectral](#), [Liquid Instruments](#), [Mineral Carbonisation International](#), [Mullion Group](#), [Reposit Power](#), [SignOnSite](#), [SKoolBo](#), [Stakone](#), and [Today's Plan](#). It is understood that there have been follow-up interest from potential investors.

4.9.2 Other networks

There are also other networks, such as user groups, developer networks in the ICT area, often established with the support of ICT platform businesses, creative networks around film, multimedia and gaming, professional and industry associations, and alumni organisations.

4.9.3 Networks with Commonwealth agencies

Networks with Commonwealth Government agencies have also developed around industry and technologies. However, Commonwealth procurement and probity requirements, which have a strong transactional focus, make it very challenging to develop strong trust-based relationships between the Commonwealth government and the business community in an environment of process compliance, rules based procurement, and highly active parliamentary, public audit, press and social media scrutiny.

4.9.4 Collaboration with NSW

Canberra-Queanbeyan conurbation is the third largest city within NSW with a population in 2017 of 447,457⁴⁵. By 2031, the combined Canberra and Canberra Region population is expected to reach 745,000. Collaboration with the NSW element of the innovation ecosystem has been improving over the last 20 years, and particularly the last 10.

The economic, educational, business, and social connections in Canberra and the Capital Region are seamless notwithstanding the existence of a state border.

There are barriers, often politically driven, that stand in the way of effective collaboration. For example, there is a suggestion that the NSW Government is currently reluctant to provide a grant to UNSW to develop a capability at its Canberra campus that would provide overall benefit to NSW and globally.

Collaboration has improved with cross border initiatives around economic development, infrastructure, the environment, services, and regulation. In 2016, the ACT Chief Minister and the NSW Premier re-committed to the ACT-NSW Memorandum of Understanding (MoU) on Regional Collaboration (first signed in 2011):

The MoU strengthens the collaboration between the ACT and NSW Governments and serves to optimize regional outcomes and service delivery to the people of the ACT and South East NSW Region. The MoU reflects the desire to pursue a regional approach on a range of areas. It recognizes the mutual benefits and increased opportunities that emerge through such collaboration⁴⁶.

There has been strong engagement with the [Canberra Region Joint Organisation](#), where the ACT is an Associate Member. The Organisation's logo uses the CBR brand identity.

The recently published *A 20-Year Economic Vision for Regional NSW* (NSW Government, 2018) identifies 37 "Functional Economic Regions" (FERs) in NSW. The document expects that the "Capital Region" (excluding the ACT) will be the fastest growing, "adding more than 65 per cent more people".

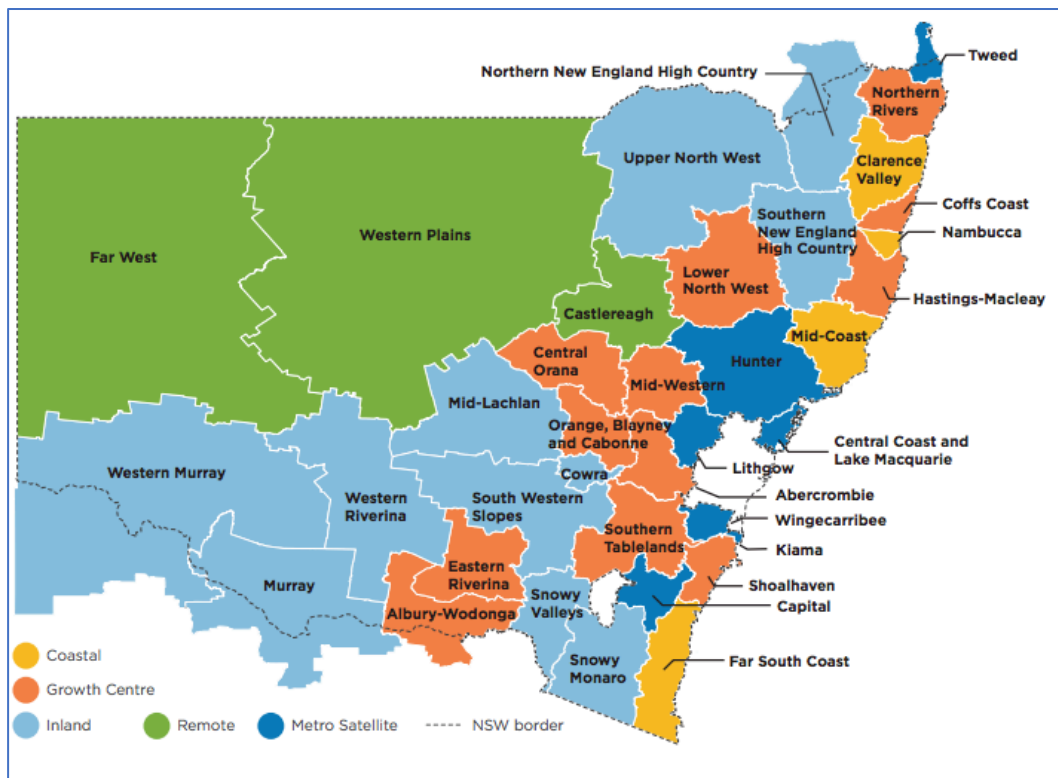
The *Vision* document makes little mention of the important education, employment, business and innovation opportunities, and resources, that will come from Canberra for the benefit of the Capital and Southern Tablelands Regions (including Goulburn, Murrumbateman and Yass). Even though businesses may be located in NSW, they will draw on demand generated in the ACT. The expected additional people will have access to the universities and the VET institutions located in the ACT.

The ACT is often seen as the 'hole in the doughnut', as conveyed in Figure 7, below. Yet, as mentioned, Canberra-Queanbeyan-Palerang is the third largest city *within* NSW.

⁴⁵ The largest city in NSW is Sydney (4,741,874) followed by Newcastle-Maitland (481,457). The Central Coast is fourth (329,437), and Wollongong (299,203) is fifth. <https://blog.id.com.au/2018/population/population-trends/the-50-largest-cities-and-towns-in-australia-by-population-2018-update/>. Other NSW 'cross border' cities are Albury-Wodonga and Gold Coast-Tweed Heads.

⁴⁶ <http://www.cmd.act.gov.au/policystrategic/regional/nsw>

Figure 7: NSW Functional Economic Regions – with the ACT as the ‘hole in the doughnut’



It is vital for the future economic success of Canberra, the Capital Region, and indeed NSW, that Canberra is seen and valued as a major partner in the overall economy⁴⁷.

The development of the Canberra and Capital Region must reflect a ‘seamless’ connection across the ACT-NSW border.

4.10 Access to early stage venture investment

The role of risk capital providers cannot be understated. Canberra and the Capital Region is now very well served in terms of the innovation and entrepreneurship programs to help researchers, inventors and entrepreneurs understand the commercialisation process. However, there is still a lack of access to well-credentialed capital.

It was argued in consultations that the current programs, people, property and capital supporting the new economy are heavily skewed towards the major capital cities.

The capital cities house a disproportional number of the country’s co-working facilities, start-up incubators, accelerator programs, angel investment groups and venture capital funds. Over the last four years this gap has become a gulf with the vast majority of Venture funds being based in Sydney and Melbourne⁴⁸.

The problem is exacerbated as The Canberra Business Development Fund, established in 2003, is now in its divestment period and closed to new investments. ANU Connect Ventures, formed in 2005, is also

⁴⁷ Not sure if there has been an economic study of the impact/contribution of the ACT on the NSW Economy. *A Priori*, the results should be positive.

⁴⁸ <https://www.startupmuster.com/reports/Startup-Muster-2017-Report.pdf> - Accessed 21st May 2018

in its divestment period and closed to new investments. Whilst the ANU has partnered with Hindmarsh to create *Significant Capital Ventures*⁴⁹, the Fund may not address the high risk early stage investment opportunities that ANU Connect Ventures supported.

Significant Capital Ventures opened for business in early 2018 and is actively looking at local and regional investment opportunities. So far it raised over \$10 million of independent capital.

The recent *KPMG Venture Pulse Report* released in July 2018 reports (Sadler, 2018):

The amount of venture capital invested in Australia has soared to a record high, but with a lower number of deals there are concerns about a remaining funding gap for early-stage companies.

In the 2017-18 financial year, more than \$850 million (\$US630 million) of venture capital was invested in Australian companies, according to KPMG's Venture Pulse report, while in the second quarter of the 2018 calendar year, more than \$280 million worth of VC investments were recorded locally.

Despite the record amount of funding pouring into local companies, however, the number of deals in the last quarter decreased from 31 to 27 compared to a year ago.

This has led to concerns of a venture capital funding gap for early-stage startups in Australia.

The KPMG Report suggests that as the VC focus continues to shift towards larger raisings for later stage startups, it poses questions as to where the funding for early stage ventures will come from.

There is a concern about an absence of an increase in angel investors or seed investment. KPMG observes that "If we want Australia to have a successful and growing startup ecosystem, we need capital at every stage of the pipeline."

During consultations it was argued that over the last 24 months Canberra has become uncompetitive with other States in terms of their early stage incentive programs. South Australia launched their \$50 million South Australia Venture Fund. Queensland has got various incentives, and "we sit in our boardroom and our companies are saying, 'I could go here and get this'. And we have to fight to keep them here".

Next week I'm in Singapore with the Chief Minister. Same thing, the Singapore government is offering incredible incentives for companies to relocate there. We're taking ten of our growth stage companies for an investment showcase next Thursday which the Chief Minister is hosting and opening. The problem is, these pools of capital that are not here in the ACT that are very attractive for our companies. We're good at getting them started but when we're moving into this growth stage, we just don't have the fire power.

Over 90 per cent of all registered VCLP's and ESVCLP's are based in Sydney or Melbourne. Local entrepreneurs need to leave Canberra to secure investment dollars. This opens the door to them being encouraged to leave the city to be closer to their investors.

Pointy

Founded by E29 alumnus Mark Cummins in 2014. Mark moved overseas for investment in 2015 and since has raised \$20M and has 50 staff.

Pointy combines hardware and a software platform to help local retailers easily establish a presence online in order to drive more people to their store. Specifically, the "Pointy box" hardware gadget connects to a store's barcode scanner and automatically puts scanned items on a Pointy-powered website for the store.

<https://www.irishtimes.com/business/technology/retail-tech-firm-pointy-set-to-double-workforce-to-50-1.3504702> & <https://www.irishtimes.com/business/technology/pointy-raises-12m-in-funding-in-drive-to-speed-up-growth-1.3561467>

There was a view that the ACT government should think about supporting a new Seed Fund, along the same lines as it did with the original version of ANU Connect Ventures, with some confidence that the funds will be returned. The leverage benefits of ANU Connect Ventures are indicated in Attachment 2A.

⁴⁹ The Fund is structured for the Significant Investor Visa (SIV) scheme which now mandates 10% of the \$5M capital is placed with a complying Venture Capital fund. Significant Capital Ventures is a conditionally registered Early Stage Venture Capital Limited Partnership (ESVCLP).

4.11 Challenges and opportunities

This Section addresses two challenges and opportunities for the further development of the Canberra and Capital Region innovation ecosystem.

4.11.1 Competition, collaboration and connectivity

On 31 July 2018 the Premier of NSW Gladys Berejiklian announced that the State should become the pipeline for at least 50 per cent of Australia's future start-ups⁵⁰. This follows a \$35m outlay on an 11 Floor Sydney CBD Startup hub⁵¹. But in an editorial comment, *The Australian Financial Review*, pointed out:

It's great to hear start-ups championed from the top – a sentiment we hear echoed from state leaders in Queensland, Victoria and South Australia in particular. With high-growth technology companies generating most future jobs, these states are on the money.

But there is a view that the States and Territories should not be competing with each other, and should collectively adopt a global focus.

In a technology industry that is global, should the states really be focusing on domestic competition?

A better objective for Sydney would be for it to become one of the top 10 ecosystems globally reflecting the international competition that Australia collectively faces as a nation. Cooperation and collaboration across a regional innovation ecosystems would be a much more fitting strategy.

The AFR referred to the recently released survey published in the [Startup Genome Report](#) that mentioned measures government and industry need to consider. It identified a wide array of factors that materially affect the vitality of start-up ecosystems, and a need to focus on what we can tangibly affect: local connectedness, global reach and access to talent.

Local connectedness should be the first priority of the state government. The Genome report defines local connectedness as the combination of three factors: sense of community, strength of local relationships and number of "collisions" (for example, bumping into someone in a cafe) that exist in an ecosystem.

Relationships and community can be best generated within and by industry. Programs that facilitate skills development and meetings between founders are vital for generating the strong sinews of an industry.

The AFR argued that State governments have a role to support these bodies because, despite the wealth of some technology entrepreneurs, most companies in the tech industry are young, cash-poor businesses. Both Queensland (Advance Queensland) and Victoria (LaunchVic) have successfully recognised this point and created industry organisations focused exclusively on enervating local relationships and community.

The AFR did not refer to the Canberra and Capital Region, which is an exemplar promoting connectedness, reach and access to talent. But as ANU Connect Ventures points out, regions tend to get left off the metropolitan radar. This is the essence of a case for a Regional Innovation Investment Fund (RIIF).

4.11.2 Regional Innovation and Investment Fund (RIIF)

On a broader perspective, and noting that the vast majority of Australian venture funds are based in Sydney or Melbourne⁵², ANU Connect Ventures pointed out that:

⁵⁰ <https://www.afr.com/leadership/entrepreneur/why-we-need-a-sydney-silicon-valley-and-how-to-get-it-20180731-h13d6u?btis>

⁵¹ <https://www.afr.com/leadership/entrepreneur/nsw-spends-35m-on-11floor-sydney-cbd-startup-hub-20170712-gx9lv3>. This is only just under 12 percent of the \$300 million that has been allocated by the French for a Paris startup hub -

<https://www.afr.com/news/world/europe/why-france-is-taking-a-lesson-in-culture-from-silicon-valley-20170630-gx1ti3>

⁵² <https://www.startupmuster.com/reports/Startup-Muster-2017-Report.pdf> - Accessed 21st May 2018

There is a strong view that the gap between urban and regional Australia is widening as a result of the concentration of new economy activity in the major cities. However, regional Australia has the potential to create globally competitive businesses that leverage the people, talents and strengths of regional centres. The Commonwealth is now well placed to take the next step in addressing this *system* failure through building on its current rural and regional investment focus through establishing a *Regional Investment Fund* to stimulate and support new economy businesses based in regional Australia.

A new Commonwealth Regional Investment Fund (RIF) would stimulate and support the establishment and growth of new economy businesses in regional Australia.

The Fund would provide, for example, a stimulus to the growth and development of the burgeoning AgTech Sector, mentioned previously, where there is no shortage of seed and startup capital, but a lack of expansion and development capital.

The RIF would provide, for example, a stimulus to the growth and development of the burgeoning AgTech Sector, where there is no shortage of seed and startup capital, but a lack of expansion and development capital. The characteristics of the RIF could be:

- \$250M program over 10 years
- 10 managers selected to manage \$25M each in different locations across regional Australia
- Other investors to match this money dollar for dollar to create ten \$50M funds
- Use appropriate fund structures for these funds (VCLP or ESVCLP)
- Applicants selected for their regional footprint and presence

The Innovation Investment Fund (IIF) program which ran from 1998 to 2014⁵³ was a catalyst for the creation of an enduring Venture Capital ecosystem, principally in metropolitan areas. The time is now opportune to build a parallel capability in regional Australia. The ACT Government could take a lead in promoting the formation of a RIF, drawing on opportunities in the Capital and South East region of NSW.

The Fund could be used to seed and support well-credentialed providers in regional Australia. The providers will need to demonstrate:

- Significant capability in the establishment of new economy businesses
- Strong regional presence
- Established networks with regional research organisations
- Connections with regional co-working spaces and accelerator programs
- Management of other early stage investment funds (existing capability and compliance)
- Support from appropriate regional development agencies
- An ability to match Government funding on a like-for-like basis with private capital

It remains, nonetheless, critically important that the Canberra startup ecosystem continues to reach out to the larger investment centres – nationally and globally. Sydney is where the strongest Australian capability is located (only 270 km away).

Building connections with Singapore and locations where there is a strong university research presence, such as Barcelona and Boston, is an important part of this process.

4.11.3 Opportunities in AgTech

The recent KPMG *Venture Pulse* Report, which found that Australia has a particular strength in AgTech, observed that “the rise of AgTech activity and accelerators in Australia is creating more local AgTech

⁵³ Terminated in the 2014 Abbott austerity Budget, on the advice of the National Commission of Audit, despite evaluations finding that the Program had been successful.

investment opportunities, which we expect to lead to more deal activity in the second half of 2018 and beyond.”

Opportunities in Food and agribusiness

While global innovation powerhouse nations were still leading the way, countries like Australia are beginning to compete with the world on AgTech.

“There are a number of clear geographic leaders when it comes to AgTech innovation and venture capital investment. The US remains the clear leader in this space, however Israel, Australia and India have made inroads. We are seeing a burgeoning AgTech ecosystem”

“While the US, China, India and Brazil have a strong interest and investment in ag and AgTech given their growing populations, there are also innovative solutions coming out of Israel, Australia, New Zealand and the Netherlands,” the report said.

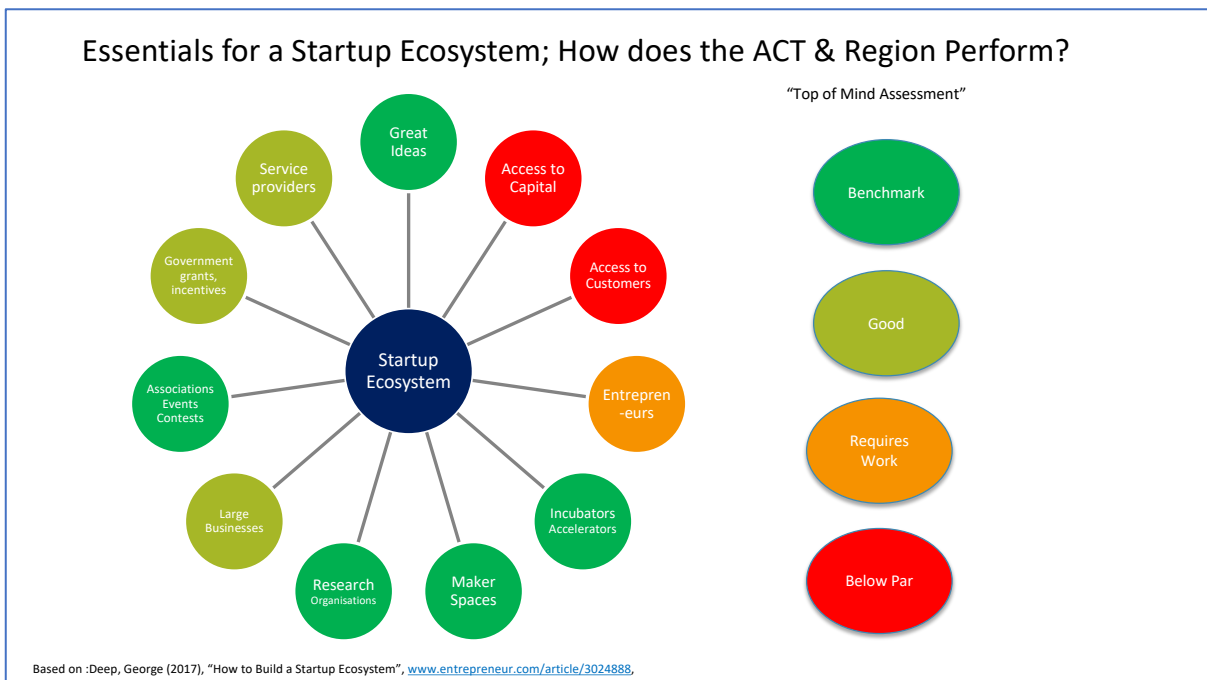
“For example, regions with multiple climatic conditions, such as Australia, are most likely to have a wider range of AgTech solutions,” it said.

Accessed through <https://home.kpmg.com/au/en/home/insights/2018/07/q2-18-venture-pulse-report-infographics.html>

4.12 Overview of Start-up ecosystem performance

A ‘criteria based’ assessment of the Canberra and Region startup ecosystem yields the front of mid results represented in Figure 8 below. Further work would be required to refine assessments and identify the means to address gaps in capability.

Figure 8: Performance of the Canberra and Region Startup Ecosystem



Brief comments are as follows:

- Challenges in access to capital have been mentioned earlier in this Section
- Direct access to customers is challenged due to Canberra’s small size, although companies like [Bird’s Nest](#) in Cooma demonstrate what can be done on-line
- The development of entrepreneurs is very much part of the CBRIN agenda
- Engagement with larger businesses, particularly government businesses is an area for improvement

In general terms, however, and as a former ANU DVC-R observed, “Canberra “ticks all the boxes”. But Canberra cannot be complacent.

Over the last 20 years Canberra has been successful in developing a robust start-up ecosystem, but it must go further in terms of the ability of startup and new technology and creative firms to access expansion and follow on capital, access

scale up and prototyping facilities, and engage effectively with larger businesses that create the jobs and generate the incomes that drive economic growth.

4.13 Bridging the gap: science and technology translation capability

The Canberra Innovation Ecosystem has come a long way. But universities still struggle with the issue that the IP generated is, by and large “deep tech”. There is IP that comes out of physics, engineering, and many other diverse disciplines and research fields. To commercialize and take that forward requires a general entrepreneurial approach - but it also requires something which is slightly different. ANU Connect Ventures commented during discussion:

If we look at a spectrum, on one hand you've got ICT type stuff and on the other end of the spectrum you've got pharma/bio. Everyone thinks all this innovation is just all the same. It is not all the same. I think we've done very well here, but I think we need to move along the value chain in terms of the skill sets we're trying to build and the funding we need to try and provide and the space we need to try and provide. And in particular, so for instance, we've got Liquid Instruments, which is probably the next level along. Very high tech, we've had to incubate inside the university, it needs facilities in the university.

To get some of the high added value from discoveries and inventions, which is the foundation for creating high added value jobs, there is a requirement for access to facilities. ANU has some much needed facilities, as does UC and there is a brokered arrangement between the two institutions. But there is a view that the system needs to get better at accessing scale up and prototyping capability.

There is a need to move more along the value and the technology chains in order to build a more cohesive and a broader industry base in Canberra and the Region.

Otherwise, there is pressure to go elsewhere for development work, which means that Canberra universities will remain as licensees. One of the biotechs that came out of JCMR, Pharmaxis - it started in Canberra it went to Sydney.

The research came out of the ANU. Now, if we'd had the right environment, the right skills, the right people and the right money, there's a chance that Pharmaxis, which has got an enormous building up in North Ryde, would be here. But it just had to move out of here.

To retain more of the development work in Canberra requires:

- having the right programs that support the founders for what they're doing
- the right access to the facilities, what they need at that time – in the first instance you would just build them, you'd try and access the facilities that are here which are in the research institutions.
- funding lines that suit the funding profiles of those particular organizations.

For example, Beta Therapeutics, a recent startup that needs money, could try and develop with small amounts of funding from various sources, or it could move to Queensland to get access to a large Queensland or South Australian. There's a real temptation to go, otherwise exist with a “some kind of really odd hybrid structure which is non optimal”.

There's a gap that's got to be played further down the IP commercialisation trajectory in a way that we keep companies in Canberra.

4.14 Concluding comment: Moving beyond incubation

An interviewee commented during the consultation that:

One of the things that's missing that needs to happen in the Canberra innovation system – and this is about maturity for the city as well as the innovation network, is there needs to be more big companies involved. More companies that have a cheque book who have a vested interest in innovation.

These companies include SAP which runs a digital government business, CSC, and HP. These companies are champions of innovation and employ very experienced senior executives in Tier One firms in Canberra.

Finding those companies who understand the value of innovation in Canberra and developing successful collaborations with them enables smaller, technology intensive new companies to commercialise and expand and export into other markets. Intelledox is an exemplar in this regard:

I think people forget that we have four of the largest customers in the southern hemisphere. And our strategy needs to be deeply tied to them, because they're the ones that can ingest innovation and bright ideas from our factory of ideas. And we need to recognise that and realise that. We do need to map that path to who is going to pay for this? Otherwise, everything just stays at that incubation phase and doesn't actually pump out companies like Intelledox that have the ability to employ people, bring in new revenue into the city by exporting, hire people from outside the city to come to Canberra to live here and educate their kids here, it's all a dynamic cycle.

Many of the successful Canberra and Capital Region 'startups' have not been through an incubator, accelerator, or located in a coworking space. These companies, whilst having high growth potential, grew slowly, and are sustainable businesses. They grew through cash flows, development of deep trust based relationships, access to generous government R&D grants and tax incentives, financial stringency, and reinvestment of retained earnings. Many have not had private equity investment, have not sought it, and rejected unsolicited offers. The CEO of CEA technologies describes his business as "a 35 year old startup".

As indicated, however, CEOs of high growth firms, who have become 'high net worth individuals' make investments in their capacity as 'business angels'. For many, it is their way of giving back to the growth of private enterprise in Canberra and the Region. Some 'angels' operate individually, or collectively through the Canberra Business Angels Network. Many Canberra people who have been successful in business are also major supporters of Arts and Cultural institutions.

The ongoing development and evolution of CBRIN, as a professionally managed and strategically driven networking organisation, is an important resource for assisting all business in making connections throughout the innovation ecosystem – locally, nationally, and particularly internationally.

The ongoing challenge is to connect with the large government owned businesses to position Canberra as an international hub for innovation that parallels its role as a national capital in the geo-political system. This is addressed further in Section 9.

5 Talent and Skills

Talent and skills are the underpinning of growth. Canberra has an innovative K-12 system, including a commitment to the development of education technology (UC INSPIRE Centre), the institution of senior colleges and the introduction of university linked senior colleges and high schools. Compared to other States, the TAFE system has been stable and engenders a high level of collaboration with industry.

The universities, CIT, and RTOs have developed a significant local, national and international market in delivery of post graduate certificates, diplomas and high level apprenticeships to meet market demand for knowledge and skill upgrading and career development. There has been a recent lift in demand for cyber security training for example. CIT has a major commitment to training in the renewable energy sector. This is strongly linked to the cluster development work of the RDA (SERREE) and the ACT Government's innovative Feed in Tariff and reverse auction processes from 2010 to present.

The large pool of highly qualified personnel available from the military and the public service, following separation, has underpinned the development of many new businesses in the defence and specialised consulting areas, and a recruitment base for the professional services and specialised technology firms seeking to build their capability in government services – nationally and internationally.

Canberra Business Point, and its predecessor CanBAS, have provided business maintenance services targeted at reducing the risk of businesses failure due to lack of business skills. Canberra BusinessPoint continues through the Canberra Business Chamber, but without government financial support.

5.1 Background

In 2011 the ACT Tertiary Education Taskforce prepared a Strategy *Learning Capital* (ACT Government, 2011). The Taskforce had proposed that:

The tertiary education system in the ACT unite to form a coherent network of providers of excellence, from small private training providers to large, research-intensive universities. The Taskforce vision is of a fully integrated system of independently excellent institutions that collectively and collaboratively offer world-standard vocational and higher education.

It is a vision of a smorgasbord of educational offerings from which students at every stage of their life can choose, putting together programs that meet their personal and professional needs, drawing from as many educational institutions in the network as they need, with no administrative hurdles. This would create an 'education without borders.'

The Task Force had envisaged -

Canberra becoming more than an education city. It sees it as having the best tertiary education system of any city in the world, linking lifelong learning with research and innovation to create an extraordinary learning capital, serving not only the capital region but the broader Australian and international education markets. It sees Canberra becoming the education destination of first choice for local, domestic and international students, not only because of the quality and prestige of its courses, but because of the breadth of choice and ease of movement between its many world-class education providers, employment opportunities and its quality of life.

The 2011 Education Taskforce saw "a united tertiary system driving economic growth, easing the local skills crisis, shaping the city for a future less dependent on government services and building a truly civilized and cultured city".

Over the ensuing eight years much has been achieved in delivering this vision, particularly in the last three. It has been achieved through a collaborative and committed approach between Vice-Chancellors, the CIT Chair and the CEO, and the ACT Government. There is a strong focus on international education (ACT Government, 2016a).

The development of talent and skills involves a mix between vocational (technical) and academic (theory based) learning and learning through discovery and applied research. These modes of learning have tended to be assigned to unique institutional forms, but the ‘boundaries’ are becoming increasingly porous.

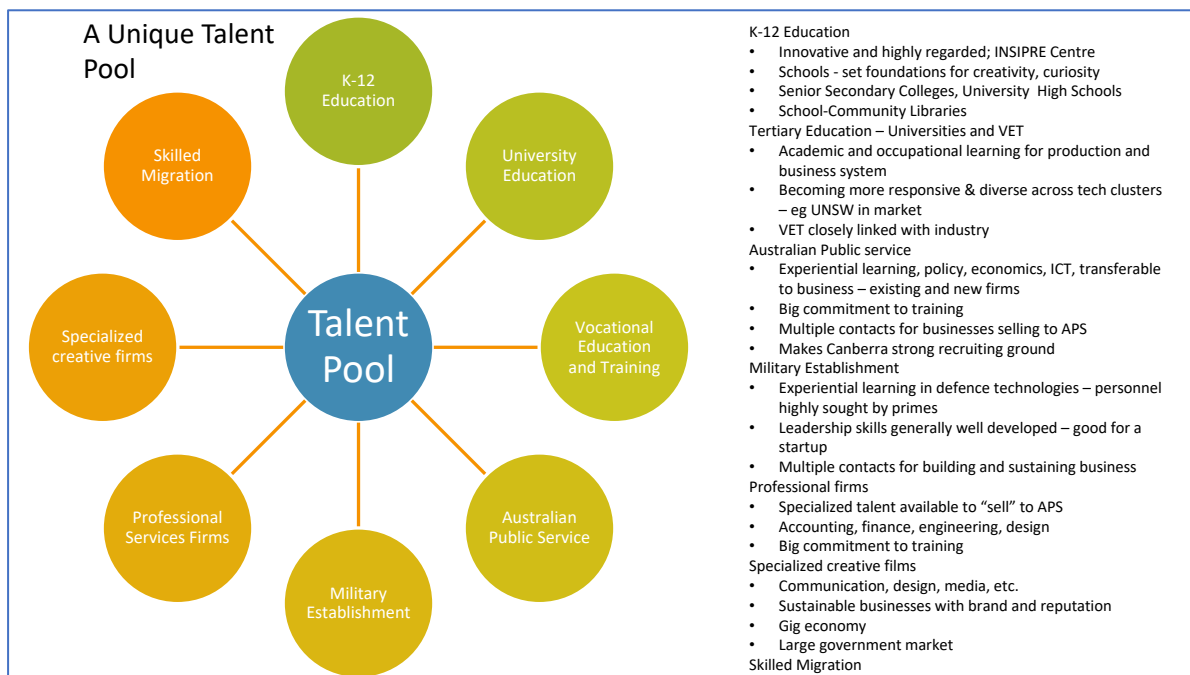
High quality research is not something that is uniquely carried out in universities or publicly funded research organisations. TAFE institutions, businesses and government agencies have a major commitment to research as a foundation for new product and service offerings and for policy development and implementation.

Both the Commonwealth and ACT Governments have developed closer linkages with the universities and CIT for the delivery of education and training. Some arrangements are formal, in terms of commissioned research, consultancy, and training programs, whilst others can be more ad hoc and informal depending on specific requirements. But there is a sense that arrangements have become much more open and fluid.

5.2 A unique talent pool

Canberra and the Capital Region is considered to have a unique talent pool. This is reflected in a number of capability areas, represented in Figure 9

Figure 9: The Canberra and Region Talent Pool



Comments on growth, change, and enrichment of the talent pool are provided below.

5.3 Universities

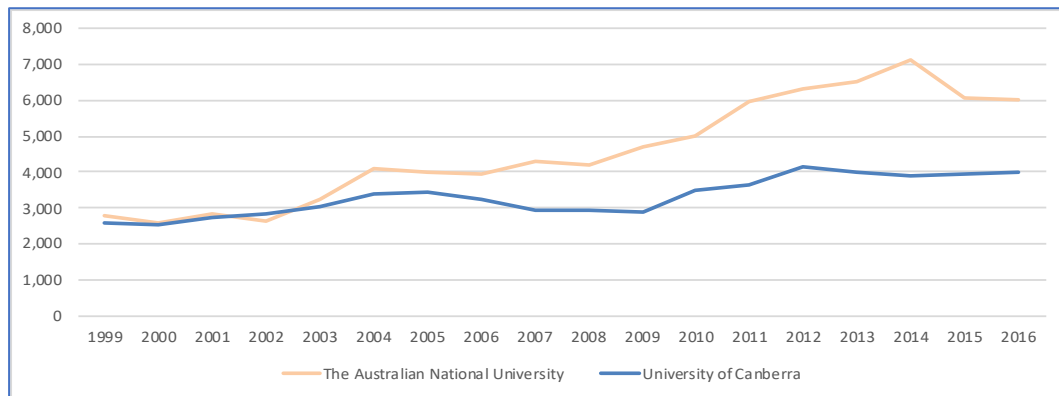
Since the introduction of the demand driven funding system for universities, and the growth of the international student market, the output of university graduates has trebled. Graduates feed into the major industries in Canberra, including Public Administration and safety, Professional and scientific services, and Financial services. There has, however, only been a modest growth in graduate output in STEM disciplines and ICT.

Over the last 20 years public funding for universities has fallen dramatically, prompted in some ways by a view towards the end of the 1990s that Universities could generate income from a greater effort at

commercialisation of their research (PMSEIC, 2001). That view could not be validated, but there has been greater pressure for universities to perform better financially and academically.

Data indicate that there has been a substantial increase in student course completions over the period 1999-2016. Figure 10 provides data for the *university sector* on *all* academic award course completions at the ANU and University of Canberra over the period.

Figure 10: Award Course Completions, All Students, ANU and UC, 1999-2016



Source: <https://docs.education.gov.au/documents/2016-award-course-completions>

Figure 10 shows an ‘uptick’ from 2009 for UC and from 2007 for ANU. ANU has recently decided to cap international enrolments. The two universities accounted for 3.0 per cent of completions in all Australian universities in 2016, down from 3.5 per cent in 2012. In 2008, before the demand driven system kicked in, the proportion was 2.7 per cent.

As in the US and the UK, with declining public sector resources, universities compete – and they compete vigorously for students, research income, and prestige (eminence). Competition for students is reflected not only in potential academic attainment but also in employability and the overall on campus ‘student experience’. Involvement in enterprise development programs is very much part of this experience.

Prestige, generally linked to *academic excellence*, is reflected in placements in global rankings, and is a platform for attracting eminent scholars, students, and further research income. It has become a mantra within industry (and to some extent in public policy) that academic staff are only interested in publication on scholarly journals rather than engaging with industry in relevant research. However, the evidence is that the best universities are good at both academic excellence and industry relevance.

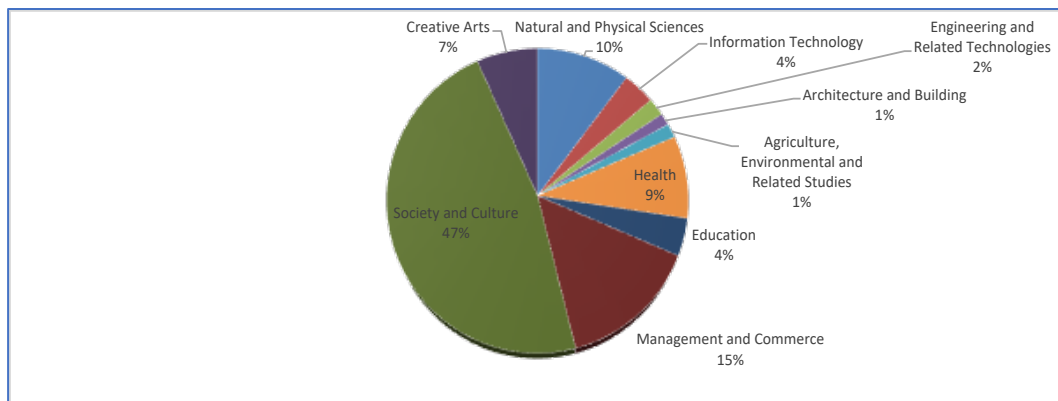
ACT economic strategy documents celebrate Canberra’s university education system. The two largest universities, ANU and UC operate in a national and international student market and research system. The ANU has a number of overseas offices. This helps provide the ACT and Region with a national and international focus.

Canberra based international students provide economic benefit in terms of the fees, accommodation, and living expenses.

There may be leakages of these benefits out of the ACT if accommodation ownership and other provider businesses is held by non-ACT companies or residents.

In order to inform consideration of how university course completions contribute to the innovation system, Figure 11 provides data on completions for *domestic* students, by field of education in 2016. The data point to a very strong proportion of completions in Society and culture (predominantly humanities, arts, and social sciences), Management and commerce (including economics, accounting, finance, law, statistics), and in the Natural and physical sciences (including biology and biotechnology).

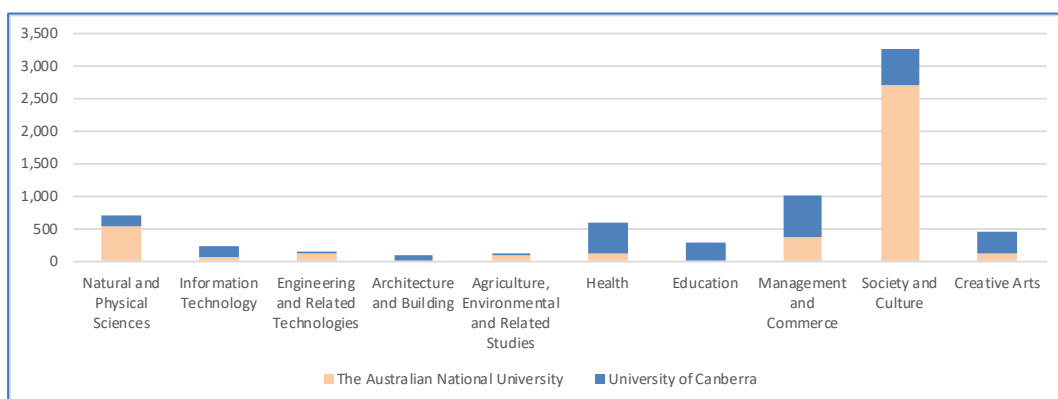
Figure 11: Award course completions for domestic students, by field of education in 2016.



Source: <https://docs.education.gov.au/documents/2016-award-course-completions>

Figure 12 indicates that the ANU has a very high proportion of completions in Society and culture and the Natural and physical sciences. At UC there is a very high proportion of completions in Health sciences and Management and commerce. The data do not include information from UNSW Canberra, which has a very strong Engineering and related technologies capability, CSU Canberra, or the Canberra campus of ACU. The majority of completions are at the Bachelor level (54.3 per cent) with Doctorate by Research at 4.1 percent, Masters by coursework, 16.5 per cent, and other Postgraduate 23.2 per cent

Figure 12: Award Course Completions, Domestic Students, by Field of Education, 2016



Source: <https://docs.education.gov.au/documents/2016-award-course-completions>

The profile of course completions relates to the innovation and industry structure in Canberra. For example:

- Graduates in society and culture⁵⁴, would be available for careers in businesses in some of Canberra’s largest industries: Public administration and safety (for example, public policy, international relations, economic analysis and advice); Professional and scientific services (the law, social assistance); and Arts and recreation services.
- Graduates in management and commerce⁵⁵ would be available for careers in other significant industries in Canberra: Accommodation and Food Services; Finance and insurance services; Professional, scientific and technical services; and Public administration and safety.

The comparatively small level of domestic graduations in STEM type education may not be addressing talent needs of new and emerging industries in defence related manufacturing and information technology businesses focussed on the development and application of new and emerging and

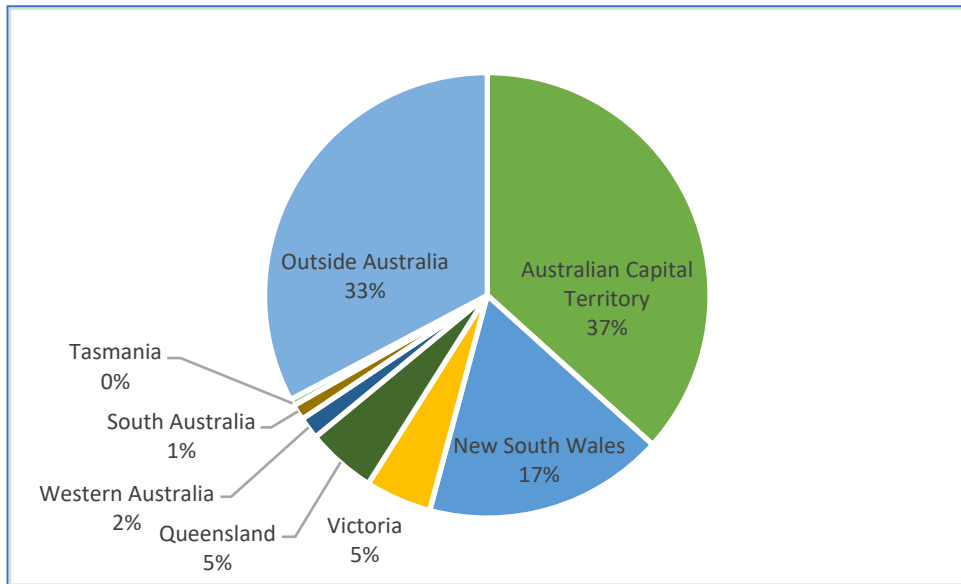
⁵⁴ The field of education Society and Culture covers: Political Science and Policy Studies; Studies in Human Society; 0905 Human Welfare Studies and Services; Behavioural Science; Law, Justice and Law Enforcement; Librarianship, Information Management and Curatorial Studies; Language and Literature; Philosophy and Religious Studies; Economics and Econometrics; Sport and Recreation.

⁵⁵ The Management and commerce field of education covers: Accounting; Business and Management; Sales and Marketing; Tourism; Office Studies; and Banking, Finance and Related Fields

potentially disruptive digital technologies across all industry sectors⁵⁶. It is understood that there is a skills shortage in data science, analytics, and software engineering. This is referred to below.

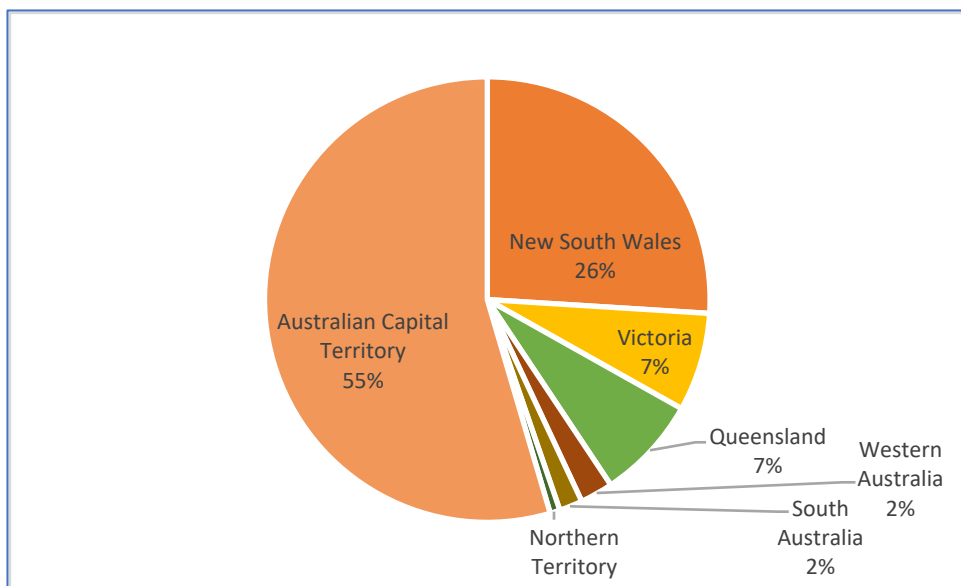
Commencing student data indicate that in 2016, 37 per cent of the 16,543 students starting at ACT Universities were permanent residents of the ACT. A third were overseas residents, and 17 per cent residents of NSW. This is illustrated in Figure 13 below.

Figure 13: Commencements at ACT Universities - Permanent Residence



Data indicate that of the 9,868 resident ACT commencing students in 2016, 55 per cent started at either ANU or UC, 26 per cent enrolled at NSW universities and a further seven per cent at a Victorian university.

Figure 14: ACT Resident Commencements at Australian universities



In other words, ACT commencing students take a broad view of their education options and tend to choose the institution that most meets their needs. The ACT located universities meet only just over a half of commencing student requirements. While more detailed information is not available, anecdotal evidence suggests that ACT students tend to study architecture, engineering and design oriented courses at interstate universities (Universities of Sydney, NSW, RMIT, for example) where there is only

⁵⁶ Including, but not limited to: mobile internet, cloud technology, IoT, advanced robotics, AVs, automation of knowledge work (relevant for the APS), next generation genomics (including synthetic biology), energy storage, 3D printing, advanced materials, and renewables.

a small capability in the ACT. It is important to note that commencing students covers not only school leavers but also on-line and mature age students, including those who wish to upgrade and extend their knowledge and skills through Masters degrees and post graduate Diplomas, and Certificates. This has been a growing market, and is highly competitive across institutions.

In the competitive higher education market both ACT and interstate universities will weigh up their options to deliver more courses in these areas in the ACT.

Necessarily, decisions will involve considerations of cost, risk and return.

The Canberra Institute of Technology (CIT) has a strong focus on technical education, and is strongly industry facing.

5.4 Vocational education and training

Following changes to the CIT Act, and moving responsibility to the ACT Economic development portfolio, CIT courses have become increasingly aligned to ACT innovation and industry objectives. For example:

Innovation and future skills is going to be huge so I think we are heading down that path where trades, working with designers, new products, those sorts of things. Food I think is still pretty big so people wanting an experience so therefore people going out to get those skills to do that. What else is huge? Up skilling for trades, I think is going to become bigger, so that skills set. So we are seeing that in electrical already, so PV training, battery training. I think data analytics is going to grow pretty quickly. And in health, the more aged we get, the more skills we are going to need in that area to address that. I just don't think we really recognize what that is yet.

The Canberra Institute of Technology is strongly industry facing and has been an essential pillar in the Canberra and Region Innovation system

Information on relative growth in enrolments for ACT resident students across the top 20 parent training packages is provided in Attachment 3. The data shows that CIT and CIT Solutions have responded aggressively to a demand for training in Public administration and services (a major growth sector) and in the Creative arts and culture. This has occurred during a time when enrolments in TAFE across the country have been falling. Enrolment data for the top 20 training packages also demonstrates the significance of training for the public sector.

Attachment 3 also demonstrates that there has also been a significant growth in the level of CIT enrolments sourced from NSW. These also reflect a large increase in enrolment in training packages in the Creative arts and Public services. There has also been an increase in take up of Government training packages.

Since the move to the economic development portfolio, CIT has been giving much more attention to engaging with industry:

... a lot of people think CIT has been around for a very long time and therefore we just do the same old thing, it's actually not like that at all. I think if you speak to a lot of industries, especially the newer areas, you'll realize that we're actually changing as quickly as we can, based on the regulatory models that we have in place and we're actually coming up with solutions.

It is also the case that people are no longer going to CIT for course completions. What people are looking for now in education is short, just in time, units of competency that deliver needed skills to get that next job or to get that next promotion.

CIT targets are aligned to the ACT Government industry growth centres, or hubs. The more CIT develops in Cyber security, the more defence people are approaching for help. There are currently 130 people in Cyber, and 800 people in ICT programs. There are 200 trainees with the Commonwealth government

doing ICT programs at CIT. CIT had developed the first Certificate IV in Cyber Security, a Graduate Certificate in Cyber Security and is now rolling out an Advanced Diploma.

CIT leads the way to fix Australia's cyber security skills shortage

Released 05/12/2017

Canberra Institute of Technology (CIT) with Box Hill Institute in Victoria will lead a new strategy to address the shortage of cyber security personnel in Australia by partnering with other vocational education providers across the country to develop work ready graduates with much-needed technical skills.

This new One TAFE approach, announced today in Victoria, will promote cyber security training by combining national vocational education resources, and set a benchmark for other industries experiencing skills shortages.

"With over 11,000 cyber security jobs required to be filled by 2020, we have a great opportunity to lead the way and work collaboratively to address this skills shortage right here in Canberra," Minister for Higher Education, Training and Research Meegan Fitzharris said.

"CIT is part of an exciting new collaboration with TAFEs across Australia working to create a national standardised cyber security training solution.

"Through this partnership the TAFE network will share training resources, programs and the strengths of teachers and facilities across the country to ensure we have a coordinated approach to training cyber security experts across Australia."

AustCyber (the Australian Cyber Security Growth Network) and Special Adviser to the Prime Minister on Cyber Security Alistair MacGibbon, have strongly advocated for a single, standardised set of training nationally.

"Here in Canberra we have the opportunity to demonstrate our ability to lead this effort. The ACT Government is committed to increasing the number and quality of cyber security specialists both here in Canberra and across the country.

"The vocational education sector here in Canberra is innovative and has the ability to work closely with industry to address skills shortages.

"Ultimately this new approach will ensure students have the opportunity to work and study so they can move into these jobs of the future sooner, helping to address this looming skills shortage.

"If you've ever wondered what a career as a cyber security expert would look like, now is a great time to find out," said Minister Fitzharris.

CIT is a member of the Canberra Node of the Australian Growth Center for Cyber Security and has been driving cyber security skills delivery in the ACT and region for two years.

CIT delivers a nationally accredited Graduate Certificate of Networking and Cyber Security (10198NAT) that was developed with Industry in 2015. Under the One TAFE partnership, CIT will also deliver the Box Hill Institute Certificate IV in Cyber Security and Advanced Diploma in Cyber Security to ensure students are getting the technical skills industry requires. These programs were developed with funding support from the Victorian Government and were developed in close partnership with industry.

http://www.cmd.act.gov.au/open_government/inform/act_government_media_releases/meegan-fitzharris-mla-media-releases/2017/act-leads-the-way-to-fix-australias-cyber-security-skills-shortage

UNSW is also involved in the delivery of cyber security education and training.

Interestingly, CIT doesn't do anything specifically in the Space industry, but is heavily involved in precision engineering, a critical capability for the space sector. One of the most specialised space instrument companies in Australia is based in Queanbeyan and all of their apprentices go to CIT. It is an important contribution that is not being generally acknowledged. CEA technologies has, at any one time approximately 17 apprentices at CIT.

In the spatial sector, CIT has a strong capability in radar systems and GIS training.

... it's absolutely amazing and when I start to look at space innovation and the space industries, one of the ANU guys said to me, we need to talk to you about our engineers doing some of your training.

This reflects a commitment at CIT and the universities to build collaboration between 'academic' learning and 'occupational' learning that the review of higher education highlighted 10 years ago (Bradley et al., 2008). Over the last three years, the CIT has been devoting a great deal of effort to building collaborations with the universities in delivering training components. These cover:

- Working with ANU in their growth sectors, currently cyber security and agriculture, but also looking to other areas, and in pathways programs in the arts and design, and potentially engineering. CIT can offer training in areas such as CNC machining, 3D printing, and injection moulding that add value to academic programs.
- With UNSW, it's cyber security, but it will probably also cover space industries as well.
- With UC the first two years of the advanced diploma has always been the first two years of the UC degree for interior design, and a similar pathway articulation for graphic design⁵⁷. Health and children's services

⁵⁷ The arrangement had been in place for 20 years. But "a couple of years back, UC decided to go out on their own and drop us from that and it was probably a mistake because the of has maintained its contact with CIT interior design in those areas. We still have students who go onto UC though, but it's not as big as it used to be".

are probably the two biggest pathway areas, and many people will do a pathway through fitness, massage and into physiotherapy.

- With Charles Sturt University there are ICT graphic design and cyber security pathways.
- There are pathways with ACU in Health.

These links are not readily visible as, it was observed during consultation, people who graduate from university don't really talk about where they had been before they commenced at university. But the pathways to universities are one of CIT's 'biggest sellers'. It was also observed that if Commonwealth supported places at universities are declining, universities will want to strengthen pathways again. With the introduction of the demand driven system, "universities were motivated to get as many people as possible, and they didn't really need pathways".

There has been a strong collaboration between CIT, UC and AFP in Forensic Science for many years as the [National Forensic Science College](#). CIT and the Academy for Interactive Entertainment have been collaborating for almost 20 years. CIT currently offers Bachelors degrees in Animation in collaboration with Academy for Interactive Entertainment.

Bachelor of Games and Virtual Worlds

The Bachelor of Games and Virtual Worlds (Programming) is a three year Degree delivered in partnership with Canberra Institute of Technology (CIT). The degree is designed to produce graduates for the simulation, virtual worlds and games industries and provide professional game programmers with the skills and knowledge of a computer science degree contextualised by gaming applications, plus core skills in programming and design.

This degree will provide you with specialist skills in digital game/simulation design and programming. You will create 2D and 3D interactive applications for entertainment and serious, real life scenario visualisation (virtual worlds). You will also learn how to research the market, develop business concepts and manage digital game/ simulation development projects. You could end up working as a 3D Games Programmer or Simulation Software Engineer — building interactive virtual worlds for real-world training and research!

The degree is jointly delivered online by CIT and face-to-face in AIE Campuses.

http://www.aie.edu.au/courses/game_programming/bach_of_games.html

There are 200 students enrolled in the degree. The importance of the animation, simulation, and gaming industry to Canberra often goes unremarked. It also provides an example of the interaction of technology and creativity.

Ten years ago there was pressure for an amalgamation between UC and CIT. It was canvassed in the Hawke Governance Review (Hawke, 2011) and was strongly advocated by the University of Canberra in 2011 as well. The current level of collaboration between CIT and all universities, and the commitment to innovation and business development, would make such advocacy redundant.

The NCVER data also show that school providers strong in ICT and business services, at the Certificate I and II levels. Private providers strong in community services, business services, tourism, construction, plumbing, & integrated framework, property services, sport. Total enrolments amounted to 16, 940 in 2016, mostly in Certificates I and II. The Certificate IV in Building and Construction, provided by the MBA, was strongly supported.

5.5 Other sources of talent

5.5.1 The Australian Public Service and the Defence Establishment

Australian public service personnel are generally highly educated and transfer well to business as advisers. Public service cutbacks and staff ceilings have created many opportunities for knowledgeable and skilled people to start new careers.

It has been remarked upon quite frequently that former military personnel bring exceptionally well developed leadership capabilities into business contexts. This is illustrated in the case of Aspen Medical and CEA technologies. Glen Keys commented in an interview:

I'll tell you who's great at [leadership] who we completely ignore is the military. The military is very, very good, they train some of the best leaders and they deliberately say you have two years in this job or three years in this job, now we need to put you in that job. Now you haven't done a personnel job yet, we need to get you into personnel, right? So we did that. I genuinely think most businesses are terrible at training, are really bad at training. The military is brilliant at training, public service is very good at training. I'm not saying they do all the right training ...

5.5.2 The professional services firms

The architecture, engineering, finance, legal, and technology firms recruit highly qualified and skilled personnel, not only locally, but also nationally and internationally. The 'Canberra only' focus of the professional firms has changed considerably over the last 20 years, with many now managed as integrated national practices, with 'Government Services' and ICT as strategic specialisations. They also run their own professional development programs.

Lawyers, tax, finance and IP professionals play a key role in the startup ecosystem.

National and global firms see advantages for their staff in a Canberra and Capital Region location. Location facilitates contact, development of networks, and social capital.

5.5.3 Specialised creative firms

The last 20 years has seen a substantial growth in the number of small specialised communication, design, media and public relations businesses. They have grown in response to demand for services as communication becomes more strategic for government and private businesses.

Many have been started by University and CIT students after graduating – or even before. These businesses are important for startup ecosystem as startups tend to 'outsource everything' - mostly to local firms.

5.5.4 Skilled migration

The ACT Government has been well focused on managing the skilled migration program through its various interventions.

5.5.5 International education

Tertiary education institutions and the ACT government have a strong focus on international education as a driver of economic growth. From an innovation perspective, profits from international student fees help finance innovation investments by universities in research and innovation facilitates. International students do not contribute substantially to the innovation system, (Clark & Moonen, 2018), particularly if course delivery is in-country or on-line.

On-campus international students may participate on innovation events and participate in work-based learning. But their contribution to talent is likely to be greatest through Alumni contacts and Chapters after they return home (reference and referrals to Australian innovation capability) and successful applications for permanent residency.

A high priority for international education should be to establish and maintain international student Alumni networks

It is also the case that many Canberra residents study overseas and return with skills, knowledge and experience that adds substantially to talent.

5.6 Skills and talent gaps

The ACT Government publishes annually a Skills Needs List in relation to sought after technical qualifications.⁵⁸ The 2018 List identifies skills needs and qualifications in the following categories as set out in Table 8.

Table 8: ACT Skills needs by industry and occupation

Industry Sector	Occupation
Agriculture, Horticulture and Conservation and Land Management	Gardeners, Greenkeepers

⁵⁸ http://www.cmd.act.gov.au/enterprise-canberra2/skillscanberra/industry_and_community_consultation/act-skills-needs-list

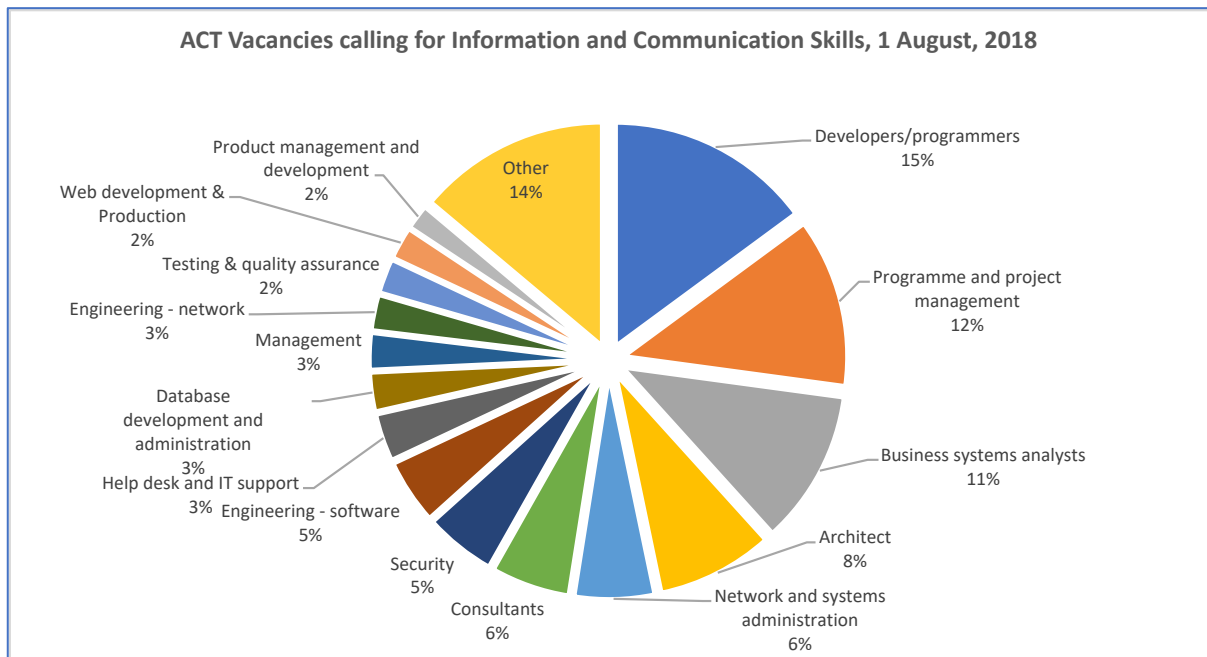
Industry Sector	Occupation
Automotive Services	Automotive Electricians, Motor Mechanics, Vehicle Painters
Business and Financial Services	Contract, Program and Project Administrators, General Clerks, Office Managers
Community services	Aged and Disabled Carers, Child Carers, Counsellors, Education Aides, Health and Welfare Services Managers, Nursing Support and Personal Care Workers, Welfare Support Workers
Construction, Plumbing and Services	Architectural, Building and Surveying Technicians, Bricklayers and Stonemasons, Cabinetmakers, Carpenters and Joiners, Construction Managers, Floor Finishers, Painting Trades Workers, Plasterers, Plumbers
Creative Arts and Culture	Performing Arts Technicians
Electricity Supply	Electricians
Electrotechnology	Air conditioning and Refrigeration Mechanics, Electricians, Electronics Trades Workers
Hair and Beauty	Beauty Therapists, Hairdressers
Health	Enrolled and Mothercraft Nurses, Medical Technicians, Nursing Support and Personal Care Workers, Other Health Diagnostic and Promotion Professionals, Other Miscellaneous Clerical and Administrative Workers
Information Communications and Integrated Telecommunications	Computer Network Professionals, Database and Systems Administrators, and ICT Security Specialists, Electronics Trades Workers, ICT Support Technicians, Multimedia Specialists and Web Developers, Software and Applications Programmers, Telecommunications Technical Specialists
Laboratory Operations	Science Technicians
Metal, Engineering and Manufacturing	Other Building and Engineering Technicians, Sheetmetal Trades Workers
Property services	Architectural, Building and Surveying Technicians, Real Estate Sales Agents, Security Officers and Guards
Public Safety	Fire and Emergency Workers
Public Sector	Contract, Program and Project Administrators
Resources and Infrastructure	Architectural, Building and Surveying Technicians, Earthmoving Plant Operators
Tourism, Travel and Hospitality	Bakers and Pastrycooks, Chefs, Cooks, General Clerks, Hospitality Workers nfd, Other Hospitality, Retail and Service Managers
Transmission, Distribution and Rail Sector	Electrical Distribution Trades Workers
Transport and Logistics	Railway Track Workers, Travel Attendants, Truck Drivers

Source: http://www.cmd.act.gov.au/enterprise-canberra2/skillscanberra/industry_and_community_consultation/act-skills-needs-list

Table 8 does not cover skill needs in relation to academic/university qualifications. However, it is clear that there is a demand for technical qualifications in Business and financial services, Community services, Construction, plumbing and services, Health, and in particular, Information communications and integrated telecommunications

Data from seek.com indicate a substantial demand for people with digital skills. As at 1 August, the demand for skills in information and communication technology amounted to 1282 persons. The composition of this demand, according to occupational; categories, is illustrated in Figure 15

Figure 15: ACT Vacancies calling for Information and Communication Skills, 1 August, 2018 (n=1282)



Other includes: Engineering – hardware; Sales – pre and post; Technical writing; Team leaders; Telecommunications; Computer operators

Source: Seek.com

ICT records the highest number of vacancies in the ACT. Other categories with high demand are Government & defence (452); Healthcare & medical (295); Trades and services (404). There were 109 vacancies that specified 'social media'; 107 jobs for engineers, 226 for marketing and communications, 38 for public relations, and 174 for 'public policy'.

5.7 Concluding comment

Notwithstanding the strengths and uniqueness of the Canberra and Region talent development system, there are some gaps.

- Education and training in ICT lags demand, particularly for systems architects, systems analysts, developers and programmers, and program and project managers
- There is a very weak built environment teaching and research program at universities. This should be a matter of concern given Canberra's continuing development focus. There is scope for scale up in combination with CIT, private RTOs and other universities. UNSW has particular strengths in this area.

6 Economic Governance

This Section examines the evolution of ACT economic governance over the 20 year period to 2018. The political leadership over the period has been as follows.

Chief Minister	Start	End	Affiliation
Carnell, Kate	March 1995	October 2000	Liberal Party
Humphries, Gary	October 2000	November 2001	Liberal Party
Stanhope, Jon	November 2001	May 2011	Australian Labor Party
Gallagher, Katy	May 2011	December 2014	Australian Labor Party
Barr, Andrew	December 2014	ongoing	Australian Labor Party

6.1 Policy Statements and strategies

The ACT Government's approach to economic governance has been reflected in a series of innovation, industry/business development, statements, strategies, announcements and related reviews over 20 years. There has been a number of major economic and industry development state,ets, which are canvassed below.

6.1.1 The 2003 Economic White Paper

The 2003 *Economic White Paper* (ACT Government, 2003) set out a vision for Canberra and a close connection with the Canberra Spatial Plan (ACT Government, 2004) and a Canberra Social Plan.

The Economic White Paper: Minister's Foreword
<p>The Government has a clear vision for Canberra. We see a strong city and community, confident and prosperous, and asserting its place in the country's affairs.</p> <p>Our plans to achieve this vision have been laid down in three important strategy documents - the Economic White Paper, the Canberra Spatial Plan and the Social Plan. Their coming together in the overarching Canberra Plan will provide a strategic framework to create a sustainable future for Canberra and the ACT Region.</p> <p>The Economic White Paper, presented here, outlines an economic and industry policy framework to achieve sustainable growth and development. A core theme of the Economic White Paper is the need to harness the region's many assets and be a little more clever and strategic in the way we work together.</p> <p>The Economic White Paper is also a strategy about building from within, looking to the firms, industries and institutions that have already committed to the ACT and working with them to grow and develop our economy, city and region.</p> <p>At the policy level we will do this by:</p> <ul style="list-style-type: none"> • being unashamedly pro-business and committed to actions that will make the ACT the premier business friendly location in Australia; • knowing our strengths, opportunities and weaknesses and being judicious about how we apply community resources to industry and business development; • building Canberra's intellectual assets and related skills base and establishing better links between our world-class research institutions and the entrepreneurs; and • providing supportive planning and highly competitive infrastructure - the aim is to not only provide the hard infrastructure investments that any modern economy needs, but to give Canberra the look and feel of a vibrant and dynamic 21st century city. <p>The Economic White Paper re-states the interdependence of the three Plans and the underlying principles of sustainable development and prosperity for all. However, the Economic White Paper is about creating a highly productive and competitive regional economy and recognising that growth, properly managed, is the foundation of superior social and community outcomes. We also recognise the currency of our community is secure jobs.</p> <p>In this document, we deliver the economic policy foundation that will underpin the Government's broader vision for Canberra. Making it happen will, of course, depend on the actions and responses of our citizens, businesses and institutions.</p> <p>Ted Quinlan MLA, Minister for Economic Development, Business and Tourism</p>

In June 2006 the Chief Minister commissioned a *Strategic and Functional Review of ACT Public Sector and Services* (the Functional Review) to review the outlook for the ACT Budget, to benchmark government expenditure against other jurisdictions and to identify options to improve efficiency through more effective government structures. The Review was also tasked with making recommendations for reducing expenditure or increasing non-taxation revenues.

The Review highlighted "longstanding systemic weaknesses in ACT finances - namely that the ACT has long sustained public spending at well above State/Territory averages and has in turn relied largely upon land based revenues to support this higher spending". The over reliance on land sales was seen to make the ACT vulnerable to the fluctuations in the property market and cannot be sustained.

The Government announced that it would direct “business support to areas where it will have greatest impact – providing information and advice to small and micro businesses and making the ACT an even more attractive place in which to do business”.

The Government said that it would focus on providing support to business through simpler, clearer and more efficient government structures, scaled to the realities and potential of Canberra as a small city-state. This meant abolishing the Department of Economic Development and formation of a new delivery arrangement.

In 2007 the Government commissioned a study of the ACT Innovation System. The Report, *Innovation, Creativity and Leadership* (Howard Partners, 2008) gave a focus to the connection between science and technology and art, design and creative practice and payed up the importance of networks and informal leadership connections. The recommendations included ACT Government support an annual Canberra Exhibition that showcases, celebrates and markets ACT innovation capability across the science, technology, and the cultural and creative sectors.

6.1.2 Capital Development, 2008

The 2003 *Economic White Paper* was followed five years later with an economic statement, *Capital Development* (ACT Government, 2008b). It was informed by the outcome of an *ACT 2020 Summit* in April 2008, attended by approximately 300 people, including local and federal Members of Parliament, public servants, and members of community and interest groups (ACT Government, 2008a). The key themes emerging from the discussion at the Summit were reported in the following way:

1. Canberra will be characterised by a culture of active citizenry that is enabled by social inclusiveness
2. Building on the resources we have in our educational and other institutions, Canberra will be recognised as a city of excellence and innovation
3. Canberra will have strong links to other communities internationally, nationally and regionally, which will be enhanced by a modern transport system
4. Planning and design will be future focussed and based on principles of sustainability
5. It will be easy for all community members to participate and make informed choices
6. Through increased engagement and connectedness among residents, there will be fewer ‘lost’ or disconnected people.

Capital Development was accompanied by a number of supporting plans including a new version of the *Canberra Plan* and an *Infrastructure Plan* (ACT Government, 2008c). Reference was made extensive progress and achievements in the 2003 *Economic White Paper*. The Chief Minister’s Foreword which is broad in its orientation, is reproduced below.

Capital Development, 2008: Chief Minister's Foreword

A strong and growing ACT economy is a priority for the ACT Government and at the heart of achieving our vision for Canberra as a prosperous, healthy and connected city.

The ACT Government's economic record over the past five years is enviable. We have delivered on the strategies and initiatives of the 2003 *Economic White Paper*. We have responsibly managed the ACT's budget, while maintaining high-quality services and increasing our investment in education, health and infrastructure to record high levels. We have responded decisively to challenges such as water security, skills shortages and housing affordability.

These policies have supported the great success of the ACT economy—an economy that today delivers the highest average incomes and lowest unemployment levels to the best educated community in Australia.

The record is outstanding, but the Government is determined to remain responsive to new challenges and opportunities. Among these are uncertain levels of Federal Government spending and climate change, along with opportunities created by a new era of intergovernmental cooperation and a growing international economy.

As we approach the centenary of Canberra, it is appropriate to assess the economic achievements of the last five years, and to recalibrate our economic priorities to secure our continued prosperity over the coming years.

This document, *Capital Development: Towards Our Second Century*, is the ACT Government's response to these new challenges and opportunities. It is grounded in the Government's belief in a strong and resilient economy and a sustainable, fair and prosperous future for all Canberrans.

Capital Development is a plan for a rapidly changing economic environment. It refocuses our economic policies to ensure the ACT is well-placed to respond to both challenges and opportunities. It sets out a flexible policy framework that will allow economic policies to be flexible and adaptable to future challenges and opportunities.

The strengths of the ACT economy are its skilled and motivated workforce, and its flexible and enterprising business sector. The Government's role is to enable economic activity—to create an environment that attracts and retains skilled workers and investment, and allows both employees and business owners to drive economic growth and development.

Capital Development recommitments the ACT Government to responsible fiscal management and high-quality service delivery, to appropriate regulation and to sustainable development. These are the basics that help create the macroeconomic conditions that support business and consumer confidence and put us on the path of sustained development. Capital Development also reaffirms our commitment to working with the broader region to increase economic activity and opportunity.

Three strategic themes will guide the ACT Government's economic policies in the coming years. The Government will *invest in people*—to increase the capacity, flexibility and efficiency of the ACT economy. We will *encourage innovation*—to help business create a more competitive and dynamic business sector. And we will *build infrastructure* and plan for future infrastructure—to support and coordinate economic activity.

Capital Development is a plan to increase the attractiveness of Canberra as a place to live and work, invest and do business. The ACT Government's investments in education, health, family services, an integrated transport system, affordable housing and sustainable living are delivering a city that is an even better place to live, work and raise children. And our commitment to responsible financial management, business-friendly regulation and taxation, encouraging innovation and deepening our skills base is creating an environment that attracts investment and allows businesses to thrive.

Capital Development reflects our vision of Canberra as a place where businesses can prosper, and where people will choose to live and work and where their children will want to do the same. It is a plan to meet the challenges and make the most of the opportunities before us or just around the corner. It is a plan to secure and share the prosperity of the ACT economy into the future. I commend this plan to the people of Canberra.

Jon Stanhope, Chief Minister

The vision for *The Canberra Plan: Towards Our Second Century* embraced the concept of social inclusion and sustainability.

Canberra will be recognised throughout the world as a truly sustainable and creative city; as a community that is socially inclusive—acknowledging and supporting those who are vulnerable and in need and enabling all to reach their full potential; as a centre of economic growth and innovation; as the proud capital of the nation and home of its pre-eminent cultural institutions; and as a place of great natural beauty.

The Plan articulated the vision through “seven strategic themes that reflect the ACT Government's priorities”:

- quality health care
- a fair and safe community
- excellent education, quality teaching and skills development
- a strong, dynamic economy
- a vibrant city and great neighbourhoods
- a sustainable future
- high-quality services.

There were a large number of plans, strategies and reviews produced between 2011-2012 covering a range of policy areas. Many of these are quite lengthy and well thought out documents, and some make reference to innovation. The documents do not appear to have been updated, although there have been many policy announcements in the domains in the ensuing years.

6.1.3 Growth. Diversification. Jobs, 2012

A new economic and business development strategy, *Growth. Diversification. Jobs* (ACT Government, 2012b) was released five years after *Capital Development*. It followed a comprehensive report, *Governing the City State*, carried out by former Commonwealth Department Head Dr Allan Hawke (Hawke, 2011).

Growth. Diversification. Jobs has a strong emphasis on economic development, but with less on skills development and infrastructure. It acknowledges the city's foundations of creativity and connectedness, but is not as 'overarching' as the previous economic and business strategy documents.

Growth. Diversification, Jobs: Message from the Chief Minister

As Canberra enters its second century we want to start a new chapter in our ongoing journey for economic sustainability. Our economy is about our people, our knowledge, our assets and how we grow by enabling innovation.

Our economy will grow as we diversify our private sector base and this in turn will create new jobs. In short, the overall goal of this Business Development Strategy is growth, diversification and jobs.

We are going to achieve this by:

- fostering the right business environment;
- supporting business investment; and
- accelerating business innovation.

In the language of business, Canberra's competitive advantage and distinctive capability stems from its function as Australia's national capital. It occupies a unique place in Australia and in the world. The city is a national icon and major visitor destination. It gets attention as the centre of Australian public policy-making and for its leadership in the formation of Australian public opinion.

The ACT Government places a high priority on market based policies and actions to broaden employment, and increase business and economic performance. We recognise the crucial role of the Commonwealth in our economy, but equally see the private sector as a key influencer and shaper of a dynamic and robust economy that provides a diversity of job opportunities.

Strong partnerships between government, business, education institutions and the region will position us to take advantage of our strengths and build on our capabilities.

In particular, clean economic development offers major opportunities for business development in relation to the creation of industries to meet new market demands. The ACT Business Development Strategy links in with our sustainability vision and provides leadership and support for the development, application and use of clean technologies in energy, transport and urban design.

This strategy refocuses the ACT Government's business development initiatives for the next four years. Importantly it builds on the successful policy and program foundations that have been put in place this Century.

Canberra's creativity and connectedness – together with our commitment to clean technologies – provides a strong foundation to build a dynamic private sector economy. Our aim is to harness knowledge to drive innovation and business growth, to ensure our business community is highly collaborative, connected and sustainable, and to make Canberra a preferred location for businesses to operate.

Andrew Barr, MLA Minister for Economic Development

April 2012

In 2012 the Government released an *ACT Planning Strategy: Planning for a Sustainable City*. The Strategy set out a planning vision (ACT Government, 2012a):

Canberra will be recognised throughout the world as a truly sustainable and creative city; as a community that is socially inclusive –acknowledging and supporting those who are vulnerable and in need and enabling all to reach their full potential; as a centre of economic growth and innovation; as the proud capital of the nation and home of its preeminent cultural institutions; and as a place of great natural beauty.

The five strategic outcomes were intended to reinforce the Canberra Plan vision and the community's vision for Canberra in 2030.

- Outcome A: In 2030 Canberra will be a city that makes it easy for people to make more sustainable living choices and has the resourcefulness and capacity to manage change.
- Outcome B: In 2030 Canberra will be a city where everyone can take advantage of its network of centres, open spaces and modes of travel to enjoy a sense of wellbeing and participate in a vibrant civic and cultural life.
- Outcome C: In 2030 Canberra will be at the centre of an innovative, prosperous region that has established a diverse 'clean' economy and has a wide choice in jobs and lifestyles.
- Outcome D: In 2030 Canberra will be the 'capital in the bush' recognised for the quality of its public places and buildings that reflect its unique climate, character and identity.
- Outcome E: In 2030 Canberra will be at the centre of a region that demonstrates the benefits of good stewardship of the land, its resources and the beauty of its rivers, mountains and plains.

In 2012 the Government announced a new program, *Global Connect*, as a single program interface, for the various trade development related activities it supported. These covered

- a competitive grants program providing funding to emerging Canberra exporters to support certain trade development activities;
- the ACT Exporters' Network which provides private sector leadership promoting exporting in a unique forum for new and experienced exporting companies to network, share knowledge and expand their export activities;
- the Trade Mission Program, an annual outbound ministerial-led mission providing companies with soft landing support in new markets;
- the ACT Chief Minister's Export Awards, which recognise 'excellence in export performance and feed into the National Export Awards. It provides ACT finalists with a prestigious reference to expand international markets;
- the Exporting Government Solutions Centre of Excellence, which will provide resources and expert mentoring to SMEs with a demonstrated capability of delivering innovative solutions to the Australian public sector to access international markets;
- the delivery of the Government-Industry Education Exports Strategy; and
- the ACT International Student Ambassador Program, which aims to leverage the international student experience of Canberra as both an international education marketing tool and as a skills network that can link to the ACT economy

In 2013 the Government introduced the *Invest Canberra* Initiative and in the following year announced a Digital City Action Plan.

Digital Canberra: A Leading Digital City Action Plan 2014-2018. Chief Minister's Introduction

Canberra is a city full of early adopters of new technology, innovators and entrepreneurs.

Developed in consultation with industry and the community, the Digital Canberra Action Plan 2014-2018 will be our roadmap for how we lead, inspire and collaborate in identifying, testing and implementing ideas and solutions that take advantage of digital opportunities.

I see a Digital Canberra as a city that:

- connects people, information and business to foster innovation, partnerships and creativity;
- identifies opportunities for business to optimise the use of digital technology, creating jobs, boosting key industries and attracting new businesses; and
- has a government that designs faster, more efficient digital services that enhance citizens' quality of life and social inclusion and makes it easier to do business with a more open government.

The Digital Canberra Action Plan provides a platform for identifying and promoting how business, the community and the government can diversify the digital economy and deliver more efficient, faster services.

The Action Plan focuses our efforts on accelerating the digital revolution around five key areas:

- Smart City – enhancing our sense of place and access via free public Wi-Fi, digital arts, a vibrant CBD and digital spaces.
- Digital Economy – accelerating our digital economy to strengthen the workforce, boost productivity, build ICT capacity and facilitate collaboration.
- Connected Community – new ways of engaging with democracy and participating in civil society through social media, more flexible working arrangements and social inclusion.
- Open Government – unleashing the economic power of big data, transforming health and education services, delivering information how people want it.
- Digital Services – faster more efficient digital services, delivered to citizens as they live, work, learn and play, improving efficiency and creating a digital government.

The next step is to share information, facilitate and encourage new partnerships and collaboration across sectors, and build on these ideas.

Canberra's digital vision is to promote Canberra as a modern, dynamic, digital city.

Katy Gallagher, Chief Minister, March 2014

http://www.cmd.act.gov.au/_data/assets/pdf_file/0006/565566/digcbractionplan_print.pdf

6.1.4 Confident & Business Ready, 2015

The themes of *Growth. Diversification. Jobs* were reinforced three years later with *the ACT Business Development Strategy 2015: Confident and Business Ready, Building on our Strengths* (ACT Government, 2015b). As the title suggests, it has a very strong business development message. The Chief Minister's introduction is reproduced below.

Confident and Business Ready: Chief Minister's Message

A strong and sustainable economy is essential for us to meet the needs of the Canberra community now and into the future. We know that our economy will grow as we are diversifying our private sector and that this in turn will create new jobs. That's why the ACT Government is focussed on continuing to create the right business environment and using our competitive strengths to accelerate innovation and investment.

Through this renewed strategy, we will build on the effective approaches we have pursued over the last three years to support investment, accelerate innovation and create and keep jobs here in the ACT. We will also continue to work with our business community and university sector to create a city with its own distinct economic identity for the future.

Earlier this year I reported to the ACT Legislative Assembly that we had successfully implemented all 26 actions of the 2012 strategy, *Growth, Diversification and Jobs*. In particular, I highlighted the following key achievements:

- the creation of the CBR Innovation Network External Link - opens in new window – a first for Australia, bringing together five nationally and internationally renowned higher education and research institutions to work with the ACT Government to grow Canberra's innovation ecosystem;
- the establishment of Invest Canberra External Link - opens in new window – to lead the ACT Government's international promotion initiatives and develop international networks and partnerships; and
- the launch of Brand Canberra External Link - opens in new window (the CBR brand) – to support business and promote Canberra as Confident, Bold and Ready.

Growth, Diversification and Jobs also played a role in driving broader policy directions across government in relation to enterprise and the digital economy, transformation in services and access to the Government. This can be seen in major Government initiatives, such as Access Canberra, iConnect and the Digital Canberra Action Plan.

This strategy builds on my vision for a strong economy by:

- creating the right business environment;
- accelerating innovation to create wealth and jobs; and
- supporting business investment in future growth areas.

Strong partnerships between the Government, our business community, our world-class education institutions and the region is also a major focus of this strategy because it is these partnerships that are helping make Canberra a truly international city and knowledge economy. The Government recognises that thriving and porous campuses create opportunities for collaboration, commercialisation, and business creation.

We recognise that we need to work closely with organisations like the Canberra Business Chamber and the CBR Innovation Network to shape and build support for the directions we collectively need to pursue, and we also need to work together with our nearby regional neighbours to shape a compelling and inclusive economic value proposition.

Canberra's creativity and connectedness provides a strong foundation for a dynamic business sector and economy. By working together with a shared vision we will continue to ensure Canberra is a preferred location for businesses to operate as we build a strong and diversified Canberra economy for the future.

Andrew Barr MLA, Chief Minister, May 2015

https://www.business.act.gov.au/resources_and_networks/business_development_strategy

In May 2015 the ACT Government released a *Renewable Energy Industry Development Strategy* (ACT Government, 2015c). The strategy is based on a partnership between the ACT Government and key stakeholders including SERREE Industry Cluster, the ANU Energy Change Institute, CIT, ACTEWAGL Distribution, and the innovation community.

The Strategy identified the following priorities for local industry development:

1. Deliver enduring benefits to local businesses through the inclusion of regional contractors and labour force.
2. Build Canberra's capacity as a national tertiary education and trades' skills hub.
3. Stimulate productive research partnerships that will develop the capacity and global recognition of our tertiary institutions.
4. Grow the local corporate footprint of national and international businesses.

The strategy provided \$1.2 million for a Renewable Energy Innovation Fund, which was developed as part of the ACT Government's 200MW wind auction. The Strategy consisted of 14 initial actions to be completed by 2016. A review of the strategy, foreshadowed for 2016 would determine the scope and timing of future actions.

A window of opportunity exists to grow our vibrant renewable energy industry in the ACT. This reflects the timescales of the ACT's planned investment in renewables and the timing of the South East Region for Renewable Energy Excellence (SERREE) regional renewable energy industry cluster initiative (ACT Government, 2015c).

The strategy review does not appear to be available publicly.

In 2016 the Government, in collaboration with universities and the CIT released an *International Education Strategy* (ACT Government, 2016d). It is essentially a marketing and promotion prospectus to position Canberra as a study destination of choice. There is a consensus view that international education delivers substantial economic benefits to the economy, although quantification is hazardous. "Big numbers" can hide a raft of assumptions and qualifications. There are also investments (costs) required on the supply side (infrastructure, urban services, particularly) that can be overlooked.

In May 2016 the ACT Government released a discussion paper *The High Growth Potential of Australia's Space Economy* (ACT Government, 2016c). The ANU, UNSW and Electro Optic Systems were involved in its preparation. The paper suggests that:

... there is currently an opportunity for Australia to leverage its existing strengths in the space economy to develop the critical mass necessary to gain a larger share of this important and rapidly growing industry. While states and territories can play a role in the development of the industry, it is our view that a truly national industry requires national leadership.

To realise this opportunity, the ACT Government calls on the Commonwealth Government to recognise the space economy as an Industry Growth Centre and to work with all the states and territories to prioritise the development of the sector.

The Australian Space Agency was launched in Canberra on 1 July 2018. The ACT initiative reflects leadership and a positive contribution to build critical mass and build intergovernmental collaboration in this emerging and important industry.

In 2017 the Government released the ACT Defence Industry Strategy, *Established, Capable, Skilled: Growing: The Defence Industry In The Canberra Region* (ACT Government, 2017). An important aspect of the Strategy is the appointment of an *ACT Defence Advocate* (Kate Lundy) and an *ACT Defence Industry Advisory Board* to provide strategic direction to guide the ACT Government's commitment to the defence sector.

The *Commissioner for International Engagement* will also work closely with the many global defence prime contractors already invested in Canberra to attract increased investment and identify new opportunities internationally. It is important to be aware that the Defence Industry is highly competitive between States. For example: in 2016 the Victoria Government released a *Defence Technologies Sector Strategy*⁵⁹; in 2017 the NSW Government released a *Defence and Industry Strategy*⁶⁰; and in June 2018 the Queensland Government released a *Queensland Defence Industries 10 Year Road Map and Action Plan*⁶¹.

Given the competitive environment for Defence Industry attraction, It is absolutely vital that the ACT Government keep its "finger on the pulse".

Cyber security is becoming a rapid growth industry. On 22 July 2018, a leader for a *Financial Times* sponsored conference commented -

Cyber security attacks continue to dominate news headlines. Data breach costs can exceed £4 million. Global cybercrime costs could reach £5 trillion by 2021. As criminals find increasingly innovative ways to bypass software and controls, how can we shift the focus to resilience and active defence? How will interconnected systems be defended and by whom? How can we restore the public's 'crisis of trust'? Where is the line between data capture and privacy? Held under Chatham House rules, this event will highlight government and board-level discussions on how to drive cyber security resilience and compliance across the organisation.

A separate Cyber Security Strategy has not been released. However, action has been underway to address the cyber security skills shortage.

6.1.5 Comment

Since the 2003 and 2008 economic strategies, the approach to innovation and industry development has appeared more tactical, more expansive in terms of coverage of the Capital Region and inclusive of "target" industries (*nine*)⁶². The approach is also more closely connected to research organisation

⁵⁹ https://www.business.vic.gov.au/data/assets/pdf_file/0008/1275479/9778-DEDJTR-IT-VFI-International-Defence-strategy-WEB.pdfThe Victorian Government also developed a Defence Industry Supply Chain Program (VDISCP) that "offers up to \$100,000 to help Victorian Small to Medium Enterprises (SMEs) compete for and win more defence, aerospace or security related work". See <http://www.business.vic.gov.au/support-for-your-business/grants-and-assistance/victorian-defence-industry-supply-chain-program>

⁶⁰ https://www.industry.nsw.gov.au/data/assets/pdf_file/0011/98624/NSW-Strong-smart-and-connected-defence-strategy.pdf

⁶¹ <https://www.statedevelopment.qld.gov.au/resources/plan/defence-industries/defence-industries-roadmap.pdf>

⁶² ACT Investment Attraction Framework: New Frontiers— identifies nine sector/capability priorities that present short, medium and long term priorities. The target industries are not consistent across documents.

agendas. But it is less coherent in terms of an overarching vision of Canberra as a place to run a business, work, learn, live and connect, and for people to feel secure and included.

Since the release of *Confident & Business Ready*, there have been *ten* plans covering the Arts, climate change, international engagement, education exports, investment attraction, higher education collaboration, defence and digital. Across these documents there are literally hundreds of initiatives and actions across agencies with no clear responsibility or accountability for delivery, timeframes, and achieving results in the broader innovation ecosystem – what success will mean, and how results will be monitored.

The approach has had a strong technological orientation, which is consistent with a view that technological advances drives industrial innovation. But practice and experience demonstrates that innovation has a strong creative and socio-cultural dimension. Since 2008, Canberra has not made a strong commitment to a becoming a *creative city*, reflecting the observatories of Richard Florida (Florida, 2002, 2003, 2005) or Charles Landry (Landry, 2006, 2016; Landry & Comedia (Firm), 2000) as a way of stimulating creativity and innovation, or as canvassed in the ACT innovation system study, *Innovation, Creativity and Leadership* in 2008.

Canberra does not celebrate its status as a ‘city of design’ or made a commitment to become a design hub by building teaching, research, innovation and practice capability in human centred design, particularly in relation to the built and socio-cultural environments. This is in contrast to many international cities, including New York, London, Berlin and Venice.

This issue has recently been addressed, however, in the *ACT Arts Policy* (ACT Government, 2015a) and in *Canberra: A Statement of Ambition* (ACT Government & Williams, 2016). Canberra does not feature on indexes of the world’s most creative cities⁶³. Canberra is highly regarded for “liveability”, but this criterion is only one dimension of creative indexes. It is important that the *Statement of Ambition* be further developed and linked to economic, business, environmental and social initiatives (a ‘triple bottom line’). This is addressed further Section 8 below.

There is currently a great deal of emphasis in economic strategy documents on ‘capability’ and ‘creating awareness’ - but much less on creating distinctiveness - what the Canberra and the Capital Region has and others do not, or would find difficult to replicate⁶⁴. These centre around, for example, research excellence commercialisation in specific aspects of the life sciences, defence and cyber security, AgTech and related rural based technologies, and national data – as an asset and source of wealth creation.

There is some effort being applied to making strong capabilities distinctive in other areas, but the investments are often small and tactical, and the competition is tough. In many of these areas more research and analysis would be required, actions taken and investment committed to build distinctiveness.

6.2 Implementation measures

From a public administration perspective, the ACT Government approach to economic governance has been ‘soft touch’, with a strong focus on implementation and delivery rather than the development of high level policy or significant levels of investment.

The period since then has been characterised much more by announcements, actions, and one off commitments.

The implementation focus appears has been driven by limited resource availability and a capacity to link with local business, professional and community networks. The relatively small size of the business ecosystem makes personal contact easier with the follow on capability to build social capital and trust. This has provided a uniqueness not available in large cities such as Sydney or Melbourne.

The Government has been reasonably good at is taking small amounts of money and implemented by engaging with networks and business organisations, such as continuing support for the ACT Exporters Network. Historically, the Canberra Business community has been well engaged with the ACT

⁶³ The most creative cities to “live, work and play” vary according to which index is selected, but variously include: San Francisco; New York; Berlin, London; Paris; Copenhagen, Barcelona, Melbourne, Amsterdam, Portland, Oregon, and Manchester, UK.

⁶⁴ As Singapore has demonstrated, distinctive capabilities can be created – with commitment *and very large* amounts of public investment.

Government through vehicles such as CBC Industry Taskforces. These have engaged and advocated to Government (Territory and Commonwealth) on issues of importance to business and the economy.

Policy development, which involves research, analysis, and options appraisal, provides the basis to create a long term strategic focus, as well as continuity and opportunities for review. Otherwise resources can be misallocated – or wasted – with one ‘one off’ allocations, without consideration to longer term return on investment⁶⁵.

The ACT Government focus on implementation, with a limited emphasis on policy development and analysis, may give rise to a longer term cost. Successful implementation requires a strong evidence based policy foundation.

The implementation focus has tended to give rise to relatively modest and ‘low risk’ interventions in terms of cash commitment – and sometimes thinly spread across a range of recipient and sponsor organisations. The formation of CBRIN changed this dynamic in innovation programs. Nonetheless, small interventions have often brought a ‘seat at the table’ in encouraging collaboration, building and leveraging networks, and preparedness for access to larger Commonwealth funding programs (for example, AusIndustry programs, EMDG, R&D Tax Incentive, Trade Missions).

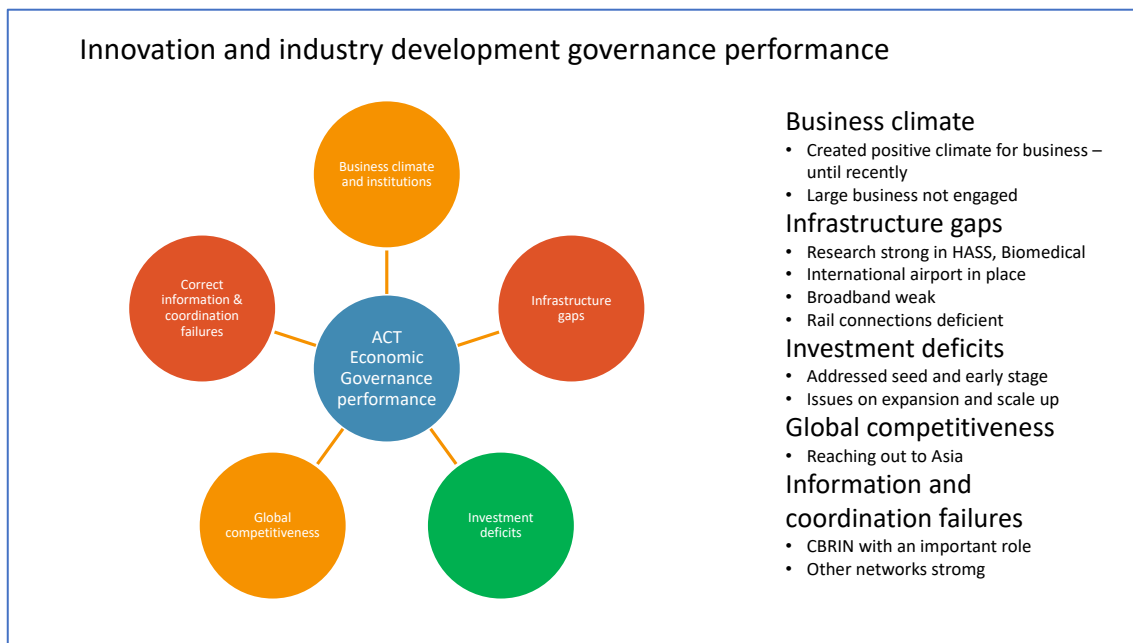
The ACT Government has avoided expenditure on industry attraction strategies – a strategy adopted by other States, with very modest long term success. Businesses are often confronted with a wide range of incentives for location – cash payments, soft loans, and tax concessions, but these may not be the highest ranking on investment location decision criteria.

Access to customers, talent and skills, and research organisations for collaboration, may be more powerful location motivators and lead to the attraction of businesses that make a more impactful contribution to a city. These attributes have been played up strongly in *Confident & Business Ready* and the *International Engagement Strategy* (ACT Government, 2016a).

6.3 Overall assessment summary

An overall assessment based on recent work for the NSW Government by *The Business Of Cities Limited* (Clark & Moonen, 2018) is presented below.

Figure 16: Overview of ACT performance in economic governance



⁶⁵ The return on the substantial investment in NICTA has not been demonstrated.

6.4 Concluding comment

Since 2008 the focus of economic governance has shifted *from economic policy*, covering investment initiatives in capability development, particularly in economic infrastructure⁶⁶, *to business policy*, covering initiatives to encourage and ‘nudge’ business behaviour. In the process, the link between economic policies and broader environment and social policies has become less pronounced. These connections were a feature of the 2003 and 2008 approaches.

Environmental policy appears to have been developed separately and there is an absence of a clear direction relating to innovation in health and social policy. The revival of a commitment to urban renewal will address some of these gaps and encourage connections and a longer term strategic perspective. Foreshadowed investments in cultural infrastructure provides a climate for the attraction and retention of talent.

Business development policies have tended towards an ‘industry sector’ focus, but the current coverage of *nine* priority areas means that policy effort becomes thinly spread and looks disconnected. Many of these sectors will develop through market signals and the business acumen of entrepreneurs without much need for policy intervention⁶⁷. In several areas Government intervention has a strong marketing, promotion and communication focus, with an aim to encourage inward investment. All governments engage in this sort of activity, and the costs are relatively small.

Consultations suggested a focus on *four industry sectors* where there is an opportunity to have a major impact on generating economic outcomes (employment, investment, income growth, and exports):

- *Health and Life Sciences* – substantial capability at JCSMR and UC, generous funding through NH&MRC, MRTF, the Medical Frontiers Project, internationally. Gap in scale up facilities.
- *Defence and Cyber Security* – a substantial growth sector and where ACT and Region has very substantial capability. Many substantial businesses in Canberra are already in this sector and there is an opportunity to further develop commercial capability.
- *Agriculture, AgTech, Genetics*, and related technologies (e.g. Phenomics) – the sector is undergoing transformation and disruption and expectations of growing demand for food and fibre. Canberra and Capital Region is well placed with excellent connections from CSIRO/ANU to other hubs at Wagga Wagga and Orange and as far afield as Armidale.
- *Renewable Energy, Sustainability and a healthy community* – addresses ACT leadership in policies and initiatives in this environmental and social outcomes.
- The adoption and application of enabling and *digital technologies* – essential for lifting performance across all industry sectors.

Other sectors would continue to be regarded as important and would be expected to grow, but would not be the focus of specific policy attention.

It is imperative that there be a balance and reinforcing dynamic between Canberra and Capital Region longer term economic policy and business policy.

The ACT Government has supported the emergence of an active and vibrant startup ecosystem around the tertiary education institutions. As mentioned earlier in the Report a remaining challenge is to ensure that those businesses with potential are able to access risk capital for prototyping and scale up into businesses that are commercially viable and sustainable – and to become large employers and investors in Canberra and the Capital Region.

Innovation policies and strategies can contribute to achievement of not only economic but also environmental and social policies. It is important that these be driven by an overarching ‘purpose’ that bring the stands together to achieve human centred outcomes. This must combine the instrumental, science and technology considerations with the cultural, artistic and creative. This is addressed in the following Section.

⁶⁶ The Canberra Airport development has been a major contribution to economic infrastructure. The Light Rail will also be an important contribution. But much is still to be done in high speed broadband and in an efficient and effective rail link within the Region and to Sydney – as road transport becomes more congested – and dangerous.

⁶⁷ The argument for policy intervention should rest firmly on considerations of market failure, streamlining of business regulation, and developing a seamless interface with government.

7 Issues for Further Consideration

This Section addresses a number of issues that have emerged in preparing the Narrative that may warrant further consideration in developing policy and strategy for economic development and innovation in Canberra and the Capital Region.

7.1 A broader view of innovation - environmental, social, and community outcomes

There is an emerging view that innovation has become contestable and there are large segments of the community that do not have any ownership of the concept. As one observer commented in an interview:

It was apparent that in the 2015 election, there was quite a discernible backlash against if you like, to put it 'charicaturely', the inner-city hipster model of innovation. So, there was an attempt briefly to say, 'Innovation is for all.' And then essentially it slipped off the radar.

It follows that if innovation is to be embraced more broadly, it can no longer just be an 'expert system' approach. Other countries and regions, particularly Europe, have more developed approaches to innovation and have embedded social innovation, creative innovation, and public sector innovation in their Innovation agendas.

Innovation must be seen to have a human and environmental dimension.

Internationally and nationally there is increasing interest in policy balancing disruptive economic growth with inclusive and more sustainable growth strategies, including the concept of the 'circular economy'. This is an approach where resources are kept in use for as long as possible, and action is directed towards extracting the maximum value from them whilst in use, then recovering and regenerating products and materials at the end of each service life.⁶⁸

Over the last 10-15 years the ACT Government has led in innovation around sustainability objectives, particularly in the area of renewable energy.

The OECD has also reported that governments are seeking to spread the benefits of increased prosperity more evenly across the economy and society⁶⁹. Inclusive innovation policies enable low productivity entrepreneurs and firms to boost their economic performance, and lower-income groups to improve their welfare. This means exploring the relationship between innovations aimed at competing on global markets with innovations aimed at securing greater industrial and societal inclusiveness.

Inclusiveness occurs through 'democratisation' (extending participation) and 'distribution' (sharing the benefits more widely). Digital technologies have supported initiatives along both dimensions⁷⁰. Achieving inclusiveness in terms of gender, socio-economic disadvantage, minority groups, and people using English as a second language, should also be an important part of policy discussions and the development of innovation support measures.

Policies on innovation, sustainability, and inclusive growth must be designed in a comprehensive and interconnected way if they are to be effective.

Social and cultural innovations play an important role in the innovation system, and are often overlooked in policy discussion and analysis. Social innovations create new solutions and 'shared

⁶⁸ (European Commission, 2015) and http://www.mckinsey.com/insights/manufacturing/moving_toward_a_circular_economy

⁶⁹ (OECD, 2015a)

⁷⁰ http://www.oecd.org/sti/inno/Symposium%2020-21%20March_Summary_Record.pdf. See also (OECD, 2015b)

value' for society, or groups within society⁷¹. The Mill House initiative, supported by the ACT Government, has been an important contribution to social innovation in Canberra.

Cultural innovations impact on societal beliefs, attitudes and behaviours. Australia has achieved marked success in changing attitudes and behaviours in areas such as multiculturalism, discrimination, biodiversity protection, water and energy use, drink driving and smoking. We can now observe a further process of cultural change in relation to innovation and entrepreneurship as more people embrace the 'startup' economy.

7.2 International engagement – a unique Canberra capability

Canberra is unique among most Australian Capital and regional cities in having an outward looking and international focus as part of its "DNA". Being the national capital, Canberra is the base for several Commonwealth agencies that, by the nature of their business, are globally connected (Defence, Foreign Affairs and Trade, Agriculture and Water Resources, Industry, Innovation and Science, Immigration and Border Protection, for example).

7.2.1 An international innovation hub

This is the history of European city states, and more recently Hong Kong, and currently being played out in Singapore. Since 2008 Canberra has been increasing its connections with Singapore, as well as other national capital cities. There is probably much to learn from these parallels, and it is coming together in the thinking behind the *International Engagement Strategy* (ACT Government, 2016d).

There are 108 diplomatic missions currently in Canberra. Sixty six have developed chancery or residences on designated land and about 40 are currently renting premises. As physical manifestations of the nations they represent, they are also places collect visas, discuss trade and defence – as well as stage protests and show support in times of crisis⁷².

Australia's only National University, established in 1946, was formed with an expectation of strong international connections. The CSIRO, with multiple international connections is also based in Canberra. National collecting institutions are engaged internationally, and interact globally on research and exhibitions.

This international attribute gives Canberra a unique and distinctive capability – a capability that has substantial spillover benefits for business and industry. For businesses to grow and succeed in Canberra, a small city state, it must engage internationally through trade and commerce.

With developments in technology, communication, and media over the last 20 years Canberra is also much more externally engaged socially and culturally. A parochial and inward looking culture has been eroding. However, the 'bush capital' attribute remains valid in terms of Canberra's rich hinterland of mountains, rivers and unique biodiversity.

Aspirations and ambitions for Canberra and the Region must embrace its position in the global geo-political, economic and innovation system.

As Canberra has grown in population and economic activity it has developed a vitality, confidence, and maturity that has moved beyond a parochial and insular culture apparent in the latter years of the last century. This may be associated with the emergence of a vibrant startup ecosystem and continual reinforcement of a culture of private enterprise through celebrating successes.

7.2.2 Southern hemisphere location

Canberra can do more to exploit the often under recognised innovation potential that stems from Australia's unique role as the dominant science power in the Southern Hemisphere (no other nation

⁷¹ (Porter & Kramer, 2006) and <https://www.gsb.stanford.edu/faculty-research/centers-initiatives/csi/defining-social-innovation>

⁷² <http://www.abc.net.au/news/specials/curious-canberra/2017-09-25/how-many-embassies-are-there-in-canberra-and-are-there-rules/8967562>. <http://dfat.gov.au/about-us/foreign-embassies/Pages/foreign-embassies-and-consulates-in-australia.aspx>

matches our status in this regard). Canberra's location in the Southern Hemisphere is also especially important. As the national capital of the developed nation that is pre-eminent in this entire hemisphere of the planet, Canberra has a myriad of advantages.

These advantages stem from the ability to connect and exploit a range of geographically-driven advantages (southern skies for astronomy and aviation, southern oceans and weather systems, Antarctica etc) with public policy. This geographical connectivity between southern hemisphere science and public policy, in turn, can drive novel and distinctive innovation trajectories. Indeed, this has been taking place for several decades on a practical level (e.g. astronomy and oceanography) but has not, arguably, been supported at a strategic level.

The broad range of science involved in southern hemisphere research drive innovation through areas such as technological advances in instrumentation and mapping and modelling complex systems. The rate of advance of the scientific frontiers in the southern hemisphere is defined by the rate of technological progress in the instruments and research facilities that generate the necessary data. Whether this is, at the vertical extremes, in astronomy or in the deepest parts of the southern oceans, these instruments allow phenomena to be measured that could not be measured without these sophisticated instruments.

This measurement capability creates a vibrant set of innovation collaborations between university and public sector research organisation research teams and the business sector – and SMEs in particular. Indeed, these research collaborations can drive startup formation and subsequent growth. This collaborative innovation pathway, in effect, converts a proportion of scientific research funding into innovation support via the need to develop new and improved instrumentation technologies.

This southern hemisphere-based innovation pathway is especially attractive for the ACT because it provides a means of attracting additional inward overseas investment in scientific research (many international funders are interested in southern hemisphere oceans, atmospheric and astronomic processes). This inward international investment in public science can then be converted into additional innovation activity and associated startups via the ACT's scientific instrumentation innovation pathway.

The greater the ACT's participation in global scientific research networks and international collaborative research on southern hemisphere concerns – the greater this potential to *amplify* scientific research funding via inward investment and then to *convert* this augmented funding into innovation and startup activity that would not otherwise occur. This strategy can create a virtuous circle via which past success in closely coupling public science to innovation via advances in instrumentation technologies breeds greater future success through demonstrated outcomes.

Ambitious strategic positioning which leverages the southern hemisphere factor can convert the 'tyranny of distance' from a disadvantage to an advantage.

7.2.3 A Commonwealth innovation strategy for Canberra

To date, the Commonwealth Government has not had a specific development strategy for Canberra – beyond the land use role of the National Capital Authority. As indicated above, Canberra can be an essential element in a broader strategy to use its 'science power of the Southern Hemisphere' locational advantage to position Australia even more strongly as a 'soft power' in international relations and diplomacy.

Department of Foreign Affairs and Trade: Soft Power Review

The 2017 Foreign Policy White Paper committed the Australian Government to conducting a review of the nation's unique soft power strengths and capabilities.

The White Paper defines soft power as the ability to influence the behaviour and thinking of others through the power of attraction and ideas. Soft power assets can include a nation's education institutions, its aid program, its tourism assets and economic strength as well as other elements of national identity such as lifestyle and culture.

DFAT is leading the review, which is a whole-of-government effort to ensure Australia continues to build soft power and exercise influence effectively. The review will consider ways to better leverage Australia's soft power assets and build effective partnerships to advance Australia's security and prosperity.

Australia starts from a position of strength towards the top of global surveys of soft power, but there is always more we can do to strengthen our influence on issues of national importance.

Our region is changing quickly and Australia's ability to build partnerships with other nations and people is becoming increasingly important. Rapid globalisation and technological advances are changing the way influence is exercised. Social media and digital platforms in particular have empowered individuals and non-state actors to shape outcomes on issues of importance to Australia.

In this context, effective diplomacy will require us to consider new ways to engage and a more systematic and sophisticated approach to harnessing our soft power assets.

Scope of the review

The review will explore options for the Government to maximise our soft power, particularly in the Indo-Pacific region. It will do this by:

- exploring the nature of attraction and influence in the changing global context, particularly in the face of rapid globalisation and unprecedented technological change;
- identifying Australia's soft power objectives and Australia's key soft power assets and challenges;
- examining policy options to build and leverage soft power assets to promote Australia's security and prosperity, and strengthen Australia's reputation in an increasingly networked world;
- considering new and more effective partnerships with other governments, the private sector, development partners and civil society, drawing on examples of best practice.

<https://dfat.gov.au/people-to-people/soft-power-review/Pages/soft-power-review.aspx>

Industry and innovation policies aimed at economic and business development, sustainability, and inclusion can address this purpose. Canberra's research, education, and training institutions are already aligned this way, as are established and emerging high growth firms. Commonwealth defence, security, industry, and environmental agencies are engaged internationally. It is a firm basis from which to proceed. The ACT Government is also reaffirming its commitment to engagement with other national capitals.

The Commonwealth Government has made commitments to innovation hubs, maker spaces, and human centred design labs across agencies including Defence, the Department of Foreign Affairs and Trade, the Department of Human Services, and the Department of Industry, Innovation and Science.

It would make a great deal of sense for the Commonwealth Government internal commitment to innovation be connected with the Canberra and Capital Region innovation ecosystem.

During consultation suggestions were made for Canberra and the Commonwealth to launch a 'city deal' investment proposition for an international innovation hub that would build scale across Canberra, the Capital Region, and Commonwealth Government's defence, trade, foreign policy, industry, finance, and income security responsibilities.

A future industry strategy must position Canberra not only as Australia's national capital, but also its "international" capital for globally inter-connected innovation.

7.3 Connecting Art and Science – creativity and the role of cultural institutions

It is now well accepted that art and cultural institutions perform an important role in stimulating creativity and addressing the broader view of innovation referred to at the beginning of this Section. But in Canberra, and in contrast to other national capital cities and, there is only a limited focus on developing the connection between Art, Culture, Science, and Innovation.

Writing in 2006, in *Between a Hard Rock and a Soft Space* (Howard, 2008). It was observed

The contribution of arts and cultural institutions, arts education and arts entrepreneurship in innovation systems is only beginning to be recognised. Cultural institutions have a direct impact in the creative industries, as well as in a broad range of industry segments.

A nation's public cultural institutions, including its libraries, museums, galleries, theatres and archives, have an important role in supporting the creative dimension of innovation. In addition, the nation's universities provide an important public culture dimension through their schools of

visual and performing arts, architecture, design and music, as well as the cultural facilities and collections they own and manage.

Canberra has a very extensive and unique inventory of ‘cultural capital’ that has been accumulated over many years in national museums, libraries, archives, galleries and a small performing arts centre. That cultural capital is a knowledge and creative resource for innovation across all industry segments, including the cultural and creative industries. Missing from the portfolio is a national science and technology museum. Sydney Powerhouse museum is important, but has a State, not a national focus.

Most institutions have well-developed research programs, they require high-quality research to inform the interpretation and presentation of their collections, and they provide an important route for arts and humanities research to be communicated to a wider public. For example, the Australian War Memorial has a highly regarded capability in military history.

In Canberra, the national collecting institutions in the four collecting domains (archives, galleries, libraries and museums) have a major potential impact and influence on the development of the city’s creative and innovative capability. Moreover, national institutions have important international connections that can create a further dimension for innovation. However, the connection could be stronger.

Canberra’s national art and cultural institutions are poorly connected with each other and with the broader innovation ecosystem.

Museums and galleries are not generally included within definitions of “innovation systems” yet they provide a hugely important resource for designers, inventors, scientists and engineers. This reflects their role as ‘knowledge repositories’ in preserving both physical and increasingly digital material. Their role in the innovation system is important on other grounds:

- Cultural organisations create markets for the creative industries through shops inside arts centres and museums, providing retail outlets for craft work and small-scale publishing.
- Publicly funded cultural organisations act as brokers, bringing together practitioners from different sectors and helping to develop networks and practice.
- Publicly funded cultural organisations act as a source of legitimacy for emerging creative talent and for creative industries’ products (designer products are often displayed in galleries and museums, adding to their status as design objects as well as functional items).
- The education programs of galleries, orchestras, theatres and museums help young people learn about different cultural and creative (including technological) forms, generating interest, enthusiasm and eventually a more creative workforce for the future.
- Arts spaces provide cafes, bars, performance spaces, exhibition spaces, equipment rooms, rehearsal spaces, recording studios and projection rooms, often on a commercial basis, that enhance interaction and networking.

Quantifying the strength and overall impact of these mechanisms for knowledge transfer between public culture and commercial application is challenging. But just as policymakers continue to be concerned about the economic impact of basic research in science, they will require similar evidence for the impact of investment in public culture.

Investment in ‘public culture’ provides a stimulus in the domain of expressive value, just as investment in ‘public science’ provides a stimulus for the generation of new ideas in the science and technology domain.

The Australian National University and the University of Canberra are important owners, patrons and agents in Canberra’s cultural life, as well having a significant role in training and showcasing professional writers, visual and performing artists, filmmakers, designers, arts teachers, curators and administrators, and in the education of their audiences. They also have an important part to play in supporting creativity and innovation through involvement in support for artistic and cultural activities and events.

A university community offers a wealth of cultural, institutional and recreational opportunities for social interaction, leadership and personal development. Universities support libraries, museums, archives, galleries and bookstores, and use those assets to hold performances (plays, music, readings, etc.). For example, the ANU School of Music and Llewellyn Hall, as well as the Menzies and Chifley Libraries are major Canberra based public cultural assets. The Australian Academy of Science and the well-known architectural landmark, the [Shine Dome](#) constructed in 1959, is located in Acton, adjacent to the ANU campus.

The [National Centre for Australian Children's Literature](#) at the University of Canberra is also a highly regarded national asset.

University-based schools and colleges of art, music and design have a growing role in innovation through education and training in areas that have direct commercial and business application.

Start-up companies based on artistic and creative ideas emanating from current and former students in art, architecture and design schools, particularly when enabled by software and the capacity to create digital content, attract the interest of venture capital and other technology investors.

7.4 Liveability - innovation in an urban context.

An argument has developed that a placemaking strategy should be central to an innovation agenda. Such a strategy would address both the physical and human aspects of innovation ecosystems, and the districts, precincts and clusters within them.

The Canberra Ambition Strategy pointed out (ACT Government & Williams, 2016):

In an era where talent and entrepreneurs can choose to go to cities which have the right assets, cities must have coherent and integrated strategies and interventions. Cities succeed by design and collaboration. Cities have to show how they fit with the major trends in demography and modern economy, and have strategies and investment mechanisms that work.

The Statement adds that at the heart of Canberra's planning, transport and cross government coordination activities is the understanding that in a knowledge and 'start-up supportive' economy, placemaking matters.

Canberra must keep creating places that attract knowledge workers and entrepreneurs.

Reflecting well known themes, the Strategy points out global talent in the knowledge economy is coming together around locations that encourage interactions and the sharing of ideas. Higher density, mixed-use, walkable areas with jobs and research activities, well connected by public transport to homes, services and lifestyle options, are said to be at the heart of the success of 'innovation districts'. Cities around the world are addressing these aspects of innovation.

This thinking is being taken up by the City Renewal Authority and reflected in the Master Plans of The ANU and UC, and provides a context for the envisaged CIT-UNSW Reid precinct development.

It has been found, and is now widely accepted that the importance of geographical proximity cannot be assessed in isolation: it should always be examined in relation to other dimensions of proximity that may provide alternative solutions to the problem of coordination (Boschma, 2005). In particular:

... geographical proximity *per se* is neither a necessary nor a sufficient condition for learning to take place. Nevertheless, it *facilitates* interactive learning, most likely by strengthening *other dimensions* of proximity. However, proximity may also have negative impacts on innovation due to the problem of internal 'lock-in'.

These other dimensions of proximity include cognitive, organisational, social, and institutional factors.

Nonetheless, location is being seen as a major factor in the “battleground of international competitiveness ... where cities are increasingly viewed as the cauldrons of innovation, enriching not only their surrounding regions but their nations as a whole” (Leon, 2008). Moreover -

Across the globe massive renewal is taking place in our cities, fundamental shifts in the nature of work and the workplaces they host, and transformation of their output as well as their consumption. Cities compete with one another to attract not only firms and direct foreign investment, but also skilled knowledge workers to develop their social capital and capacity for innovation (Leon, 2008).

Understanding the importance of cities in trade and economic development is of course not new. The economic and commercial role of cities can be traced back to the mercantilist city states of the 16th century, and more recently, to the emergence of modern city states such as Singapore and the Chinese cluster strategy.

Much is made of the ‘triumph of the city’ in terms of efficiency in production of economic output (Glaeser, 2012) and the drift of population from rural areas to cities. This is not always seen as socially desirable, and is reflected in regional policies. Maintaining viable regional centres is an important dimension of contemporary regional policy. It is relevant to thinking about the future of cities like Goulburn in the Capital Region, for example.

Examination of the literature indicates that the impact of initiatives to encourage co-location of businesses, universities, and research agencies is mixed – where impact is taken to mean additional knowledge based employment, investment, increased sales of products and services, and exports into international markets and global value chain. Co-location does not, of itself, dictate whether knowledge accumulates, becomes embedded, or is shared across firms.

Businesses may ‘cluster’ for the purposes of competing for customers and talent, but remain otherwise unconnected. Competition law prevents too much collaboration between similar firms.

It must be kept in mind that innovation in an urban context is much more than developing innovation precincts and clusters. It must apply to the whole city – and extend into the broader Capital Region. In this line of thinking, engineering, architecture and design must, above all, be human focused. The term *human centred engineering* has entered the lexicon.

Several people commented in consultations that the time might be opportune to revisit the Canberra *Metropolitan Plan*. The *Canberra Spatial Plan*, that connects with the 2003 =, was released in 2004 (ACT Government, 2004). In conversations people mentioned the potential to use data and ‘city analytics’ as technologies to assist in the development of planning directions and implementation guidance.

Attachment 1: Discussion and Consultation

The following people kindly agreed to engage in a conversation in developing the narrative

Adamek, Petr, CEO, CBRIN	McNaughton, Nick, CEO, ANU Connect Ventures
Adler, Lindsay, CSIRO	Miller, Jayne, CIT
Cardew-Hall, Mick, PVC Innovation, ANU	Nelms, Keats, ANU
Care, Robert, Arup	Pantano, Victor, UC Engage
Cover, Leanne, CEO, CIT	Pearson, Sarah, Chief Innovation Officer, InnovationXchange, DFAT
Cram, Lawrence, DVC-R, Charles Darwin University	Pegrum, Annabelle,
Davis, Craig, CBRIN	Penders, Monica, CEO ScreenCanberra
Faulks, Chris, Deputy Chancellor, UC	Ryan, Paul, Director, CIT Solutions
Gaul, David, CEA Technologies	Smyth, Brendan, International Engagement Commissioner
Green, Roy, Vice-Chancellor's Adviser, Innovation, UTS	Snow, Malcolm, CEO, City Renewal Authority
Hendry, Robyn, CEO, Canberra Business Chamber	Stevens, Neville, Chair NSW Innovation and Productivity Council
Henshaw, Tony, Chair, CBRIN	Van Aalst, Robert, Innovation contractor
Kroeger, Ken, CEO Seeing Machines	Weir, Brian, University of Canberra
Masters, David, Microsoft,	Williams, Tim, Arup

Reference was made to transcripts of conversations held during February-May 2017 in conception with the Review of CBRIN, and assistance for ISA in preparation of the 2030 Innovation System Strategic Plan

Batainah, Hala, Microsoft	Keys, Glen, CEO, Aspen Medical
Blackhall, Lachlan	Mansell, Todd, DST
Bullock, Matt,	Noonan, Lisa, CSIRO
Cox, Ian	Pearson, Sarah
Dawe, Marcus	Pino, Anna, Lighthouse Innovations
Deamer, James	Piper, Zoe, Data 61
Dickerson, Wayne, Architect, JPW	Sani, Deep, UC
Frater, Michael, UNSW Canberra	Shannon, Frances, UC
Harris, Andrew, The University of Sydney	Snell, Andrew, product and communication strategy developer
Hawthorne, Hamish	Tulloch, Sylvia, Griffin Accelerator, Dyesol
Hoff, Brand	Wulf, Monica, Startup Aus

Attachment 2: Success Stories

A. Startup businesses

A brief profile of successful Canberra backed startup businesses is provided in Figure 17. These are companies that grew out of incubators, accelerators, co working spaces and had early stage venture backing. Proprietor backed startups are in Figure 18 (*both subject to revision*).

Figure 17: Successful ACT and Region Venture Backed Startups

Organisation	Purpose	Founded	CBR Staff	Capital Raised	Economic Benefit
BarleyMax	Food	2009	0		CSIRO Technology. Australian Capital Ventures Investment. BARLEYmax™ is now licensed to a CSIRO spin-off company, The Healthy Grain. An ingredient in multiple food products.
Beta Therapeutics	Life Science	2014	4	Raised \$2M; Raising another \$8M in 2018	Beta Therapeutics is working on an orally consumed drug to help prevent the development of macular degeneration; <i>ANU Spinout</i> ; <i>ANU CV lead investor</i> ; About to commence clinical trials
Enabled Employment	Social Enterprise	2013	9	>\$750k	GRIFFIN 2014 winner; Employing countless capable people with disabilities
Epiaxis therapeutics	Life Science	2014	10	Raised \$2M; Raising another \$2M in 2018	EpiAxis Therapeutics aims to prolong remission through a drug development program directed at the prevention of metastatic disease; UC spinout; <i>ANU CV lead investor</i> ; local HNW individuals additional backers; Phase I clinical trial advanced.
GPS Sport	Health	2000			
Instackustr	Open-Source as a Service	2013	50 (100 by 2020)	>A\$10M to date; Raising A\$19M in August	180 customers; Revenue growth from A\$1M in 2015 – A\$8M in 2017 – projecting A\$15M in 2018 & A\$30M in 2018; 75% of revenue from North America; ACT Payroll tax run rate is currently \$17.5k per month / \$210,000 per year. In 2019 that is projected to grow to between \$25-30k per month (or \$300-360k). <i>ANU CV lead investor</i> ; <i>ACVL Lead investor</i>
InterfereX	OTT Video	2014	7	>\$1M	Raised >\$1M in capital; <i>ANU CV lead investor</i> ; Sold to US listed global technology company in March 2018; returned 5.8x cash-on-cash for early investors; 7 staff based in CBR @ E29; building 100 person team in Australia around IFX technology
Liquid Instruments	Advanced Instrumentation	2014	17	Raised A\$2M; Raising A\$10M in Q3	Liquid Instruments is disrupting the test and measurement industry with a new class of software-enabled hardware; <i>ANU Spinout</i> ; <i>ANU CV lead investor</i> ; <i>ACVL Lead investor</i> ; Will double staff to 35 by end of 2019; Revenues of \$2M in 2018; Forecasting \$8M in revenue in 2019 & \$20M in 2020
Lithicon	Exploration	2009	40+	A\$11M	<i>ANU Spinout</i> ; Technology to create digital 3D images and simulations of fluids in rock samples acquired by US-based FEI Company for A\$76M; <i>ANU CV lead investor</i> <i>ACVL Lead investor</i>

CANBERRA AND CAPITAL REGION INNOVATION SYSTEM

Organisation	Purpose	Founded	CBR Staff	Capital Raised	Economic Benefit
Mediaware	Energy Management				
Quintessence Labs	Quantum Security	2008	35	Raised > A\$25M to date	Global leader in quantum cyber security; Westpac became an investor in 2015; Employ over 35 people in Canberra; Raised over US\$20M in capital; <i>ANU Spinout</i>
Reposit	Renewable Energy	2013	34	Raised over A\$5M since founding	Reposit builds Virtual Power Plants (VPPs) out of distributed energy resources; Now have over 1500Mw of capacity under management from over 1600 homes; Employ 34 people in Canberra; Backed by local high net worth individual
Seeing Machines	AI human interaction	2000	150 (200 by 2019)	>A\$60M	Global leader in eye tracking solutions; Global customers in Automotive, Aviation, Fleet, Medical, Off-Road & Rail; Employ over 300 people globally; Raised over GBP 35M in December 2017 to fund global growth; <i>ANU Spinout</i> ; <i>ACVL Early investor</i> ; Will pay approx. A\$1M in payroll tax in 2018. By the end of FY 19 they will have another 40-50 engineers
SHRIMP	Computing	1996			
SignOnSite	Construction	2015	8	>\$1M	GRIFFIN 2015 winner; Now manage >\$2BN in construction projects; 60 customers; 400 projects; 12k+ users; 8 staff based in Kiln Incubator @ CBRIN; heading towards \$1M in ARR
Skoolbo	Ed Tech	2010	10	Self-funded to date	Over 50,000 schools on Skoolbo learning platform; Over 2.5 million views on ChuChu School (world's largest children's YouTube channel); Employ 10 people in Canberra (15 in total); Created by founder of Mathletics – Shane Hill
Windlab	Wind Developer	2003	22	>\$70M; ASX IPO Aug 2017	Global leader in wind prospecting; 7000 Mw of capacity under development around the world; A\$23M in revenue in 2017 (up from A\$5M in 2014); Blue Cove Ventures / Innovation Capital / local Angels early investors; <i>CSIRO spinout</i> ; <i>Epicorp investee company</i>
		TOTAL	1070+	A\$310M	

Source: ANU Connect Ventures

B. High growth businesses

A number of successful high growth businesses are identified in Figure 18.

Figure 18: Successful ACT and Region Proprietor Backed Startups

Organisation	Purpose	Founded	CBR Staff	Capital Raised	Economic Benefit
Academy for Interactive Entertainment	Multimedia	1996			<p>The Academy of Interactive Entertainment (AIE) is an Australian video games and Computer animation school. Founded in 1996, it was one of the world's first institutions to offer qualifications in these industries. The AIE provides courses covering CGI, animation, video game asset creation and games programming. Campuses are located in Canberra, Sydney, Melbourne, Adelaide, Seattle Washington and Lafayette, Louisiana and an online campus. The Australian ABC has said that the AIE, "is one of Australia's most awarded 3D animation, game design and visual FX educators".</p> <p>AIE partners with other organisations including Microsoft, with Sony Computer Entertainment Europe, with Nnooo and the University of Canberra. Campuses are also located in Adelaide, Seattle, Lafayette.</p>

CANBERRA AND CAPITAL REGION INNOVATION SYSTEM

Organisation	Purpose	Founded	CBR Staff	Capital Raised	Economic Benefit
					In 2015 AIE submitted a proposal to the ACT government to transform the old Watson high school site – on which AIE is currently located – into a large education precinct, at an estimated cost of \$111 million. The proposed development will enable the production of feature films, along with facilities to create special effects for films and games. On site, there will be accommodation providing for 400 students. https://en.wikipedia.org/wiki/Academy_of_Interactive_Entertainment
AOFR	Fibre Optics	1983			OFR Pty Limited engages in the design, development, manufacture, and supply of fiber photonic components to the telecommunications and associated markets. Its products include multimode and signal path power combiners for the fiber laser market; dual and single window couplers and taps, and monolithic splitters; and single mode and video overlay wavelength division multiplexers. The company also offers single mode dual window and single window fixed attenuators for applications requiring optical power management; multimode couplers and taps, and anymode tap couplers for applications in local area networks, test equipment, and optical sensing systems; and polarization maintaining couplers for original equipment manufacturer applications. In addition, it provides planar splitters for FTTX passive optical networks; fiber bragg gratings; and fiber organizer and component clips for storage of couplers, mechanical and fusion splices, and excess fiber. The company is based in Symonston, Australia.
Aspen Medical	Health	2003	250+	N/A	Bootstrapped. 220 employees globally; Winner of ACT Exporter of the Year six times
Auspace	Space				
Australian Scientific Instruments	Scientific and Technical Services				ASI manufactures leading-edge instrumentation for geochemistry, including the SHRIMP IIe and SHRIMP IV ion microprobes, the RESOLUTION laser ablation instrument, the Alphachron automated thermochronology instrument, and the RESOchron double dating instrument. The instruments are based on research undertaken at the Research School of Earth Sciences (RSES) at the Australian National University (ANU), the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Curtin University, and elsewhere. https://asi-pl.com.au/about-asi/
Auraya	Voice recognition				Auraya's founders have been involved in the science, technology development and implementation engineering of Voice Biometrics since the formative years. https://aurayasystems.com/about-auraya/
Biotron	Life Sciences	1999			Biotron Limited (Biotron) is a clinical stage publicly listed Australian Biotechnology Company based in Sydney, Australia. The company is developing and commercialising a novel small molecule approach that has the potential to treat a number of serious viral diseases. The technology targets viroporin proteins, which are key to enabling the pathogenicity of a number of viruses including hepatitis C, HIV-1, Dengue, Zika, Influenza and Respiratory Syncytial Virus (RSV). http://www.biotron.com.au/about-us/
Canberra Data Centres	Data Management	2007			CDC was formed in 2007 with the sole purpose of being a trusted partner for data centre services. Since its creation, CDC has developed two data centre campuses and continues to expand to support growing client needs and demands. CDC is based out of Canberra in the ACT and is now the largest owner and operator of data centre capacity in Australia. https://canberradc.com.au/content/cdc-company
CEA Technologies	Defence	1983	340	>\$30M	Developer of Active Phased Array Radar (PAR) System; Secured the Anzac Frigate Contract \$700M and secured \$148M contract for radar upgrade for ANZAC Class Frigates in October 2017
Citadel	Health	2000	16		Citadel is a leading technology and software company that specialise in secure enterprise information management in complex environments. Citadel provide secure information to support real-time decisions across the Health, National Security and Defence industries. Citadel created and continues to manage Australia's largest enterprise content management solution which holds over 500 million secure objects. Citadel's health solutions support 50,000 daily transactions and hold over 27 years of data. Citadel also manages content and collaboration services for Australia's leading education providers.
Dyesol	Renewables	2004	61	\$90m	Dyesol is a renewable energy supplier and leader in Solid State Dye Solar Cell (ssDSC) technology – 3rd Generation photovoltaic technology. This unique technology can be integrated into glass, metal, cement and polymeric building materials to generate energy even in low light conditions.

CANBERRA AND CAPITAL REGION INNOVATION SYSTEM

Organisation	Purpose	Founded	CBR Staff	Capital Raised	Economic Benefit
					Dyesol's technology will change the way energy is generated and consumed by creating solar enabled buildings – this emerging industry is known as Building Integrated Photovoltaics (BIPV). Dyesol manufactures and supplies ssDSC materials and is focussed on the successful commercialisation of ssDSC photovoltaics. http://www.greatcellsolar.com/wp-content/uploads/2017/09/FINAL_Dyesol_ASX_Investor_Series_13102014.pdf
EOS	Space	1994	84	Raised A\$60M in Feb 2018	Electro Optic Systems Pty Ltd (EOS) is a leading Australian technology company building laser tracking systems for the aerospace and defence markets; Revenues >A\$23M in 2017; Forecasting >A\$80M in 2018; 171 staff in total.
eWay	Fin Tech	1998			eWAY, was founded in 1998 by Matt Bullock, and away.com.au was launched in 2000. By 2004, eWAY was linked to all major Australian banks, and in 2009 the company expanded by a further 65%. In 2009 eWAY partnered with all the major New Zealand banks, expanding payment services in the region. In 2014, eWAY expanded into Singapore, Hong Kong and Malaysia. eWAY has partnered with major SaaS companies to provide integrated payment services. In 2013 eWAY partnered with Xero to produce the 'Pay Now' add-on for Xero online invoices. Similar ventures have followed with the eWAY's integration with NetSuite. eWAY expanded its partnership with Magento. eWAY has integrated with Shopify. In November 2015, eWAY became the first Australian payment gateway to offer a mobile integration with Apple Pay. In April 2016, eWAY was purchased by Global Payments. https://en.wikipedia.org/wiki/EWay
Gamma Vaccines	Life Sciences				Gamma Vaccines Pty Ltd is an Australian company targeting primarily the human and avian influenza market. Formed in July 2009, the company is developing a cross-protective influenza virus vaccine, GammaFlu®, designed to replace current seasonal injectable flu vaccines with an easy-to-administer, broader-spectrum intranasal vaccine. The Company's products also hold the prospect of being able to be stockpiled for use as an immediate first response to any new influenza pandemic. In addition, Gamma Vaccines is developing a vaccine that can provide better protection against highly pathogenic avian influenza in poultry. The Company is also conducting research on vaccines for preventing bacterial pneumonia. Gamma Vaccines' proprietary technology was invented by leading researchers from The Australian National University's John Curtin School of Medical Research and The University of Adelaide's School of Molecular Life Sciences. The company has attracted significant equity investments from Australian, Indonesian & US investors and been awarded numerous grants from the Australian Capital Territory and the Commonwealth Government of Australia. Founded by experienced early-stage managers and the inventors themselves, the company is currently negotiating with several partners in Asia and Europe to commence clinical trials for applications in both human and animal vaccination markets. http://www.gammavaccines.com/
Gravity Consulting					
Funnelback	Data	1999			Funnelback is a search engine platform. Funnelback is typically deployed as a vertical search (site search) or enterprise search solution, and has been cited as suitable for search-based applications. It features a broad array of plug-ins and APIs, and is platform-agnostic. Funnelback's headquarters and research and development is based in Canberra, with additional offices in Sydney, Brisbane, Melbourne, Hobart, Adelaide, Perth, London, Seattle, Wellington, Edinburgh and Szczecin. https://en.wikipedia.org/wiki/Funnelback
Green Mag Group	Environment				
Health Horizon	Health	2013			Built on the Horiz.in data tracking platform, Health Horizon tracks the progress of health innovations around the world in real time. The platform allows tracking the progress of any innovation "so you never lose track of it again. Our experts and partners curate guided journeys featuring innovations by topic or disease to help you make sense of the complex global ecosystem". https://thehealthhorizon.com/about-us

CANBERRA AND CAPITAL REGION INNOVATION SYSTEM

Organisation	Purpose	Founded	CBR Staff	Capital Raised	Economic Benefit
Inland Trading	Wine				<p>Inland Trading Co (Aust) Pty Ltd is an award-winning export company specialising in the supply of premium quality wines from Australia (and New Zealand and South African) to an ever-expanding world market. The portfolio includes many of the best labels in the world today, from every Australia region. (and New Zealand)</p> <p>The ITC team of highly knowledgeable local and international staff has deep-rooted connections in the Australian wine industry. Those strong relationships allow us to open the door to the very best wines the country's boutique domains have to offer.</p> <p>Led by renowned and respected Australian wine specialists Greg and Marita Corra, all ITC staff have many years experience in exporting and marketing the best Australian wines. Our team expertly manages winery relationships and facilitates all logistics and planning, and is on hand at all times to take care of your needs and inquiries.</p> <p>https://www.inlandtrading.com.au/</p>
Intelldox	Software development	1992			<p>Intelldox Pty Ltd (formally DPM Consulting) is a software development company that specializes in business process digitalization. Intelldox began as a consulting business and soon evolved into a software company, developing software products such as learning management system Capabiliti LMS and Intelldox Infiniti.</p> <p>Intelldox Infiniti[was developed to address the market requirement[7][8] for software specifically designed to assist with the construction of repetitive documents (document automation/ECM). Intelldox allows non-technical users to implement common Microsoft Word skills, to create reusable document components in a central repository, without the requirement of macros or coding.</p> <p>Intelldox Pty Ltd is an Australian company headquartered in Canberra with offices in Sydney, Singapore, New York, Dallas, and London. The Intelldox platform is used by many of the world's leading companies and government organizations to transform outdated forms and processes into intelligent, customer-centric experiences.</p> <p>https://www.intelldox.com/about-us/, https://en.wikipedia.org/wiki/Intelldox</p>
Lipotek	Life Sciences	2001			<p>Lipotek is a privately held Australian company (ABN 51 098 824 509) with laboratories and offices on the campus of the Australian National University. The company operates primarily as a research and development entity seeking to identify, protect, and commercialise adjuvant and delivery technologies to improve vaccine formulations.</p> <p>The company seeks to demonstrate 'proof-of-concept' for its Lipovaxin and Lipokel adjuvant platforms and aims to secure strategic alliances with biotech or pharmaceutical companies for the clinical development of selected products.</p> <p>In recent years Lipotek completed a Phase I clinical trial of Lipovaxin-MM, a allogeneic candidate vaccine for malignant melanoma. More recently the company has focussed on the application of its technology for the development of nano-vaccines based on recombinant proteins for tuberculosis, malaria and cancer.</p> <p>http://www.lipotek.com.au/about/</p>
Microforte	Multimedia	1985			<p>Micro Forté Studios is an Australian electronic entertainment company with development studios in Canberra and Sydney. Founded in 1985 by John De Margheriti at a time when there was little game development presence in Australia, Micro Forté has been closely linked to the growth of the Australian game development industry, with CEO De Margheriti initiating events such as the Australian Game Developers Conference (AGDC) and founding the Academy of Interactive Entertainment (AIE) which have helped to lift the profile and create a pool of talent for the industry in Australia.</p> <p>Micro Forté Studios is primarily a developer of massively multiplayer online games and virtual world content.</p> <p>https://en.wikipedia.org/wiki/Micro_Fort%C3%A9</p>
Mineral carbonisation International	Environment	2012			<p>Mineral Carbonation International (MCI) is an Australian based privately held company which is developing technology for carbon utilisation (CU). Its priority is to develop the technology platform for large scale transformation of CO2 into valuable products by combining with minerals or waste streams through an accelerated natural process called mineral carbonation.</p> <p>If successful at scale, this would assist as a transition technology for the major emitting countries as they move away from carbon intensive industry to more sustainable energy mixes and low carbon economies.</p> <p>It is estimated that by 2030 the market for carbon utilisation in industry will be around US \$1Trillion.</p> <p>https://www.mineralcarbonation.com/</p>

CANBERRA AND CAPITAL REGION INNOVATION SYSTEM

Organisation	Purpose	Founded	CBR Staff	Capital Raised	Economic Benefit
Pharmaxis	Life Sciences	1998			<p>Pharmaxis is an Australian pharmaceutical research company focussed on inflammation and fibrosis with a portfolio of products at various stages of development and approval.</p> <p>Established in 1998 and listed on the Australian Securities Exchange in 2003 (symbol PXS) the Company's head office, manufacturing and research laboratories are located in Sydney, Australia.</p> <p>The Company has a signature partnership with Boehringer Ingelheim on a drug discovered by Pharmaxis which is being trialled to treat the common liver disease NASH and diabetic retinopathy - a leading cause of blindness. These two trials are due to report in the first half of 2019.</p> <p>http://www.pharmaxis.com.au/about/</p>
Simmersion		1997			<p>While working for JHU/APL in 1997, Dr. Dale Olsen developed the patented simulation technology PeopleSIM. His first simulation was designed to teach the detection of deception during criminal investigative interviews by talking to the character, Mike Simmen.</p> <p>In 1998, Dr. Olsen delivered this technology to the Federal Bureau of Investigation (FBI) to train new field agents. In turn, the FBI distributed the Mike Simmen simulation to federal, state, and local law enforcement agencies throughout the country. In recognition of his successes in the law enforcement community, he was appointed Director, Program Development for Law Enforcement at JHU/APL.</p> <p>There was an immediate demand for more training systems, leading Dr. Olsen to found SIMmersion in October 2002 and obtain an exclusive license from JHU/APL for the PeopleSIM technology.</p> <p>Since that time, we have contracted directly with government sponsors and have been awarded several new contracts with the FBI, as well as the U.S. Army, Navy, Air Force, the Office of the Secretary of Defense, Joint Forces Command, the intelligence community, and various institutes at the National Institutes of Health, including NIAAA, NIMH, and NIDA.</p> <p>Simmersion Holdings Pty Limited (www.simmersionholdings.com) is a now a wholly owned subsidiary of XTEK. Simmersion Holdings provides spatially accurate real-time 3D visual impact analysis software and associated services to build geospatially accurate 3D simulations.</p> <p>https://simmersion.com/about/history/</p>
SmartWard	Health	2008			<p>In 2008, Canberra local Matt Darling spent several months in hospital caring for one of his children. He could never have expected that that experience would lead him on a journey to help revolutionise the delivery of patient care in hospitals</p> <p>SmartWard has been designed from inception to manage the safety-critical nature of hospital wards, balancing highly accurate data-capture with the utmost respect for the challenges of managing acute care patient information safely and confidentially.</p> <p>SmartWard was awarded Innovation Connect (ICon) grant funding in 2010-11 to assist with development of the technology</p> <p>http://smartward.com.au/about.html</p>
Spinify	People Management	2016			<p>Spinify helps track, engage, and reward employees. "Leaderboards engage and motivate employees to focus on business metrics that matter".</p> <p>https://spinify.com/</p>
Tower Software	Records Management	1985			<p>TOWER Software began making records management software in 1985. It shifted to providing electronic document and records management software with the introduction of TRIM Captura in 1998. TRIM Context was released in 2002. In 2004 the company re-branded itself as a provider of enterprise content management solutions.</p> <p>TOWER Software contributed to the development of international and local standards by sitting on a working group to develop AS4390 (the Australian standard for records management), which influenced the ISO 15489 standard, and by reviewing the MoReq and DoD 5015.2 standards.[3]</p> <p>In April 2008, TOWER Software shareholders were advised of the company's intention to accept an offer by Hewlett-Packard to acquire the company for approximately US\$105 million.[4] At that time, TOWER Software had 1000 customers in 32 countries representing the public sector and highly regulated industries such as healthcare, energy and utilities, and banking and finance.[5]</p> <p>TRIM Context is now called HP TRIM Records Management System software and is based on the ISO standard 15489 for records management.[6] TRIM software also has U.S. Department of Defense (DoD) 5015.2 certification and adheres to the principles outlined in AS4390.[7]</p> <p>https://en.wikipedia.org/wiki/TOWER_Software</p>

CANBERRA AND CAPITAL REGION INNOVATION SYSTEM

Organisation	Purpose	Founded	CBR Staff	Capital Raised	Economic Benefit
Xtek	Security services				<p>XTEK Limited's business was established just before the Hilton Hotel bombing in Sydney during the Commonwealth Heads of Government Meeting in 1978. The Company provides equipment, capability based solutions, training and support services to defence, law enforcement agencies and other government departments responsible for Australia's national security.</p> <p>XTEK is the leader in its field with a large number of exclusive reseller agreements and the ability to provide first-class after-sales service, training, support and capability consultancy.</p> <p>XTEK in Canberra, Australian Capital Territory, is primarily focussed on electronics and software engineering associated with the exploitation of video and other sensor data.</p> <p>http://www.xtek.net/corporate/about-us/#.W2ftctgzacY</p>
Stratsec	Computer & Network Security	2003			<p>Stratsec - the largest and most awarded information security consulting and testing firm in Australia – now a part of BAE Systems.</p> <p>In 2010 Stratsec became a part of the BAE Systems group of companies. BAE Systems is a global defence, security and aerospace company with over 80,000 employees worldwide. The Company delivers a full range of products and services for air, land and naval forces, as well as cyber security, advanced electronics, security, information technology solutions and customer support services.</p>

Source: ANU Connect Ventures, (Dawson, 2014)

Attachment 3: CIT Enrolment Patterns 2014-2016

Table 9: Canberra Institute of Technology Top 20 parent training packages (based on 2016 activity), ACT Residents

	2014 No	2015 No	2016 No	%	2015-16
3 Public Services (PSP)	810	630	990	6.3	57.1
11 Creative Arts and Culture (CUA, CUE, CUV)	290	275	360	2.3	30.9
16 Hairdressing and Beauty Services (SHB, SIH, WRH)	220	205	265	1.7	29.3
4 Construction, Plumbing & Services Integrated Framework (BCF, BCG, BCP, CPC)	980	835	855	5.4	2.4
13 Agriculture, Horticulture and Conservation and Land Management (AHC, RTD, RTE, RTF, RUA, RUH, AGF, AGR)	290	295	300	1.9	1.7
14 Automotive Industry Retail, Service and Repair (AUR)	255	290	290	1.8	0.0
19 Property Services (CPP, PRD, PRM, PRS)	220	175	175	1.1	0.0
20 Animal Care and Management (ACM, RUV)	155	145	140	0.9	-3.4
17 Furnishing (MSF, LMF)	270	265	255	1.6	-3.8
8 Financial Services (FNA, FNB, FNS)	590	605	575	3.7	-5.0
1 Community Services (CHC)	1800	1900	1795	11.4	-5.5
6 Information and Communications Technology (ICA, ICT)	945	815	770	4.9	-5.5
10 Health (HLT)	410	435	405	2.6	-6.9
7 Electrotechnology (UEE, UTE, UTL)	730	670	610	3.9	-9.0
12 Training and Education (BSZ, TAA, TAE)	565	390	340	2.2	-12.8
15 Sport, Fitness and Recreation (SIS, SRC, SRF, SRO, SRS)	445	335	275	1.8	-17.9
18 Metal and Engineering (MEM)	235	240	195	1.2	-18.8
5 Foundation Skills (FSK)	1910	990	795	5.1	-19.7
9 Tourism, Travel and Hospitality (SIT, THH, THT)	670	745	535	3.4	-28.2
2 Business Services (BSA, BSB)	2765	2520	1675	10.7	-33.5
Total	14555	12760	11600	73.9	
Other					
Total for selection	20315	16280	15695	100.0	-3.6

Source: <https://www.ncver.edu.au/data/data/all-data/total-vet-students-and-courses-2016-data-slicer>.

Table 10: Canberra Institute of Technology Top 20 specific training package programs (based on 2016 activity) ACT Residents

	2014 No	2015 No	2016 No	%	2015-16
15 DIPLOMA OF GOVERNMENT	150	115	180	1.1	56.5
19 DIPLOMA OF NURSING (ENROLLED-DIVISION 2 NURSING)	115	130	160	1.0	23.1
16 CERTIFICATE III IN LIGHT VEHICLE MECHANICAL TECHNOLOGY	120	140	165	1.1	17.9
1 CERTIFICATE II IN SKILLS FOR WORK AND VOCATIONAL PATHWAYS	265	420	480	3.1	14.3
5 CERTIFICATE III IN CARPENTRY	270	250	285	1.8	14.0
13 CERTIFICATE III IN COMMERCIAL COOKERY	150	195	195	1.2	0.0
14 CERTIFICATE III IN PLUMBING	215	205	195	1.2	-4.9
17 CERTIFICATE III IN HAIRDRESSING	175	175	165	1.1	-5.7
9 DIPLOMA OF EARLY CHILDHOOD EDUCATION AND CARE	140	255	230	1.5	-9.8
2 CERTIFICATE III IN ELECTROTECHNOLOGY ELECTRICIAN	520	480	425	2.7	-11.5
6 CERTIFICATE IV IN TRAINING AND ASSESSMENT	500	325	285	1.8	-12.3
4 CERTIFICATE III IN EARLY CHILDHOOD EDUCATION AND CARE	345	420	305	1.9	-27.4
10 CERTIFICATE I IN SKILLS FOR VOCATIONAL PATHWAYS	275	355	225	1.4	-36.6
3 CERTIFICATE III IN BUSINESS ADMINISTRATION	0	0	365	2.3	-
7 CERTIFICATE III IN COMMUNITY SERVICES	0	0	260	1.7	-
8 CERTIFICATE II IN BUSINESS	0	0	245	1.6	-
11 CERTIFICATE III IN INFORMATION, DIGITAL MEDIA AND TECHNOLOGY	0	0	225	1.4	-
12 CERTIFICATE III IN ACCOUNTS ADMINISTRATION	0	0	200	1.3	-
18 CERTIFICATE IV IN COMMUNITY SERVICES	0	0	160	1.0	-
20 DIPLOMA OF PROJECT MANAGEMENT	0	0	155	1.0	-
	3240	3465	4905	31.2	
Total national training package programs	15480	13550	12120	77.2	-10.6

Source: <https://www.ncver.edu.au/data/data/all-data/total-vet-students-and-courses-2016-data-slicer>.

Table 11: Canberra Institute of Technology Top 20 parent training packages (based on 2016 activity), NSW Residents

	2014 No	2015 No	2016 No	2015-16 %	
16 Creative Arts and Culture (CUA, CUE, CUV)	35	25	65	1.6	160.0
1 Public Services (PSP)	240	300	465	11.3	55.0
19 Property Services (CPP, PRD, PRM, PRS)	50	35	45	1.1	28.6
3 Business Services (BSA, BSB)	320	235	265	6.5	12.8
17 Hairdressing and Beauty Services (SHB, SIH, WRH)	55	55	60	1.5	9.1
11 Agriculture, Horticulture and Conservation and Land Management (AHC, RTD, RTE, RTF, RUA, RUH, AGF, AGR)	85	85	90	2.2	5.9
2 Construction, Plumbing & Services Integrated Framework (BCF, BCG, BCP, CPC)	330	290	295	7.2	1.7
20 Food Processing Industry (FDF)	15	25	25	0.6	0.0
5 Electrotechnology (UEE, UTE, UTL)	250	245	225	5.5	-8.2
18 Sport, Fitness and Recreation (SIS, SRC, SRF, SRO, SRS)	75	55	50	1.2	-9.1
13 Furnishing (MSF, LMF)	125	95	85	2.1	-10.5
10 Information and Communications Technology (ICA, ICT)	135	110	95	2.3	-13.6
4 Community Services (CHC)	430	295	250	6.1	-15.3
14 Financial Services (FNA, FNB, FNS)	95	95	80	2.0	-15.8
9 Metal and Engineering (MEM)	110	115	95	2.3	-17.4
15 Training and Education (BSZ, TAA, TAE)	115	85	70	1.7	-17.6
7 Foundation Skills (FSK)	455	195	160	3.9	-17.9
6 Automotive Industry Retail, Service and Repair (AUR)	235	220	165	4.0	-25.0
12 Health (HLT)	110	115	85	2.1	-26.1
8 Tourism, Travel and Hospitality (SIT, THH, THT)	150	145	100	2.4	-31.0
	3415				
Total	4635	3740	4100	100.0	9.6

Source: <https://www.ncver.edu.au/data/data/all-data/total-vet-students-and-courses-2016-data-slicer> .

Table 12: Canberra Institute of Technology Top 20 specific training package programs (based on 2016 activity) NSW Residents

	2014 No	2015 No	2016 No	2015-16 %	
20 CERTIFICATE III IN HEAVY COMMERCIAL VEHICLE MECHANICAL TECHNOLOGY	0	30	35	0.9	16.7
2 CERTIFICATE IV IN GOVERNMENT	60	115	130	3.2	13.0
3 CERTIFICATE III IN PLUMBING	120	120	120	2.9	0.0
5 CERTIFICATE III IN CARPENTRY	85	85	85	2.1	0.0
10 DIPLOMA OF NURSING (ENROLLED-DIVISION 2 NURSING)	45	50	50	1.2	0.0
12 CERTIFICATE III IN CABINET MAKING	20	50	50	1.2	0.0
13 CERTIFICATE III IN COMMERCIAL COOKERY	40	45	45	1.1	0.0
4 CERTIFICATE II IN SKILLS FOR WORK AND VOCATIONAL PATHWAYS	70	130	115	2.8	-11.5
8 CERTIFICATE IV IN TRAINING AND ASSESSMENT	100	65	55	1.3	-15.4
17 CERTIFICATE III IN HAIRDRESSING	45	45	40	1.0	-11.1
11 CERTIFICATE III IN LIGHT VEHICLE MECHANICAL TECHNOLOGY	50	55	50	1.2	-9.1
7 CERTIFICATE III IN ENGINEERING - FABRICATION TRADE	75	70	65	1.6	-7.1
1 CERTIFICATE III IN ELECTROTECHNOLOGY ELECTRICIAN	160	165	155	3.8	-6.1
14 CERTIFICATE III IN AIR-CONDITIONING AND REFRIGERATION	60	50	45	1.1	-10.0
6 CERTIFICATE IV IN GOVERNMENT (INVESTIGATION)	45	45	70	1.7	55.6
15 CERTIFICATE III IN EARLY CHILDHOOD EDUCATION AND CARE	50	60	40	1.0	-33.3
18 CERTIFICATE I IN SKILLS FOR VOCATIONAL PATHWAYS	30	30	40	1.0	33.3
9 CERTIFICATE III IN BUSINESS ADMINISTRATION	0	0	55	1.3	-
16 CERTIFICATE IV IN GOVERNMENT (HRM/GSD/LND/INJURY CLAIMS ADMINISTRATION/INJURY REHABILITATION MANAGEM	0	0	40	1.0	-
19 DIPLOMA OF GOVERNMENT (INVESTIGATION)	5	20	35	0.9	75.0
Total national training package programs	3770	3055	2925	71.3	-4.3

Source: <https://www.ncver.edu.au/data/data/all-data/total-vet-students-and-courses-2016-data-slicer> .

Attachment 4: ARC ERA data on Canberra Universities Research Strengths

For information and reference, the following table sets the Excellence in Research Australia (ERA) assessments of research quality in Fields of Research for Universities with a major presence in Canberra. A rating of 5 indicates 'world class', and 4 is approaching world class.

ANU	University of Canberra	ACU	University of New South Wales	
01 Mathematical Sciences	5		01 Mathematical Sciences	5
0101 Pure Mathematics	5		0101 Pure Mathematics	5
0102 Applied Mathematics	4		0102 Applied Mathematics	4
			0104 Statistics	5
02 Physical Sciences	5		02 Physical Sciences	4
0201 Astronomical and Space Sciences	5		0201 Astronomical and Space Sciences	3
0202 Atomic, Molecular, Nuclear, Particle and Plasma Physics	4		0202 Atomic, Molecular, Nuclear, Particle and Plasma Physics	3
0203 Classical Physics	5			
0204 Condensed Matter Physics	5		0204 Condensed Matter Physics	5
0205 Optical Physics	5			
0206 Quantum Physics	5		0206 Quantum Physics	5
03 Chemical Sciences	4		03 Chemical Sciences	4
0303 Macromolecular and Materials Chemistry	4		0301 Analytical Chemistry	5
0304 Medicinal and Biomolecular Chemistry	4		0302 Inorganic Chemistry	3
			0303 Macromolecular and Materials Chemistry	5
0306 Physical Chemistry (Incl. Structural)	4		0304 Medicinal and Biomolecular Chemistry	4
0307 Theoretical and Computational Chemistry	4		0305 Organic Chemistry	3
			0306 Physical Chemistry (Incl. Structural)	5
04 Earth Sciences	4		04 Earth Sciences	5
0401 Atmospheric Sciences	5		0401 Atmospheric Sciences	5
0402 Geochemistry	5			
0403 Geology	4		0403 Geology	4
0404 Geophysics	4			
0405 Oceanography	5		0405 Oceanography	4
0406 Physical Geography and Environmental Geoscience	4		0406 Physical Geography and Environmental Geoscience	5
05 Environmental Sciences	5	05 Environmental Sciences	05 Environmental Sciences	4
0501 Ecological Applications	5	0501 Ecological Applications		
0502 Environmental Science and Management	5	0502 Environmental Science and Management	0502 Environmental Science and Management	5
06 Biological Sciences	5		06 Biological Sciences	4
0601 Biochemistry and Cell Biology	4		0601 Biochemistry and Cell Biology	4
0602 Ecology	5		0602 Ecology	4
0603 Evolutionary Biology	5		0603 Evolutionary Biology	3
0604 Genetics	5	0604 Genetics	0604 Genetics	4
0605 Microbiology	5		0605 Microbiology	5
0607 Plant Biology	5			
0608 Zoology	5		0608 Zoology	3
07 Agricultural and Veterinary Sciences	4			
0703 Crop and Pasture Production	5			
0705 Forestry Sciences	5			
08 Information and Computing Sciences	5		08 Information and Computing Sciences	5
0801 Artificial Intelligence and Image Processing	5		0801 Artificial Intelligence and Image Processing	4
0802 Computation Theory and Mathematics	4		0802 Computation Theory and Mathematics	4

CANBERRA AND CAPITAL REGION INNOVATION SYSTEM

ANU	University of Canberra	ACU	University of New South Wales
0803 Computer Software	4		0803 Computer Software 5
0805 Distributed Computing	4		0805 Distributed Computing 4
	0806 Information Systems	3	0806 Information Systems 5
			0807 Library and Information Studies 3
09 Engineering	4		09 Engineering 5
			0903 Biomedical Engineering 4
			0904 Chemical Engineering 5
			0905 Civil Engineering 5
0906 Electrical and Electronic Engineering	5		0906 Electrical and Electronic Engineering 5
			0908 Food Sciences 5
			0909 Geomatic Engineering 2
			0910 Manufacturing Engineering 4
0912 Materials Engineering	5		0912 Materials Engineering 4
			0913 Mechanical Engineering 3
			0914 Resources Engineering and Extractive Metallurgy 4
			10 Technology 4
			1005 Communications Technologies 4
			1006 Computer Hardware 4
11 Medical and Health Sciences	5	11 Medical and Health Sciences 3	11 Medical and Health Sciences 4
			1101 Medical Biochemistry and Metabolomics 5
			1102 Cardiovascular Medicine and Haematology 5
1103 Clinical Sciences	5		1103 Clinical Sciences 5
	1106 Human Movement and Sports Science	4	1106 Human Movement and Sports Science 3
1107 Immunology	5		1107 Immunology 5
			1108 Medical Microbiology 3
1109 Neurosciences	5		1109 Neurosciences 5
	1110 Nursing	4	1110 Nursing 4
			1112 Oncology and Carcinogenesis 3
1113 Ophthalmology and Optometry	5		1113 Ophthalmology and Optometry 3
			1114 Paediatrics and Reproductive Medicine 3
			1115 Pharmacology and Pharmaceutical Sciences 4
			1116 Medical Physiology 4
1117 Public Health and Health Services	5	1117 Public Health and Health Services 4	1117 Public Health and Health Services 3
			12 Built Environment and Design 4
			1201 Architecture 3
			1202 Building 3
			1203 Design Practice and Management 2
			1205 Urban and Regional Planning 5
	13 Education	3	13 Education 4
			1303 Specialist Studies in Education 4
14 Economics	4		14 Economics 5
1401 Economic Theory	5		1401 Economic Theory 5
1402 Applied Economics	3		1402 Applied Economics 5
1403 Econometrics	4		1403 Econometrics 5
15 Commerce, Management, Tourism and Services	4		15 Commerce, Management, Tourism and Services 5
1501 Accounting, Auditing and Accountability	4		1501 Accounting, Auditing and Accountability 5
1502 Banking, Finance and Investment	4		1502 Banking, Finance and Investment 5
1503 Business and Management	5	1503 Business and Management	3 1503 Business and Management 5
			1505 Marketing 4
			1506 Tourism 3
16 Studies in Human Society	5	16 Studies in Human Society 3	16 Studies in Human Society 4
1601 Anthropology	4		1601 Anthropology 3
1602 Criminology	5		1602 Criminology 3
1603 Demography	4		
1605 Policy and Administration	5	1605 Policy and Administration 3	1605 Policy and Administration 5
1606 Political Science	5	1606 Political Science 3	1606 Political Science 4
			1607 Social Work 3

CANBERRA AND CAPITAL REGION INNOVATION SYSTEM

ANU	University of Canberra	ACU	University of New South Wales
1608 Sociology	4	1608 Sociology	3 1608 Sociology 4 1699 Other Studies in Human Society 3
17 Psychology and Cognitive Sciences	4	17 Psychology and Cognitive Sciences	5 17 Psychology and Cognitive Sciences 5
1701 Psychology	5	1701 Psychology	5 1701 Psychology 5
18 Law and Legal Studies	5	18 Law and Legal Studies	3 18 Law and Legal Studies 5
1801 Law	5	1801 Law	3 1801 Law 5
	19 Studies in Creative Arts and Writing	3	19 Studies in Creative Arts and Writing 5 1901 Art Theory and Criticism 5 1902 Film, Television and Digital Media 5 1904 Performing Arts and Creative Writing 4 1905 Visual Arts and Crafts 4

Attachment 5: Growth Drivers in the ACT Economy: 1987 - 2018

Demand side drivers

Overview

Over the last 30 years economic growth in the ACT has been largely driven by:

1. Public sector final demand – predominantly Commonwealth Government purchases of goods and services
2. Household expenditure on goods and services
3. Private Capital Expenditure

Trends in these aggregates from 1987 is reflected in Table 1.

Figure 19: ACT Economy - Drivers of GDP Growth

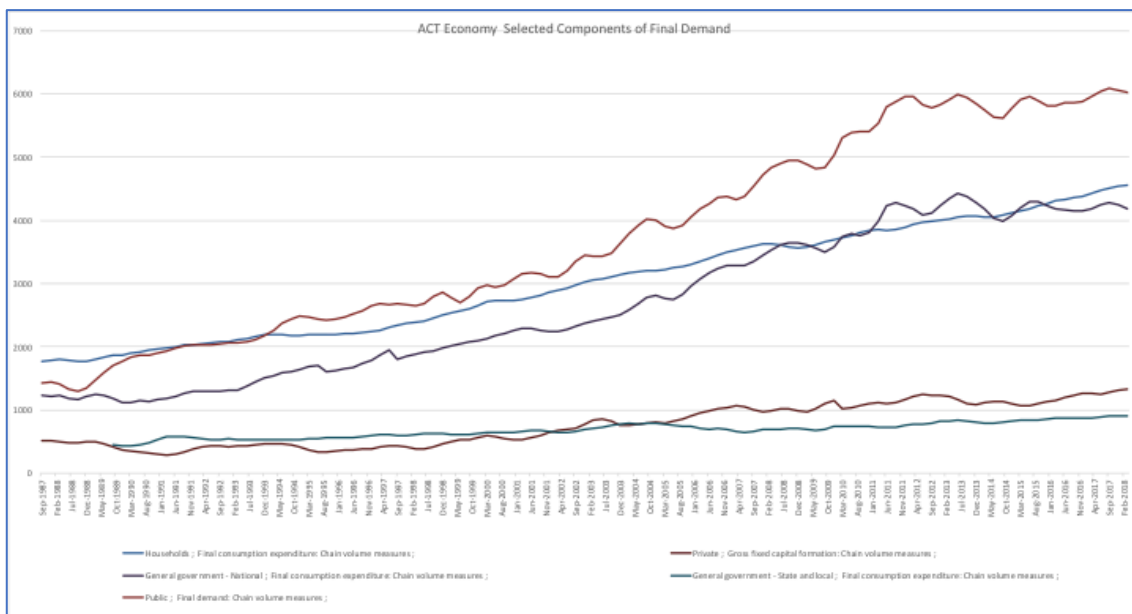


Figure 1 reflects the following:

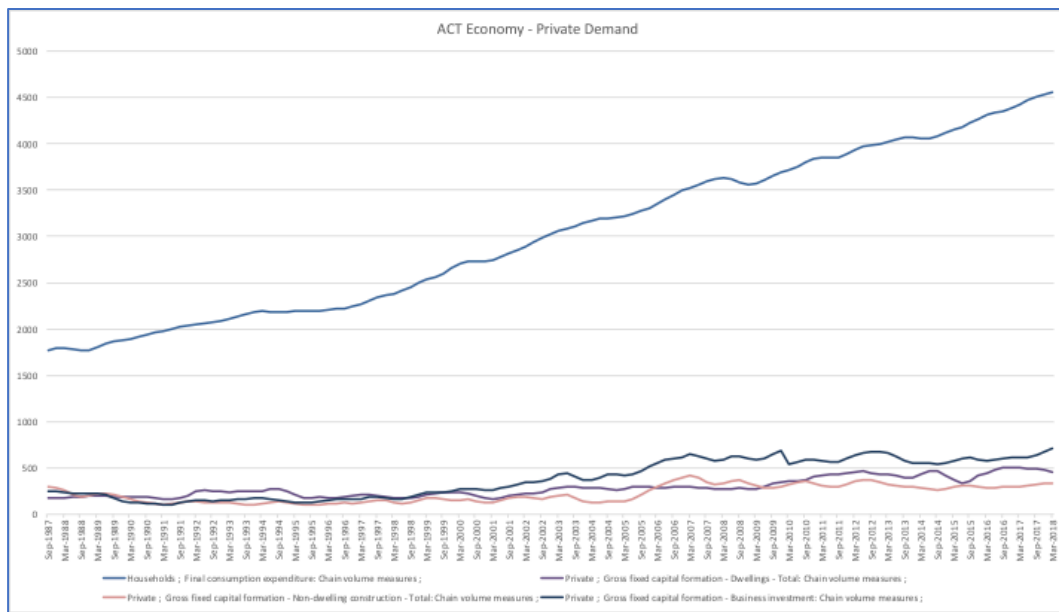
- Public sector demand has grown steadily over the period from Sept 1987 to December 2011, but has fluctuated on broad 2-3 year cycles; however, public sector demand reached a peak in December 2011, and has been flat until March 2018.
- Household demand has grown steadily, except for a short dip in late 2008 (coinciding with the CFC). The main driver of household demand is *population increase* and *rising real incomes*. A major source of household income has been wages and salaries paid by the public sector, although there has been a progressive shift to income sourced from private sector.
- Private capital expenditure has been trending up, with cyclical fluctuations, including peaks in mid 2003, mid 2007, late 2009, mid 2012, late 2016 and early 2018
- ACT Government final demand has doubled since self-government in March 1989.

Trends in Private demand

Trends in private demand are shown in Figure 2. It shows:

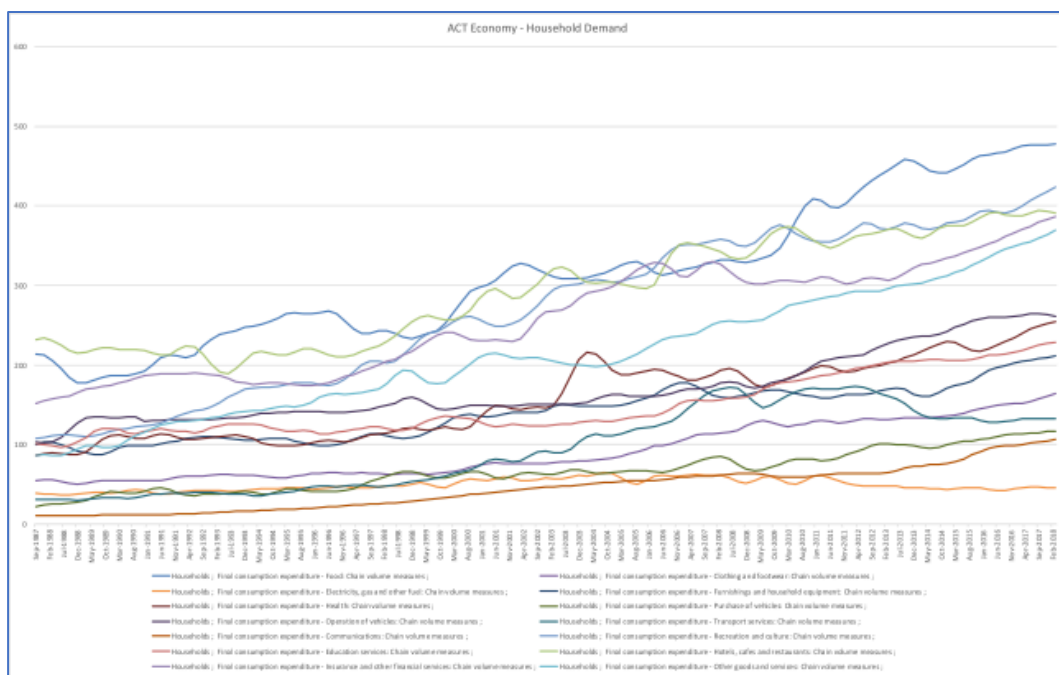
- Household demand has been the major component of private sector demand growth.
- Business sector demand has been a very small component of private demand, although it has been increasing, but not as quickly as household demand

Figure 20: Private demand



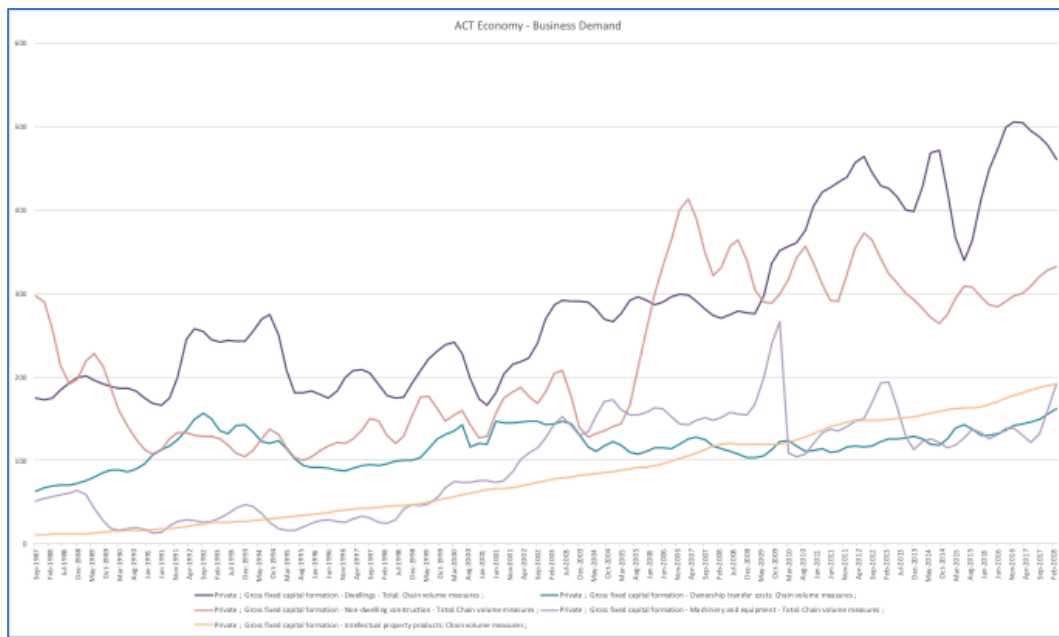
As illustrated in Figure 3, the major component of household demand is food. Expenditure at hotels, cafes and restaurants is also important.

Figure 21: Household Demand



As indicated in Figure 4, the major component of business demand is dwelling construction. Non dwelling construction fluctuates widely – with major peaks in 1987, 2006. There are growing business investments in Intellectual Property (IP).

Figure 22: Business Demand

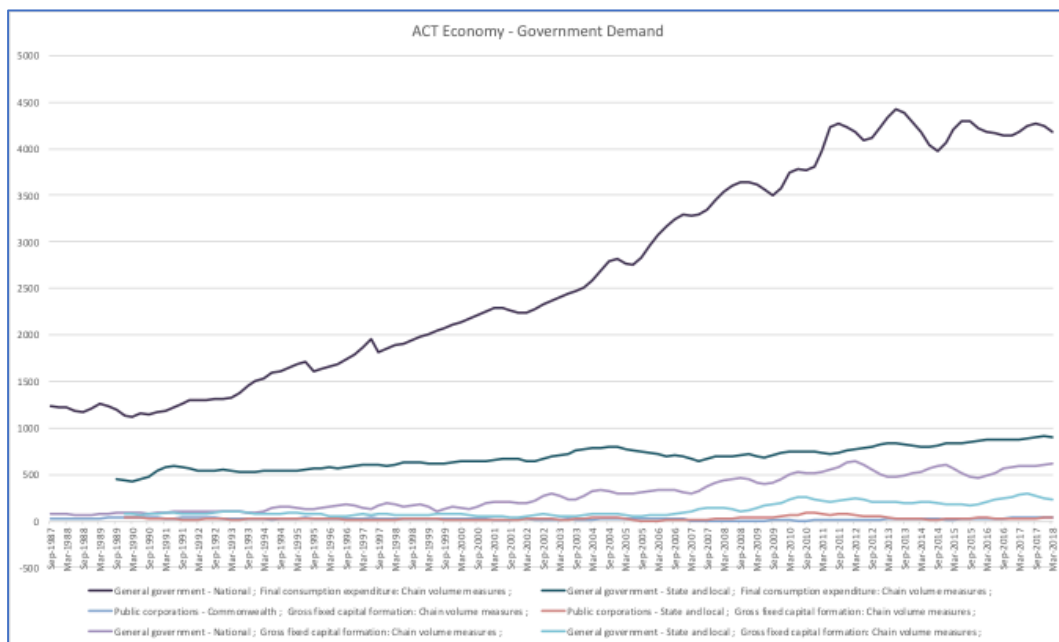


Trends in Government demand

Trends in government demand are indicated in Figure 5. It shows the pervasive influence of the Commonwealth Government, although as noted above, demand peaked in 2013. Commonwealth capital expenditure reached peaks in 2008, 2012, 2014, and 2018.

ACT Government demand peaked in 2004 and has been increasing steadily since 2007.

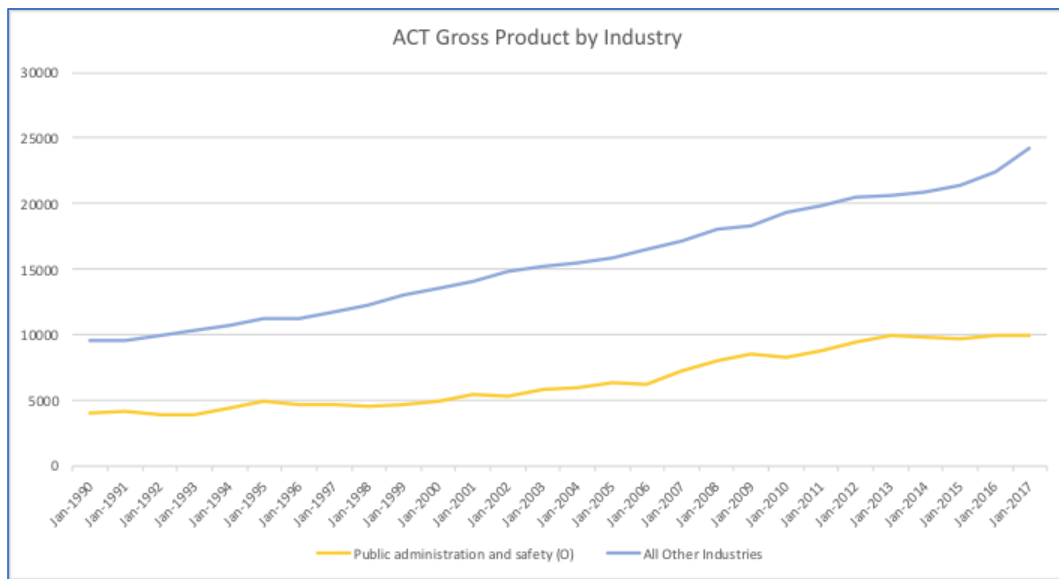
Figure 23: Government Demand



Supply side drivers - production, industry Gross Value Added

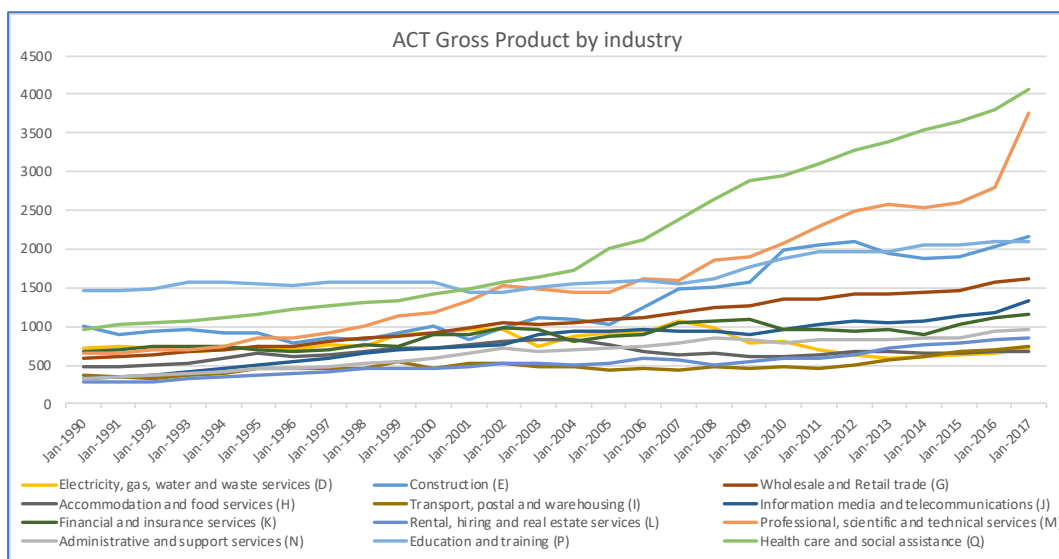
As indicated in Figure 6, Public administration and safety, is the single most dominant industry in the ACT, but others, in aggregate, are larger.

Figure 24: ACT Production (Gross value Added) - Significance of Public Administration and Safety



Public administration and safety accounts for 29.3 per cent of industry gross value added. It has grown 2.4 times since June 1990. Other industries have grown by 2.5 times. But there have been significant change within the others, as indicated in Table 7.

Figure 25: ACT Production (Gross Value Added) by Industry - Excl Public Administration and Safety



Note:

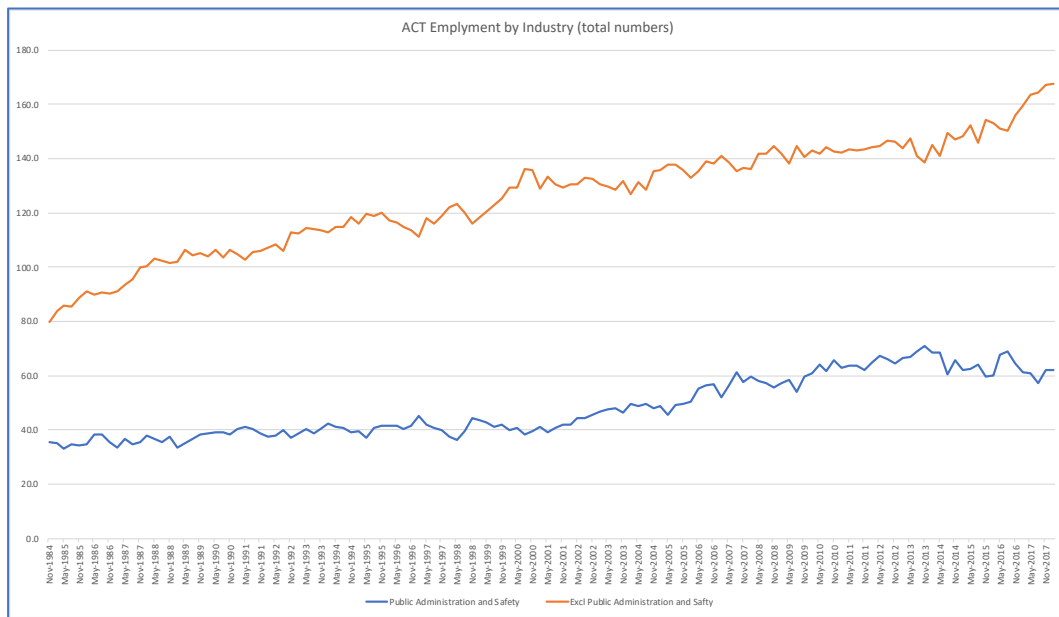
- Health care and social assistance was the largest “other” industry in 2017; 11.9 per cent of production (7.0 per cent in 1990). It is 4.2 times bigger than in 1990.
- Fast growth has also occurred in Professional, scientific and technical services, 5.7 times bigger in June 2017 than June 1990, a reflection of Commonwealth outsourcing and the growing importance of the application of knowledge; there was a take-off from 1996., when the industry was 4.8 per cent of the economy.
- Education and training was 10.6 of production in 1990; it is now 6.1, 1.4 times bigger.
- Information, media and telecommunications is now 4.0 times bigger; 3.9 per cent of economy (2.4)
- Rental, hiring and real estate, 3.1 times bigger, now 2.5 per cent of economy (2.0 in 1990)
- Administrative and support services, 2.9
- Wholesale and retail trade, 2.8
- Construction, 2.1, fluctuates, but really took off from 2005; biggest sector in 1990 (7.4 per cent, now 6.3 per cent); still significant

- Finance and insurance, 1.7 per cent increase; 3.4 per cent of economy (was 5.0 per cent)
- Accommodation and food, 1.5 bigger; now 2.0 per cent of economy, was 3.4.
- Education and training – only 1.4 times bigger
- Electricity and gas, 1.0

Employment

More people in the ACT work in industries other than Public Administration and Safety. Moreover, trends in production figures may not be reflected in employment trends, due to automation, technological change and higher productivity. Of particular note is that employment in Public Administration and Safety is falling as a proportion of total employment, as indicated in Figure 8.

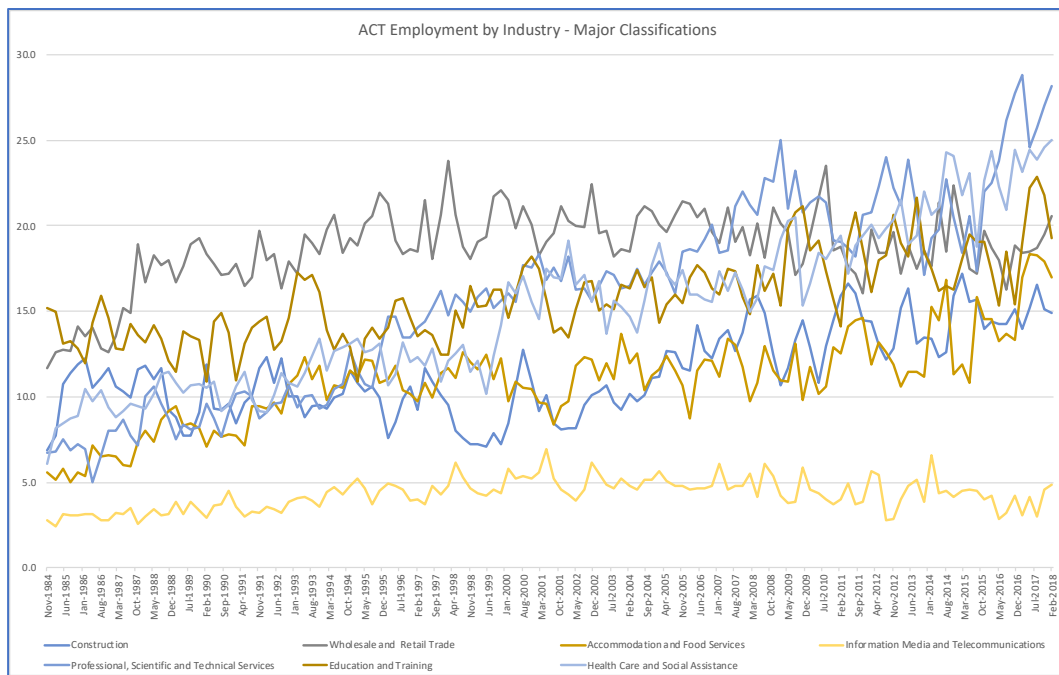
Figure 26: Broad Composition of ACT Employment



As indicated in Figure 9, there are significant trends in other industries –

- Professional and scientific employment is now that largest single category
- Health care and social assistance the second highest
- Education and training the third
- There is comparatively low level of employment in information, media and communications. This may reflect a high ‘non-resident’ component of this category.

Figure 27: Composition of Employment – Other Sectors



Comment

ACT economy has grown through government demand, but private demand, and particularly household consumption demand is becoming increasingly important. Private demand is strongly influenced by population increase.

There has been a major increase in the professional services industry, much of it driven by Commonwealth outsourcing and Commonwealth requirements for knowledge, skills, and experience not available in the public service, or would be too expensive to acquire through direct employment.

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