



# final report

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Prepared by:

Lewis Kahn

University of New England

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# **Development of Strategic Partnerships**

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## Abstract

The purpose of this project was to explore the potential for strategic partnerships between Meat and Livestock Australia (MLA) and tertiary education providers that could catalyse technology development for the benefit of the red meat industry and Australia more broadly.

The approach taken was to understand the business environment for agricultural technology (ag tech) and identify opportunities to enhance ag tech's development for, and introduction to, producers.

Opportunities exist for research and development (R&D) providers such as universities to work collaboratively with ag tech as ag tech works directly with producers iterating their product and service offerings.

Universities are ideally placed to deliver educational programs to support the ability of producers to make informed decisions about investing in technology for their farm operations.

## **Executive summary**

The purpose of this project was to explore the potential for strategic partnerships between Meat and Livestock Australia (MLA) and tertiary education providers that would catalyse technology development for the benefit of the red meat industry and Australia more broadly.

Desirable outcomes identified as targets for such partnersips to address include:

- Demonstration of the value proposition of technologies to help identify applicable, feasible technologies and improve their rate of adoption by producers.
- Improved digital literacy and preparing a workforce to service connected farm environments.
- Improved applicability, integrity and value of ag tech solutions for producers through research providers with appropriate capacity working along side ag tech in the agile product development cycle.
- Increased rural-urban diversity engaged in solving food and agricultural issues to enable producers to continually meet evolving consumer expectations.

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# 1 Background

## 1.1 The promise of ag tech

Today, typical Australian broadacre farmers have access to hundreds of apps, up-to-date weather and seasonal climate forecasts, service providers that can use remote sensing imagery to monitor biomass and soils on their farms and forecast pasture production and crop yield.

Economic modelling conducted through the 'Accelerating precision agriculture to decision agriculture: Enabling digital agriculture in Australia' (P2D) project indicates that digital technologies for agriculture could unlock up to \$20.3 billion in gross value of agricultural production. Connectivity technologies such as sensors serve to help reduce the cost of crop inputs as well as improve yields, sustainability, resilience and quality, while reducing the environmental impact through the reduced used of inputs and wastage.<sup>1</sup>

Over the past two years, momentum has quickly developed within the ag tech system - currently there are more than 250 ag tech companies operating in Australia. The amount of capital invested and the number of players in the innovation system is increasing. Innovation support is important as the failure rate for start-ups runs close to 92% over their first three years in business.<sup>2</sup>

At least ten incubators or accelerators with a focus on agriculture and food innovation have been established in Australia over the past two years. These organisations assist with the development and commercialisation of agricultural technologies — assisting entrepreneurs with going to market and ensuring product-market fit.

# 2 Project objectives

The objective met through this report is understanding the current business environment for ag tech development in Australia in order to identify opportunities for strategic partnerships between Meat & Livestock Australia (MLA), universities and ag tech.

# 3 Methodology

The business environment scan was prepared through desk-top research and industry consultation. Organisations interviewed were:

- 13 ag tech companies (including 1 international)
- 1 large corporate and family producer
- 2 Australian ag tech accelerators/ incubators

<sup>&</sup>lt;sup>1</sup> <u>https://www.crdc.com.au/sites/default/files/CRD18001-001%20CRDC%20P2D%20Report%20low%20res.pdf</u>

<sup>&</sup>lt;sup>2</sup> KPMG and NFF report March 2018: Talking 2030: Growing agriculture into a \$100 billion industry

• 2 agricultural consultants (1 international).

## 4 Results

## 4.1 Environmental scan

## 4.1.1 Global influences

The Food and Agriculture Organisation (FAO) have identified a global shift to sustainable food systems that use land, water, and other inputs efficiently and reduce waste as a key priority.<sup>3</sup>

Key change drivers and trends for world agriculture are:

- Increasing global food demand (FAO predicts food supply will need to increase 60% to meet global demand i.e. feeding >9 billion people by 2050).
- Increasing demand for meat (FAO predicts that between 1997/99 and 2030, annual meat consumption in developing countries will increase from 25.5 to 37 kg per person, compared with an increase from 88 to 100 kg in industrial countries<sup>4</sup>).
- Climate change, unpredictable weather patterns, global warming; need to regenerate natural ecosystems.
- Finite resources (agriculture accounts for 70% of water use world wide).
- Shortening of supply chains.
- Rise of consumer power.
- Consumers expect high ethical standards in the supply chain including dealing with animal welfare.
- Ability and demand to have transparency from production level to retail level including production practices and provenance.
- Lack of clarity about data ownership and control.
- Agriculture commodity prices slowly declining in real terms.
- Reshaping of agriculture by ag tech/ rapid growth of the ag tech sector aspiration to grow the Australian agricultural sector to a value of \$100 billion by 2030.
- Recognition by governments that ag tech can contribute towards addressing productivity challenges – Australian agricultural productivity growth rate at 1.4% is below the world average of 1.7%<sup>5</sup>.
- Confluence of new technologies light emitting diode (LED) improvements, cheaper sensors, more reliable robots; new techniques to mine massive datasets.
- Trend towards decentralisation: The dropping cost to operate farms and the ability to have farms in more environments (especially closer to the end consumer) means that growing produce can become more decentralised. This translates to fewer supply chain shocks, new types of farmers, and food produced closer to the consumer.

<sup>&</sup>lt;sup>3</sup> <u>http://www.foodsecurityportal.org/future-food-and-agriculture-trends-and-challenge</u>

<sup>&</sup>lt;sup>4</sup> http://www.fao.org/docrep/005/y4252e/y4252e07.htm

<sup>&</sup>lt;sup>5</sup> <u>https://home.kpmg.com/content/dam/kpmg/au/pdf/2016/powering-growth-realising-potential-agtech-australia.pdf</u>

- Trend towards accumulating leverage: Software tools are aggregating the leverage of small and mid-size farms while also providing them necessary tools and information about other farmers. With more users on their platforms, these companies can negotiate better prices and perform some of the functions of farming cooperatives.
- Trend towards greater integration: Many companies are moving from one layer of the ag tech stack to another in order to capture more data per customer. Companies that are building proprietary datasets are moving into the service layer, and some companies are starting with a full stack approach from the start.
- Mobile phones have a strong footing in ag tech: The number of mobile users in agriculture is increasing, especially in field-related use. Mobile plays a variety of important roles (remote monitoring, information dissemination, data for ag financial products).
- Fintech + agriculture: New tech-enabled farm financing start-ups believe data can better predict crop pricing and offer financing options. Speed of financing is especially important in agriculture, where extremely short time windows exist to ramp up production due to seasonality.
- Skills for tomorrow's farmers: As farms approach full automation, the skills needed to be a farmer will also shift, blending both knowledge of agronomy/ livestock production and technology.<sup>6</sup>

## 4.1.2 Key drivers for Australian universities

Industry impact and engagement are of paramount importance to both MLA Donor Company (MDC) and to Australian universities. Key drivers for universities are:

- Student numbers.
- Full-fee paying students.
- Higher degree student numbers/ completions.
- High quality training and conversion to postdocs.
- Research funding from competitive grants.
- Research standing (peer reviewed international publications, Excellence in Research in Australia (ERA), Engagement and Impact (EI) Assessment).
- Revenue from commercialisation of university-owned IP.
- Revenue from services provided by the universities.

The Government is intent on limiting its expenditure on higher education. Whilst the immediate pressure from the proposed policy change floated in 2014 to deregulate student fees has been shelved, Commonwealth funding support has now been capped for two years at 2017 levels. This restricts growth in Commonwealth-supported domestic student enrolments and increases the pressure to diversify and increase income streams to sustain Australian universities as leading education providers and world-leading agricultural and environmental research providers.

<sup>&</sup>lt;sup>6</sup> http://www.hyndes.com/uploads/9/2/0/6/9206450/cb-insights\_cultivating-agtech.pdf

## 4.1.3 Productivity growth trends in Australian agriculture

It is producers who pay for technology and supporting services on their farms. They are the ones who need to make value-based decisions about technology adoption. Commonly the ability to take on risk correlates with the capacity to absorb risk financially, and so the financial outlook and confidence of producers is linked with their willingness to adopt.

#### Commodity production forecasts

The gross value of <u>farm production</u> is forecast to decline by 5% to \$59 billion in 2017-18, reflecting an assumed return to average seasonal conditions, before increasing by 3% to \$61 billion in 2018-19.

- The gross value of farm production nevertheless remains high. If realised, the forecast value of farm production in 2018-19 would be around 11% higher than the average of \$55 billion over the five years to 2016-17.
- The gross value of farm production is forecast to grow steadily over the outlook period to around \$63 billion by 2022-23 (in 2017-18 dollars). Strong demand for livestock and some horticultural products, and improved productivity in cropping, are expected to support growth.

The gross value of <u>livestock production</u> is forecast to increase by around 3% to \$29.6 billion in 2018-19, following a forecast increase of 2% in 2017-18.

- The value of lamb, wool and dairy production is forecast to contribute strongly to growth in the value of livestock production in 2018-19 (as in 2017-18), driven by strong export demand (particularly from China).
- The value of beef and veal production is forecast to fall slightly, as a decline in export prices offsets an increase in the volume of beef produced. Despite the fall in price, returns are well above the historical average and supportive of farm profitability.

The gross value of <u>crop production</u> is forecast to increase by 3% to \$31 billion in 2018-19, after a forecast decline of 11% in 2017-18.

#### Commodity export forecasts

Export earnings from farm commodities are forecast to be \$48.5 billion in 2018-19, slightly higher than the forecast \$47 billion in 2017-18.

In 2018-19 export earnings are forecast to rise for canola (22%), cotton (17%), barley (12%), lamb (9%), wool (7%), wheat (6%), and live feeder/slaughter cattle (1%). Forecast higher prices are a strong contributor to growth in export earnings.

Export earnings in 2018-19 for beef and veal, cheese and mutton are forecast to be unchanged.

In 2022-23 the value of farm exports is projected to be around \$49.6 billion (in 2017-18 dollars), 8% higher than the average of \$46 billion over the five years to 2016-17 in real terms.

The value of crop exports is projected to be \$25.2 billion in 2022-23 (in 2017-18 dollars), 2.4% higher than the average of \$24.6 billion over the five years to 2016-17 in real terms. The value of livestock exports is projected to be \$24.4 billion in 2022-23 (in 2017-18 dollars), 15% higher than the average of \$21 billion over the five years to 2016-17 in real terms.<sup>7</sup>

A resurgent US beef industry is competing strongly in Australia's major export markets, causing prices to fall while remaining at profitable levels. Strong demand in Asia, particularly China, is forecast to continue to support higher export prices for lamb, wool and dairy products.

#### Australian broadacre farm performance

In 2017–18 the overall <u>financial performance of Australian broadacre farms is expected to remain high in historical terms</u>. Farm cash income for beef industry farms is forecast to decline from a national average of \$150,600 per farm in 2016–17 to \$132,000 in 2017–18, but remain 60% above the 10-year average to 2016–17. Farm cash income for wheat and other crop farms is forecast to decline, reflecting a fall in production volumes, from a national average of \$426,500 per farm in 2016–17 to \$266,000 per farm in 2017-18. This is around 5% below the 10-year average to 2016–17 (in real terms).

The average rate of return excluding capital appreciation for Australian broadacre farms is estimated to have been 3.4% in 2016–17 and is expected to fall in 2017–18 to average 2.5% as profit falls for many farms.

The projected average rate of return excluding capital appreciation is highest in the sheep-beef industry, at 3.4%.

The largest increase in rate of return excluding capital appreciation in recent years was for very large beef industry farms. Rates of return increased from an average of 3.6% for the five years to 2015–16 to a projected 8.9% in 2017–18.<sup>8</sup>

Generally, larger farms generate higher rates of return as a result of increasing returns to scale, greater access to superior technologies and greater management skill.<sup>9</sup>

Note: Since April 2018 the east seaboard drought in Australia has continued and intensified, with record cattle being turned off and extreme shortages of feed grain driving grain prices up rapidly. This will impact farm profitability, although the red meat industry has accumulated significant farm management deposits (FMD) over the past couple of years.

## 4.1.4 Opportunities for ag tech

It is predicted that appropriate uptake of ag tech will generate significant value to agriculture. For example, Internet of Things (IoT)-based advanced technologies and solutions such as variable rate

<sup>&</sup>lt;sup>7</sup><u>http://www.agriculture.gov.au/abares/publications/display?url=http://143.188.17.20/anrdl/DAFFService/display.php</u> <u>?fid=pb\_agcomd9abcc20180306\_6R2bY.xml</u>

<sup>&</sup>lt;sup>8</sup><u>http://data.daff.gov.au/data/warehouse/agcomd9abcc004/agcomd9abcc20180306\_6R2bY/AgCommodities201803\_v1.0.0\_lr.pdf</u>

<sup>&</sup>lt;sup>9</sup> <u>http://www.agriculture.gov.au/abares/Pages/Productivity-drivers.aspx</u>

technology, precision farming and smart irrigation are predicted to improve farm operational efficiency, yield and to minimise wastage.

#### <u>Global</u>

The global smart agricultural market size was USD 13.7 billion in 2015 and predicted to be USD 26.8 billion in 2020 (US\$189 billion between 2013 and 2022).<sup>10</sup> Ag tech promises to add value to:

- Improve sustainability of land and water through technologies that, for example, reduce chemical use, improve land mapping and enhance water management.
- Improve on-farm productivity and return on assets (ROA).
- Connectivity through the supply chain increasing confidence in food safety and traceability.
- Create jobs with entrepreneurs and new players joining the agricultural industry. This includes leveraging skills from other industries such as mining and attracting new talent and economic growth to regional Australia.

#### <u>National</u>

Ag tech holds the following prospects for Australian agriculture:

- Leveraging world-class research capability and rapid ag tech adoption by producers.
- Adding value to a core national industry through innovation impact.
- Exporting the tech and know-how of Australia.
- Reducing wastage Australia's food wastage, which has an estimated cost of \$8 billion annually, representing 4 million tonnes of produce.
- Improving productivity and sustainability ag tech can for example reduce the impact of weeds on farms and in waterways, which cost the Australian agricultural industry \$1.5 billion in weed control and a further \$2.5 billion in lost production.
- With tractor automation now commercialised here Australia is an initial world leader in adoption of medium and large machine automation in agriculture.

For the livestock industry sectors in Australia, the potential value to be added through smart farming is estimated as follows:<sup>11</sup>

- Beef AUD 2.7 billion.
- Sheep meat 0.5 billion.
- Red meat processing 2.0 billion.

### 4.1.5 Connecting with producer sites

MLA's Producer Demonstration Sites (PDS) program aims to increase the rate of adoption of key management practices and technologies that improve business profitability and productivity, by

<sup>&</sup>lt;sup>10</sup> <u>https://home.kpmg.com/content/dam/kpmg/au/pdf/2016/powering-growth-realising-potential-agtech-australia.pdf</u>

<sup>&</sup>lt;sup>11</sup> <u>https://www.crdc.com.au/sites/default/files/CRD18001-001%20CRDC%20P2D%20Report%20low%20res.pdf</u>

shortening the time lag between technological innovation and adoption of practices by producers. The PDS program supports groups of livestock producers to adapt, validate and demonstrate the business value of integrating new management practices and associated skills into local farming systems. The key outcome of a PDS is producer adoption of the demonstrated management practices resulting in improved business performance.<sup>12</sup>

Ag tech developers are working directly with users in trialling the commercial service offerings. There seems to be no shortage of producers who would like technology tested on their farms. MLA is supporting a group of nine mixed farming producers running beef cattle, sheep and fodder crops in Western Australia who have formed the Technology Innovation Interest Group. The Group's focus is on ground-truthing the claims of technical readiness and the business value proposition with respect to 'smart' farms and utilisation of Internet of Things (IoT) devices.<sup>13</sup>

The Victorian government is investing in trials on-farm for the IoT. These trails involve over 600 farms in four Victorian regions across various farm sectors:

- Grains (Birchip) .
- Sheep (Serpentine).
- Horticulture fruits, nuts, berries (Tatura).
- Dairy (Maffra).

The Victorian government acknowledges that farm trials of this type to date in Australia have largely been focused on research stations and that tackling on-farm implementation at scale has typically been considered as too challenging because of the farm numbers to achieve scale, the physical distances, and the individual nature of farming. They (or KPMG through DEDJTR) say:

*"Digitisation drives but also demands uptake at scale to deliver the greatest return on investment."* 

This is the basis for government intervention and is seen as market failure.

SproutX has developed a register of producers interested in having technology trials on their properties (SproutX Pioneers).<sup>14</sup>

# 5 Discussion

Traditionally innovation for the Australian red meat industry has come from the tertiary education sector, state departments of agriculture, from producers and supply chain participants.

Current government policy and messaging is fuelling innovation growth in Australia. Entrepreneurs with limited experience in farming are contributing their creativity, knowledge and skills to the sector. Given Australia's geography, array of terrains, wildlife and expanse, ag tech

<sup>&</sup>lt;sup>12</sup> <u>https://www.mla.com.au/extension-training-and-tools/producer-demonstration-sites/</u>

<sup>&</sup>lt;sup>13</sup> <u>https://www.farmtender.com.au/primeagnews/9-producers-join-forces-to-test-iot-devices</u>

<sup>&</sup>lt;sup>14</sup> <u>https://milduraregion.com.au/2018/03/08/farmers-wanted-for-sproutx-pioneers/</u>

products need to be able to fit into multiple farming systems and withstand wear and tear. Most importantly they need to deliver value. Ag tech providers are working directly with producers to hone their commercial products and services, and a sufficient number of producers seem to be happy to accommodate their efforts free of charge. This agile approach develops a minimal viable product as rapidly as possible but does not provide for these developments to sit within a connected and cohesive framework of optimal use for producers.

Innovation support is important as the failure rate for start-ups runs is high. Traditional innovation investors such as the Rural R&D Corporation (RDCs) and R&D providers such as the universities can assist ag tech product development if they work along side ag tech providers as they develop products and services directly with producers.

The ag tech industry in Australia is young. As it matures and there are some successes, these companies may look for deeper technological insights and draw on research sector capabilities to assist. Contract research for ag tech will require agile teams with the skills to rapidly grasp the latest technological developments presented to them.

Along with the challenges that producers have with appropriate internet connectivity in Australia, producers are uncertain about the capability and therefore value of ag tech for their farming system. There is a need for demonstrations, for digital education and effective ways to integrate information from multiple sensors and devices so it supports improved operational decision-making.

It is in these spaces that research providers such as Australian universities can generate value for industry by developing multiple linkages with many different players in the ag tech ecosystem, and strategic research collaborations.

## 6 Key messages

There are opportunies for strategic partnering between MLA and R&D providers such as Australian universities to:

- Demonstrate the value proposition of technologies to help identify applicable, feasible technologies and improve their rate of adoption by producers.
- Improve digital literacy and preparing a workforce to service the connected farm.
- Improve the applicability, integrity and value of ag tech solutions for producers through research capacity working along side ag tech in the agile product development cycle.
- Increase the level of rural-urban diversity engaged in solving consumer food and agricultural industry issues enabling evolving consumer expectations to be met.

# Appendix A: Business environment scan

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#### **Related research and research providers**

#### UNE-MLA Livestock Productivity Partnership (LPP)

The Livestock Productivity Partnership (LPP) is a \$50 million open partnership between MDC (50%, which is co-funded by the Australian Government), NSW DPI, CSIRO and UNE.

The goal is to contribute to a national increase in productivity improvement in the red meat industries from 1% to 2.5% pa by developing regional and system-specific feedbase options, and new animal phenotyping and farm management tools, primarily for producers in NSW and southern/central Queensland. Some LPP research outputs will deliver benefits to livestock enterprises in other regions to varying degrees, and others will have national impact.

LPP is developing and commercially validating options to improve:

- Year-round feed supply to better meet animal requirements, via
  - Filling seasonal feed gaps.
  - A more versatile feedbase to meet livestock seasonal nutritional requirements.
  - A more productive and resilient feedbase matched to resources and environments.
  - An improved understanding of key soil constraints and their amelioration.
- Nutrient utilisation (efficiency) by ruminants to enhance growth, maternal efficiency and better meet market specifications, including via
  - Identification of animals that are more efficient when grazing, and what makes them more efficient.
  - Modification of animal (rumen) function.
  - Developing information that allows more accurate formulation of supplements and rations to enable more efficient growth and higher achievement of market specifications for ruminants.
  - Management alerts and interventions to reduce mortality and underpin social licence to operate.
- Whole farm management and supply chain investment decisions, through provision of next generation measurement systems and tools based on predictive analytics using enhanced scientific models combined with historical weather records and forecasting abilities. Key focus areas include:
  - Validated recommendations of regional combinations of new feedbase and livestock management options that can increase whole farm profitability.
  - A science framework that underpins regionally-specific data and algorithms that increase the range and value of existing decision support tools.
  - Easier-to-use decision tools, developed with producers and their advisers.

#### Food Agility CRC

The Food Agility CRC is receiving funding of \$50M over ten years through the CRC program. The total budget including participant contributions is \$150 million over 10 years.<sup>15</sup> The bid was led by the Knowledge Economy Institute at the University of Technology Sydney (UTS) together with Queensland University of Technology (QUT) and Curtin University.

The Food Agility CRC has 54 participants (7 universities, 3 RDCs, 7 government departments) from food, technology and research sectors. The CRC will integrate the agile culture and processes of the digital economy through a whole-of-value-chain lens for fresh and processed food. They plan to develop and use digital technologies for sharing data to build brand, markets, jobs and exports across the food value chain so that:

- Producers can capture value by responding to rapidly changing consumer preferences.
- Exceptional quality and food safety records can drive our brand.
- Environmentally and socially sustainable practices are driven by data.
- Reduced risks incentivise investment.
- A digitally capable workforce drives productivity and higher margins.
- Trans-disciplinary research solves business problems.
- Industry can access social media and consumer preference market insights.

The R&D programs in the prospectus are provided below.

PROGRAMME	1. PRODUCE THE RIGHT THING	2. LEVERAGE BRAND AUSTRALIA	3. ACCESS TO FINANCE	4. BUILD FUTURE WORKFORCE		
RP 3 - SUSTAINABLE FOO	OD SYSTEMS					
ACTIVITIES	OUTPUTS					
Trusted Food Systems     Dynamic Business Models     Governance & Regulation     Future Workforce	Market insight platform(s)	Inter-operative digital systems	New financial services & products	Training systems increasing digital capability & use		
RP2 - AGRIFOOD INFORMATICS						
ACTIVITIES	OUTPUTS					
<ul> <li>Situational Awareness</li> <li>Decision Making &amp; Optimisation</li> <li>Adaptation to Emerging Opportunities &amp; Threats</li> </ul>	Informatics tools	Data-enabled decision systems	Tools for detecting and managing opportunities & risks	Optimisation of business decisions		
	UNDERPINNING INFRASTRUCTURE					
<b>RP1 - DIGITAL AGRIFOOD</b>	TECHNOLOGIES					
ACTIVITIES	OUTPUTS	OUTPUTS				
Sensing Platforms     Robust IoT Infrastructure     Certified Food	Sensing technologies & platforms     Cost-effective integration & management of data along the food value chain     A secured food chain tracking system     Development & deployment of commercial solutions and start-ups					

<sup>&</sup>lt;sup>15</sup> <u>https://home.kpmg.com/content/dam/kpmg/au/pdf/2016/powering-growth-realising-potential-agtech-australia.pdf</u>

#### Data to Decisions (D2D) CRC

D2D CRC's vision is to be a leading provider of Big Data capability resulting in a safer and more secure nation and a sustainable Big Data workforce for Australia. They plan to deliver outcomes to national security and other data intensive sectors. The D2D CRC is funded at \$25M (started in 2014) and has 24 partners.

D2D CRC have collaborated with the Sheep CRC to develop new database products to make sheep management easier and achieve better outcomes for sheep well being and productivity. The Sheep CRC and D2D CRC are working together with agricultural data collection firms to develop an application, which adds precision when managing the wellbeing of livestock. The application will complement farmers' grazing knowledge with detailed data about their livestock, pastures, and genetics, and predict opportunities and threats to their business from the weather, pests or disease.

D2D CRC partnered with 15 RDCs in the 'Accelerating precision agriculture to decision agriculture' (P2D project), about the use of big data in agriculture – increasing the profitability of producers, providing clarity about data ownership and access rights, and improving farming strategies. This project is supported by funding from the Australian Government through DAWR as part of its Rural R&D for Profit program.

#### CRC for Spatial Information (CRCSI)

This CRC is currently in its final stages of its first round funding.

The CRCSI includes research programs to:

- Solve the signal processing and economic impediments to the creation of a sparse, continental-scale, precise positioning multi-GNSS network operating at 2 cm (x and y) accuracies.
- Improve the ability and efficiency of government and industry to rapidly create and valueadd spatial information products, manually or through automation, from devices and cloud-based infrastructure.
- Identify and exploit the emerging capabilities of the semantic web to enable Foundation Spatial Data and their spatial data supply chains to create value-added applications.
- Realise high impact use of the CRCSI's research in the following areas including Agriculture, Natural Resources and Climate Change through creation of a biomass and carbon monitoring system for high resolution and high frequency application on farms and through improved environmental monitoring.

The CRCSI has pioneered the development of a new global form of precise positioning called Precise Point Positioning Using State-Space Representation in Real-Time Kinematic (RTK) Networks. PPP-RTK uses signals from all six global orbitals and a regional satellite system constellation. This precise location technology is used in the mining industry and is linked to Satellite-based Augmentation System (SBAS). CRCSI research has solved the complex signal processing challenges and primed Australia for the completion of the outdoors component of the National Positioning Infrastructure plan that will deliver sub 5cm accurate, real-time positioning to all users anywhere.

The CRCSI also developed the framework for the transition to semantically web enabled spatial databases that provide the foundation spatial data for the nation (including geocoded addressing,

cadastre and property boundaries). The research has led to the development of the concept of the Spatial Knowledge Infrastructure that provide intelligent platforms for web-enabled supply chains across the economies of Australia and New Zealand.

CRCSI has led the creation of the Natural Resource Management (NRM) Spatial Hub servicing 750 pastoralist and land management enterprises covering 60,000,000 ha with real time groundcover monitoring based on satellite imagery. The Hub is currently being remodelled as a financial sustainable business and rebranded as Farm Map Australia. The Australian Livestock Spatial Information Program is working with about 70 organisations representing most of the red meat supply chain to fully spatially enable the supply chain from paddock to plate.

#### Food and Agribusiness Industry Growth Centre (FIAL)

The Industry Growth Centres Initiative run by the federal Department of Industry, Innovation and Science is helping Australian firms to be more internationally competitive by enabling industry sectors to build capability and stronger industry systems through a collaborative, industry-led approach.

Growth Centres (there are six of them) are working across their respective sectors towards a common goal of internationally competitive Australian industry with a strong presence in the global marketplace. They are achieving this by focussing on:

- Facilitating Australian businesses to be more engaged in global supply chains and export markets to drive increased exports.
- Improving collaboration between industry and the research sector, and within industry itself, to drive innovation to meet market needs.
- Improving management and workforce skills to encourage commercialisation, increase productivity and take advantage of increased export market access.
- Reforming regulation where appropriate to reduce regulatory costs and other burdens, including those self-imposed by industry, to assist long-term growth.

Each Growth Centre has a Project Fund to support collaborative projects that contribute to the strategic direction outlined in the Sector Competiveness Plan. Growth Centres also partner with existing resources and networks such as Government programs and industry associations to deliver on the Plan.

One of the six growth centres is in food and agribusiness - formally the Food and Agribusiness Growth Centre and trading as Food Innovation Australia Limited (FIAL).

FIAL's vision: By 2025, the industry is working together to grow the share of Australian food in the global marketplace.

FIAL's objectives:

- Access new markets.
- Increase the productivity and/or competitiveness.

The inputs necessary to achieve these outputs are:

- Industry players have the confidence and capacity to use their knowledge, resources, skilled workforce and associated capabilities to develop innovative, cost-effective and differentiated offerings that meet the wants and needs of Australian and international markets and consumers.
- A culture of connected, collaborative industry participants who desire transformational change, and continue to proactively seek and utilise collaborations for national and international market and supply chain success.
- The cohesive and clear voice of industry, influences and shapes policy, and identifies opportunities for regulatory reform that fosters industry-wide innovation and entrepreneurship, in partnership with government.

FIAL runs the Fast and Furious Innovation course<sup>16</sup>, designed and developed by FIAL and Xpotential ANZ. It costs participants between \$200 and \$400 to participate.

<u>University of Sydney (USyd), Sydney Institute of Agriculture, Plant Breeding Institute (Narrabri) IA</u> <u>Watson Grains Research Centre and the Australian Centre for Field Robotics</u><sup>17</sup>

The University of Sydney (USyd) has performed a decade of research into autonomous remote sensing ad developing robotics and intelligent software for horticulture and livestock industries.

USyd's faculty of Engineering and Information Technologies host the Australian Centre for Field Robotics (ACFR).<sup>18</sup> The Centre carries out research, development and application of autonomous and intelligent robots, and systems for use in outdoor environments.

ACFR's mission is to undertake research to develop new field robotics and intelligent systems theories and methods, and apply them in industrial, social and environmental settings, focussing effort to developing technologies:

- Sensors, fusion and perception.
- Movement, control and decisions.
- Modelling, learning and adapting.
- Architectures, systems and cooperation of robotics and intelligent systems.

The research conducted at the Plant Breeding Institute (PBI) concentrates on plant production, plant breeding and related areas. Plant breeding encompasses a wide range of skills and disciplines including molecular biology, plant pathology, agronomy and cereal chemistry. Plant production research, plant breeding research and cultivar development activities at PBI span the laboratory and field.

#### AgriGrowth Tasmania

AgriGrowth Tasmania – a division of the Primary Industries, Parks, Water and Environment Department - was created in June 2014. AgriGrowth Tasmania's role is:

• Work directly with industry to seize new opportunities – especially in premium food production – and identify opportunities for Tasmania to increase its market share.

<sup>&</sup>lt;sup>16</sup> <u>https://www.fastnfurious.com.au</u>

<sup>&</sup>lt;sup>17</sup> <u>https://sydney.edu.au/agriculture/</u>

<sup>&</sup>lt;sup>18</sup> <u>http://www.acfr.usyd.edu.au</u>

- Identify new opportunities in value-added food production— such as working with the dairy industry to partner the growth in demand for packaged milk in the Asian markets and how Government can support industry investment in infrastructure.
- Work in partnership with the Tasmanian Institute of Agriculture (TIAR) to identify more targeted research and development that directly benefits industry and improves productivity and competitive.
- Work with the education and skills sector to identify directly linked training programs to support the skills requirements of our agriculture sector.
- Identify how our competitive advantages can play a greater role in exploiting Tasmania's premium brand.
- Create a single division rather than multiple sections to simplify how industry works with Government.
- Work directly with industry to develop strategic plans for each of the agricultural sectors that identify the potential and strategies to reach that potential.

#### Charles Sturt University (CSU) and NSW Department of Primary Industries (NSWDPI)

Wagga Wagga is an agricultural hub particularly for grains and livestock. It has a growing reputation for international agricultural research, education and technology commercialisation based on its cluster of AgTech research centres including CSU, industry groups and businesses.

The Graham Centre for Agricultural Innovation, an Australian Centre of Excellence for innovation in grain and red meat production and value adding, is part of the hub. Established in 2005, the Graham Centre is a research alliance between the NSWDPI and CSU. It offers partnering opportunities with growers, producers, industry and researchers, supported by world-class facilities to improve the productivity, profitability and sustainability of grain and red meat value chains. It has strong international ties, particularly with Pakistan, India, China, South East Asia and the Philippines.

Other centres at the hub include the Wagga Wagga Agricultural Institute, the NSW Centre of Excellence for Southern Farming Systems and Viticulture, and the National Wine and Grape Industry Centre. Wagga Wagga's cluster has successfully attracted established centres from other parts of Australia, such as AgriFutures Australia.

CSU is home for AgriTech Incubator (see page 27).

#### Monash University

Monash is a large (46,000 undergraduates; >70,000 students in total in 2015) university in Melbourne. It does not currently offer traditional agricultural training at undergraduate and post grad levels. However they do have a Food Innovation Centre, which is an industry shared service platform providing accessible world class expertise, capabilities and facilities at cost - that are designed to grow business for local Australian and export markets. The Food Innovation Centre offers:

- Front-end consumer research services.
- Consumer and shopper research services with eye tracking.
- Design services for product, pack and point of sale.

- Virtual store application.
- Access to R&D end to end experts to help with market execution.
- Innovation capability programs (Monash Food Incubator, Rocket Launcher and Rocket Seeder).

Below is the Monash University's Food Innovation Centre approach to increase the odds of success.<sup>19</sup>





<sup>&</sup>lt;sup>19</sup> <u>https://www.foodinnovationcentre.com.au/about</u>

Monash University and Bosch have partnered to create a 'smart agricultural research facility'. It will house a prototypical smart farm and enable collaborative industry partnerships and research. It will include cropping trials and early-stage proto-type development, enabling the use of artificial intelligence, automation, robotics and advanced sensor technology.<sup>20</sup>

#### James Cook University

The James Cook University (JCU) combined with CSIRO, Queensland University of Technology (QUT) and the Queensland Government on the Digital Homestead project<sup>21</sup>, which evaluated how information Communications Technology (ICT) such as wireless sensor networks (WSN's), data analytics and rural connectivity could support greater profitability for the Northern beef industry.

Elements of the project have been brought together through the development of a browser-based data dashboard, combining on farm sensors and external data sources including weather forecasts, market pricing, live weather monitoring, tank levels and aspects of a producer's herd such as cattle location, activity and weight.

#### Queensland University of Technology

Queensland University of Technology (QUT) is involved in a number of ag tech projects, including AgBot, Harvey, Digital Homestead and the IntelliSensing research program. At the Digital Homestead, QUT researched the application of machine vision and learning techniques for pasture monitoring.

QUT is also working with the Northern Territory Farmers Federation and the Federal Government to capture precision data of the nitrous oxide emissions from farmed soil.

#### Queensland Alliance for Agriculture and Food Innovation

The Queensland Alliance for Agriculture and Food Innovation (QAAFI) was formed from the combined scientific expertise of researchers from The University of Queensland (UQ) and the Queensland Government. QAAFI is comprised of three inter-related research centres, with a focus on the challenges facing tropical and sub-tropical food and agribusiness sectors in the tropical and subtropical systems.

#### University of Southern Queensland (USQ)

The Institute for Agriculture and the Environment brings together USQ's existing capability in agricultural engineering, plant pathology, climate science and agribusiness and puts them into a single research institute, to provide focussed effort to service the rural sector.<sup>22</sup>

<sup>&</sup>lt;sup>20</sup> <u>https://www.iothub.com.au/news/australia-first-agtech-research-centre-in-melbourne-479387</u>

<sup>&</sup>lt;sup>21</sup> <u>http://www.digitalhomestead.org</u>

<sup>&</sup>lt;sup>22</sup> <u>https://www.usq.edu.au/transcripts/research-iage-steven</u>

National Centre for Engineering and Agriculture at CSU has research programs (supported by industry funding) on precision agriculture, smart technologies, spatial analysis, remote sensing and monitoring.<sup>23</sup>

#### University of Western Australia (UWA) and the UWA Institute of Agriculture

The Institute harnesses the University strengths and diversity through four strategies:

- Communicating: Strengthening communication links with regional industry, farmer groups and the broader regional and scientific communities.
- Resourcing: Increasing the pool of resources available for investment in critical research, development, extension and adoption (RDE&A) in Western Australia and in relevant national and international issues.
- Integrating: Bringing together the University's agricultural research, and communication activities; integrating complementary activities across disciplines and organisational units, and providing a focus for leading-edge RDE&A.
- Connecting: Fostering national and international linkages and alliances that bring new knowledge and expertise to Western Australia, and allow Western Australia to share its knowledge with the world.

The Future Farm 2050 Project<sup>24</sup> is based on UWA Farm Ridgefield, a 1,600 hectare farm near Pingelly, Western Australia. The Project operates across the whole of Western Australia and links internationally. Their intention is to establish an international network of organisations that are examining future farming systems.

#### Victorian Government

The vision for the Agriculture Research and Development division of Agriculture Victoria in the Victorian Department of Economic Development, Jobs, Transport and Resources (DEDJTR) is to develop innovative farming systems that deliver production and environmental benefits for the temperate zone of south east Australia. The capability of the division is organised into two platforms: Agrifood Production Systems and Agricultural Resources.

DEDJTR is investing \$12 million in on-farm IoT trials in four regions in Victoria covering grains, sheep, horticulture and dairy.<sup>25</sup> The purpose of the IoT trials is to assess the contribution that IoT makes to farm performance. DEDJTA's desired outcome is to stimulate state-wide cultural and structural transformation around the application of digital technologies in Victorian agriculture.<sup>26</sup>

Agriculture Victoria is collaborating with Bosch Australia on research into using cloud-based technologies to make the most of data-rich smart farms for Victorian producers. The Victorian Government has invested in Rocket Seeder and SproutX.

<sup>23</sup> https://www.usq.edu.au/icacs

<sup>&</sup>lt;sup>24</sup> <u>http://www.ioa.uwa.edu.au/future-farm-2050/animals</u>

<sup>&</sup>lt;sup>25</sup> <u>https://www.iothub.com.au/news/australia-first-agtech-research-centre-in-melbourne-479387</u>

<sup>&</sup>lt;sup>26</sup> <u>https://economicdevelopment.vic.gov.au/\_\_\_data/assets/pdf\_file/0006/1631841/KPMG-summary-report-CRCP-IoT-trial-080318.pdf</u>

#### Cross-sectoral RD&E needs

RDCs diligently deliver benefits to their levy payers and the community. One area where there is at least a perceived weakness in the RDC system is in identifying cross-sectoral issues and tackling these collaboratively leading to underinvestment.

Government calls for RDCs to collaborate, particularly on cross-sectoral issues, have increased in intensity over the last decade. Development of the Primary Industries Standing Committee (PISC) RD&E Framework with its cross-sectoral strategies aims to coordinate rural RD&E investment in agreed government/ RDC-cross-sectoral areas identified by the Primary Industries Standing Committee (PISC):

- Animal biosecurity.
- Animal welfare.
- Climate change.
- Food and nutrition.
- Plant biosecurity.
- Soils.

Growers articulate cross-sectoral issues as:

- Water use efficiency Improved connectivity.
- Risk management tools focussing on improving access to finance and insurance.
- Education to improve digital literacy.
- Demonstration of new technologies and services linked to the value they add to the bottom line for producers.<sup>27</sup>

Rural R&D for Profit<sup>28</sup> is a \$200 million competitive grants program providing grants to RDCs for collaborative research that enhances farm-gate profitability and supports the continued innovation of Australia's primary industries. Rural R&D for Profit program objectives are for:

- Advanced technology.
- Biosecurity.
- Soil, water and managing natural resources.
- Adoption of R&D.

<sup>&</sup>lt;sup>27</sup> Personal communication about a Grain Growers Australia survey

<sup>&</sup>lt;sup>28</sup> <u>http://www.agriculture.gov.au/SiteCollectionDocuments/agriculture-food/innovation/rural-research-development-profit-guidelines.pdf</u>

#### Accelerators and incubators

#### NSWDPI Global Ag Tech Ecosystem (GATE)

The GATE is a NSWDPI initiative to fast-track the development of ag-tech to increase productivity. It is a collaborative partnership with research and technology providers, universities and industry organisations.

Hosted at the Orange Agricultural Institute, the facility will provide access to NSWDPI including the expertise of over 600 scientific and technical staff.

The GATE offers access to the long term data sets held by NSWDPI and facilitates on-farm validation of new technologies across 25 research stations and 13,000 ha of trial farms (on a fee for service basis where appropriate). NSWDPI is also leveraging its long standing relationships with national R&D organisations to enable a pipeline of ag-tech ideas to flow into the GATE.

NSWDPI has joined with Sparklabs Cultiv8, an accelerator and venture capital provider linked to Sparklabs, Asia's largest technology focused accelerator. Sparklabs Culitv8 has a residency at the GATE.

Every year the GATE will host up to 20 GATE projects plus additional individuals for lean start-up and mentoring.

The GATE offers five key services:

- Lean start-up and mentoring services to expand capabilities of innovators.
- Incubator services and support to assist proof of concept stages.
- Accelerator services and support for prototype scale up and production reliability.
- Commercialisation and business support including advising on business structures and planning, intellectual property (IP) management, market appetite testing and commercialisation paths.
- Investor Showcases. GATE enables investment via partner and affiliate networks and hosts investor showcases for GATE projects.

NSWDPI GATE will collaborate with Charles Sturt University (CSU) in Wagga Wagga and with University of New England (UNE).

NSWDPI has invested in the Sustainable, Manageable, Accessible Riral Technologies (SMART) Region Incubator to create the communal workspace. NSWDPI has also invested to the AgriTech Incubator based at CSU.

JobsforNSW has invested in the New England Ag Tech Cluster.

Canberra Innovation Network (CBRIN)<sup>29</sup> is providing services to GATE.

<sup>&</sup>lt;sup>29</sup> <u>http://cbrin.com.au/</u>

#### Charles Sturt AgriTech Incubator

The mission of the AgriTech Incubator is to support the development of the start-up ecosystem and SME business innovation in the wider Riverina NSW by:

- Supporting human capacity and infrastructure development.
- Supporting other regional development, government and business agencies working towards similar goals.
- Collaborating with local businesses actively supporting start-ups and SMEs.

The AgriTech Incubator will achieve these goals through:

- Tailored incubator programs.
- Providing co-working spaces in a dedicated Incubator Hub on CSU's Wagga Wagga Campus.
- Offering specialised programs supporting women and girls into tech and entrepreneurial activities.
- Providing TechVouchers to support small businesses solve R&D challenges (vouchers are up to \$15,000 of matching funding and give access to CSU's technology capabilities).

#### <u>SproutX</u>

SproutX started as an idea for collaboration between Findex and the National Farmers Federation (NFF). It has grown into an accelerator program and national co-working space network. SproutX brings together the entire ag tech ecosystem in the one place. This includes government, corporate, investment, entrepreneurs, industry and farmers.



#### <u>AgriStart</u>

AgriStart in Western Australia provides a holistic program of innovation and the adoption of innovation across the agricultural sector. It includes commercialisation workshops in regional agri centres, a state-wide technology accelerator program, an export webinar series for growers, and a program of events introducing sector experts and innovation facilitators.

The AgriStart HARVEST Accelerator program was officially launched in February 2018.

Supporting late-stage start-ups and SMEs looking to scale their businesses, AgriStart's HARVEST program includes more than 40 industry experts from local and global businesses. It covers topics such as strategic expansion planning, export pathways, applying new technologies, investor readiness, pitch coaching, media training and concludes with a pitch day to a large group of capital investment companies.

#### Cisco

Cisco is cultivating an agricultural IoT stronghold in Sydney through the establishment of a new Innovation Central collaborative facility. The facility is one of two in Australia, after Cisco launched a centre in Perth late last year to focus on IoT and big data in resources and astronomy.

Between the two centres, Cisco will spend US\$15 million (\$21 million) over the next five years, mostly in staff and administration costs.

Though the Sydney centre is hosted by incubator ATP Innovations, it is not specifically targeting collaborations with IoT start-ups, preferring instead to focus on companies with a bit more time and experience in the market.

Cisco's partners include CSIRO Data61, UNSW and ATP Innovations. As the facility in Sydney attempts to grow its agricultural technology capability, it has the support of the National Farmers' Federation, NSW Farmers and the NSW DPI in trying to improve farm yields and resource usage.

They see the centre as an opportunity to impress the benefits of digital technology on farmers, noting that many farming sectors were already early adopters of innovative ag tech.<sup>30</sup>

#### Growlab (Cicada)

Growlab is a specialised program for deep tech start-ups looking to improve the Australian and global food and agriculture sectors. Companies participating in Growlab range from biotechnologies to remote sensing and robotics, food processing technologies to food products.

Cicada Innovations' partners are:<sup>31</sup>

- University of Technology Sydney (UTS), the Australian National University (ANU), University of NSW (UNSW), The University of Sydney (USyd).
- Cook Medical, Macquarie, MLA, Ventia.
- AusIndustry, Sydney Angels, HeadsoverHeals, Austrade, NSW Health, NSW Trade and investment, City of Sydney, CSIRO, Data 61, Startmate, AcademyX.
- Davies Collison Cave, Crowe Horwath, Addisons.

<sup>&</sup>lt;sup>30</sup> <u>https://www.iothub.com.au/news/cisco-launches-iot-innovation-centre-in-sydney-415119</u>

<sup>&</sup>lt;sup>31</sup> <u>http://cicadainnovations.com/growlab/</u>

#### Rocket Seeder

Rocket Seeder<sup>32</sup> accelerates the pace of food and agriculture innovation, by helping entrepreneurs right across the food and fibre value chain bring new products and services to market, from production to consumption, including food, beverages, software, hardware, chemistry, materials, equipment, packaging, new processes and new business models. Rocket Seeder builds communities around entrepreneurs and provides the growing conditions so they can start-up fast and grow rapidly.

MDC has partnered with Rocket Seeder to deliver a series of innovation and entrepreneurship activities through 2018, designed to encourage food innovators to explore opportunities utilising red meat.<sup>33</sup>

#### New England Ag Tech Cluster

Armidale has been selected by the NSW Government to host one of three pilot projects, or 'clusters', which aim to deliver rural innovation and create jobs for the future.

An initiative of the NSW Government-backed JobsforNSW, the Cluster will work across research, ideas development, commercialisation and education, helping to grow networks and idea sharing, investment and global relationships.

The Cluster is 12 months old and builds on the region's strengths:

- Existing mature ag tech clustering such as Agricuktural Business Research Institute (ABRI), Animal Genetics and Breeding Unit (AGBU), National Breed Societies.
- High density of ag tech start-ups.
- High density of scaling ag tech businesses.
- Strong coalition of the willing including Chamber of Commerce and Local Government as key local enablers and UNE SMART Farm<sup>34</sup> and SMART Region Incubator (SRI)<sup>36</sup>.
- Fibre to the Premise NBN supplemental band with using AARNET and satellites.
- Surrounded by diverse and productive high gross value of agriculture (GVAP) landscapes, including livestock in the north west, irrigation in the west, and broad acre farming (double cropping).
- Strong history in developing livestock genetics and decision support software around breeding moving to next gen livestock sensor and real time monitoring.

The cluster involves about 30 commercial enterprises.

<sup>&</sup>lt;sup>32</sup> <u>www.rocketseeder.com</u>

<sup>&</sup>lt;sup>33</sup> <u>https://www.rocketseeder.com/2018/02/food-innovators-explore-opportunities-red-meat/</u>

<sup>&</sup>lt;sup>34</sup> http://www.une.edu.au/research/research-centres-institutes/smart-farm

#### UNE SMART Region Incubator<sup>35</sup>

The UNE Business School is home to the UNE SMART Region Incubator (SRI). With facilities based in Tamworth and Armidale, the incubator offers opportunities for joint efforts by UNE and the regional community to generate new business, boost exports and add value to people and products.

The NSW Government co-funded the establishment of SRI in 2017 through a project entitled 'Establishment and support of an incubator to exploit the scientific knowledge base of UNE and the entrepreneurial drive of the New England and Northwest'.

SRI is currently a partner in a project to develop a data platform that provides an entry point for business to UNE's data, expertise and industrial applications.<sup>36</sup>

UNE SMART Region Incubator, together with Cisco Technical, runs an event called Agmentation.<sup>37</sup> Agmentation is a concentrated hackathon-style activity to focus on what might be preventing the region's farmers from reaching optimum performance.

#### Ignite Ideas - Advance Queensland – Queensland Government

The Ignite Ideas Fund supports start-ups and small to medium Queensland businesses to commercialise market ready innovative ideas that will help them grow and compete in a global market and create new jobs.

Advance Queensland<sup>38</sup> has an industry accelerator program offering programs to help high growth small and medium sized enterprises and potential start-ups fast track ideas from concept to commercialisation, positioning participants to successfully market their products and services to leading edge customers.

#### Relevant Australian Government incentive schemes

Australia's policy settings are to encourage innovation and private investment into R&D. Many of the programs are administered by AusIndustry.

#### R&D tax incentive<sup>39</sup>

In many circumstances, companies investing in R&D can reap the benefits from the R&D tax incentive, which encourages companies to engage in R&D benefiting Australia, by providing a tax offset for eligible R&D activities. It has two core components:

<sup>&</sup>lt;sup>35</sup> <u>http://www.une.edu.au/about-une/academic-schools/unebs/centre-for-agribusiness/smartincubator</u>

<sup>&</sup>lt;sup>36</sup> <u>https://www.une.edu.au/research/research-centres-institutes/centre-for-agribusiness/pipeline</u>

<sup>&</sup>lt;sup>37</sup> <u>http://smartri.com.au/connect/agmentation/</u>

<sup>&</sup>lt;sup>38</sup> <u>https://advance.qld.gov.au/</u>

<sup>&</sup>lt;sup>39</sup> <u>https://www.ato.gov.au/Business/Research-and-development-tax-incentive/</u>

- A 43.5% refundable tax offset for eligible entities with an aggregated turnover of less than \$20 million per annum, provided they are not controlled by income tax exempt entities.
- A 38.5% non-refundable tax offset for all other eligible entities (entities may be able to carry forward unused offset amounts to future income years).

The rate of the R&D tax offset is reduced to the company tax rate for that portion of an entity's notional R&D deductions that exceed \$100 million for an income year. This change applies to assessments for income years starting on or after 1 July 2014 and before 1 July 2024.

It is possible for a company with less than \$20 million turnover investing \$250,000 into R&D to receive \$108,750. Assuming that \$108,750 is invested in R&D, then a further \$47,306 would be available, then 20,578 and so on. This means the original investment by two thirds through this Australian Government scheme.

At a minimum, applicants must:

- Be an incorporated company.
- Be conducting eligible core R&D activities. These are defined in the legislation as being experiments that are guided by hypotheses and conducted for the purpose of generating new knowledge.
- Have incurred eligible R&D expenditure or notional deductions of at least \$20,000 (unless using a Research Service Provider or a Cooperative Research Centre).

<u>Accelerating Commercialisation<sup>40</sup></u> provides expert guidance, connections and financial support to assist small and medium businesses, entrepreneurs and researchers to find the right commercialisation solutions for their novel products, process or service. Funding is through competitive matched grants of up to \$1 million over two years for commercialisation activities.

<u>Incubator Support<sup>41</sup></u> provides funding to new and existing incubators to deliver services aimed at improving the prospects of Australian start-ups achieving commercial success in international markets. Funding is available to support the establishment of new incubators in regions or sectors with high innovation potential, and to expand the services of existing, high performing incubators. Funding is provided through matched grants.

<u>Business Management<sup>42</sup></u> is a program providing experienced Business Advisers and Facilitators that review business operations, including business direction, strategy, growth opportunities and supply chain. They provide a report with strategies for business improvement.

- Business Evaluations provides an analysis of the eligible business carried out on-site by skilled and experienced Business Advisers.
- Supply Chain Facilitation helps small and medium businesses to better understand the specific needs of their buyers and develop the capabilities needed to access additional supply chain opportunities.

<sup>&</sup>lt;sup>40</sup> <u>https://www.business.gov.au/Assistance/Entrepreneurs-Programme/Accelerating-Commercialisation</u>

<sup>&</sup>lt;sup>41</sup> <u>https://www.business.gov.au/Assistance/Entrepreneurs-Programme</u>

<sup>&</sup>lt;sup>42</sup> <u>https://www.business.gov.au/Assistance/Entrepreneurs-Programme</u>

- Growth Services advisers assist businesses to develop strategies and execute processes to grow.
- Business Growth Grants small, co-funded grants to engage external expertise to assist businesses with implementing improvements recommended by their Business Evaluation, Supply Chain Facilitation or Growth Service.

<u>Innovation Connections</u> <sup>43</sup>— encourages and facilitates small and medium-sized businesses to access knowledge, engage with researchers and foster innovation. Innovation Facilitators help businesses assess the gaps in their knowledge and provide specialist support through the following services:

- IT Facilitation helps business to find solutions to their information technology needs.
- Technology and Knowledge Facilitation helps business to find expertise, technology and advice.
- Research Facilitation identifies critical and strategic research needs for business.

Following completion of a Research Facilitation, a business may apply for matched funding grants of up to \$50,000 to engage and collaborate with a publicly funded research organisation, or \$30,000 to employ a recent graduate to work on a research project within the business.

<u>Cooperative Research Centre - Projects (CRC-Ps)<sup>44</sup></u> support short term, industry-led collaborative research up to a maximum of three years. CRC-P grants are capped at a maximum of \$3 million.

<u>Venture Capital Limited Partnerships (VCLP)<sup>45</sup></u> aim to stimulate Australia's venture capital sector by attracting foreign investors. They are open to domestic investors. The advantage of VCLP registration is via tax exemptions. Registration entitles a partnership to flow-through tax treatment including, in some cases, a complete tax exemption for investors on their share of the partnership's income.

<u>Early Stage Venture Capital Limited Partnerships (ESVCLP)<sup>46</sup> aim to stimulate the Australian early</u> stage venture capital sector. The program provides the fund manager flow-through tax treatment, and for investors, tax exemptions on their share of returns.

<u>The Global Innovation Linkages (GIL) Program<sup>47</sup></u> is a key initiative of the National Innovation and Science Agenda (NISA) and provides funding to assist Australian businesses and researchers to collaborate with global partners on projects with a strategic focus and leading-edge research and development. The program supports projects focused on developing high quality products, services or processes that will respond to industry challenges.

Eligible participants will be able to apply for grants of up to \$1 million over a grant period of up to four years. Each round of the program focuses on specific priority areas aligned with the Australian Government's Industry Growth Centres of research and specific priority economies.

<sup>&</sup>lt;sup>43</sup> <u>https://www.business.gov.au/Assistance/Entrepreneurs-Programme/Innovation-Connections</u>

<sup>&</sup>lt;sup>44</sup> <u>https://www.business.gov.au/assistance/cooperative-research-centres-programme</u>

<sup>&</sup>lt;sup>45</sup> <u>https://www.business.gov.au/assistance/venture-capital</u>

<sup>&</sup>lt;sup>46</sup> <u>https://www.business.gov.au/assistance/venture-capital</u>

<sup>&</sup>lt;sup>47</sup> <u>https://www.business.gov.au/assistance/global-innovation-linkages-programme</u>

The <u>Business Research and Innovation Initiative (BRII)<sup>48</sup></u> drives innovation within both SMEs (small and medium-sized enterprises) and government by offering competitive grants to encourage SMEs to develop innovative solutions to public policy and service delivery challenges nominated by Government. Eligible businesses can apply for a competitive grant to undertake a feasibility study on their proposed solution to a challenge. Successful applicants receive grants of up to \$100,000 to develop their idea and test feasibility over three months. The most successful ideas may then be eligible for a further grant of up to \$1 million to develop a prototype or proof of concept over the following 18 months which may be purchased by government. Businesses retain the intellectual property and right to commercialise their ideas in Australia and overseas.

The <u>Women in STEM and Entrepreneurship (WISE) Program<sup>49</sup> is an \$8 million rounds based,</u> competitive grant program. It awards grants from a minimum of \$5,000 to a maximum of \$250,000 for activities that address discrimination against or inequality for girls and women in STEM and entrepreneurship.

The <u>Regional Jobs and Investment Packages (RJIP)<sup>50</sup></u> is a \$220 million competitive grant program. RJIP is helping to diversify regional economies, stimulate economic growth and deliver sustainable employment in ten pilot regions. There are three streams of funding available to all RJIP regions under the program:

- Local infrastructure grants.
- Business innovation grants.
- Skills and training grants.

The <u>Building Better Regions Fund (BBRF)<sup>51</sup></u> is a \$297.7 million rounds based, competitive grant program. It is open to eligible local governing bodies and not for profit organisations. The program funds projects in regional Australia that support the creation of jobs, drive economic growth and build stronger regional communities into the future.

There are two streams of funding available under the program:

- Infrastructure Projects Stream supporting construction of new infrastructure, or the upgrade or extension of existing infrastructure that provide economic and social benefits to regional and remote areas.
- Community Investments Stream funding community building activities including, but not limited to, new or expanded local events, strategic regional plans, and leadership and capability building activities.

The <u>Inspiring Australia Science Engagement Program<sup>52</sup></u> provides funding of \$29.8 for a range of activities contributing to the broader goals of science engagement in Australia. Funding is available for hands on learning activities, prizes and awards for STEM, opportunities to compete internationally in the STEM arena, and initiatives aimed at inspiring the broader community to develop digital literacy and public engagement with STEM.

<sup>&</sup>lt;sup>48</sup> <u>https://www.business.gov.au/assistance/business-research-and-innovation-initiative</u>

<sup>&</sup>lt;sup>49</sup> <u>https://www.business.gov.au/assistance/women-in-stem-and-entrepreneurship</u>

<sup>&</sup>lt;sup>50</sup> https://www.business.gov.au/assistance/regional-jobs-and-investment-packages

<sup>&</sup>lt;sup>51</sup> <u>https://www.business.gov.au/assistance/building-better-regions-fund</u>

<sup>&</sup>lt;sup>52</sup> <u>https://www.business.gov.au/assistance/inspiring-australia-science-engagement</u>

The <u>Stronger Communities Program<sup>53</sup></u> supports the Australian Government's commitment to deliver social benefits in communities across Australia. The program funds small capital projects in each of the 150 federal electorates to improve local community participation and contribute to vibrant and viable communities. A total of \$22.5 million is available in round 3 of the program. Each electorate will receive \$150,000 for allocation to successful applications.

#### Other relevant activity in the business environment

<u>Simplot SmartFarm</u><sup>®</sup> is a precision agriculture service in the US where a team of experts use datadriven technologies and agronomic expertise to support producers make decisions that will get the most out of their land, season after season. Their service offering includes:

- Delivering data-driven agronomy across all hectares.
- An expert team that knows agronomy and technology.
- Site-specific services provided all season, every season.
- Maximising returns while preserving resources.<sup>54</sup>

Simplot and Spensa Technologies, an agricultural services company, have entered into a multiyear partnership to build the Simplot Advisor Platform for use by Simplot's crop advisors.55 Spensa's precision agriculture technologies will power the Simplot Advisor Platform, which will be a component of Simplot's SmartFarm. The platform will collect and analyse digital data for zone management, scouting, trapping and imagery while providing Simplot a way to enhance the portfolio of SmartFarm Precision Ag Services through the use of digital data as a tool to improve agronomic decision-making.

The real-time advanced technologies of Simplot's SmartFarm, especially with the introduction of the new Simplot Advisor Platform, provide unique data that allows advisers to make fine-tuned adjustments with the goals of increasing yield and quality, improving profitability, and remaining environmentally responsible.

#### Farmers Business Network<sup>56</sup>

The Farmers Business Network (FBN Network) came about when US farmers wanted to develop an independent, unbiased, and objective farmer-driven information source.

They knew they could learn vastly more combined than by looking only at just their own farms, thereby unlocking the true power of the precision farm data. These farmers wanted objective information on seeds, fertility, soils and dreamed of what might be discovered scientifically from having more data. They wanted transparency and to be treated fairly in the market. They wanted to build a company that reflected their values and truly put them, the farmers, first.

<sup>&</sup>lt;sup>53</sup> <u>https://www.business.gov.au/assistance/stronger-communities-programme</u>

<sup>&</sup>lt;sup>54</sup> <u>http://www.simplot.com/farmers/products/smartfarm</u>

<sup>&</sup>lt;sup>55</sup> <u>https://www.purdue.edu/newsroom/releases/2017/Q2/simplot-and-spensa-technologies-enter-into-multiyear-partnership-to-build-the-simplot-advisor-platform.html</u>

<sup>&</sup>lt;sup>56</sup> <u>https://www.farmersbusinessnetwork.com/about#farmer-experience</u>

What started as the dream of a handful of farmers in 2014 spread to a network of thousands of America's best farmers managing over 8 million acres in just two years.

FBN Network provides members with seed and agronomic analytics, input price transparency, farm and team operations, data integrations and storage, plus mobile apps. They purchase farm inputs, manage crop marketing, offer farm finance - all for an annual membership fee of US\$600.

FBN Network has recently secured a deal with the Singaporean wealth fund T.Rowe Price and Temasek worth US \$110 million.

As yet the FBN Network has not entered Australia.

#### Grower Information Services Cooperative and AgXchange

The Grower Information Services Cooperative (GiSC) and Main Street Data, an agricultural data analytics company, are joining forces with IBM to introduce a suite of data-driven solutions to help growers improve their yields, operations, and overall productivity.

These solutions will combine the use of IBM's world-leading competency in technology and platforms, including IoT, weather-driven insights, and data science; more than seven years of corn, soybean and wheat yield information from Main Street Data; and farmer-provided crop, yield, and operational data from GiSC. This collaboration will enable farmers to make better, more informed decisions to help balance yield production and profits.

Main Street Data believes that data analytic technology solutions are the key to unlocking the next step-function improvement in agricultural productivity, but the adoption rate of these data solutions is slower than it needs to be because growers simply do not know what works and what delivers real return on investment. They believe that data insights will help farmers to better understand comparative performance and maximize return on investment. They say that independent validation is a critical missing piece in agriculture, which is a gap that Main Street Data will fill.

The first phase of solutions from the partnership is:

- Data sharing and aggregation.
- The Validator This benchmarking tool will assist farmers in identifying whether farming practices are producing the expected outcomes. It further ranks farmers' operations at the subfield level on a scale of 5th to 95th percentile by comparing the yields at the micro field level with other farmers growing under comparable conditions.
- Market Vision In-season productivity assessment and decision tool, as well as a grain trading tool, to help farmers maximize the price of grain.
- GiSC's National Crop Registry a tool designed to assist growers in the survey of neighbouring farmland and address some of the problems associated with chemical drift.<sup>57</sup>

Confluence of technologies; more sophisticated technologies and cheaper<sup>58</sup>

<sup>&</sup>lt;sup>57</sup> <u>http://www.precisionag.com/systems-management/data/data-coalition-growers-join-to-launch-national-ag-data-cooperative/</u>

<sup>&</sup>lt;sup>58</sup> <u>http://www.hyndes.com/uploads/9/2/0/6/9206450/cb-insights\_cultivating-agtech.pdf</u>

Several technologies are enabling the changes in agriculture today. LEDs are getting better; sensors are getting cheaper; robots are becoming more reliable; and new techniques allow massive datasets to be interrogated.









#### Producers' digital use status and needs

The Precision Agriculture to Decision Agriculture (P2D) project surveyed Australian producers and benchmarked their needs, perceived risks and benefits, and expectations associated with digital agriculture technology and in the big data context. These key factors were examined from three aspects: telecommunication infrastructure, the status of current data collection, and data sharing and concerns in the big data context.

#### Telecommunication infrastructure

- Producers are concerned over the governance of aggregated farm data.
- Adoption of on-farm telecommunication infrastructure is very limited, with only 25% of respondents having radio links to devices, and/or mobile data linked devices. The majority of those users found it was challenging to keep the systems working. In addition, knowledge of on-farm telecommunication options was limited across all industries. These findings highlight the urgent needs of concerted efforts to effectively communicate the value proposition of on-farm telecommunication infrastructures and agricultural data, as well as the on-farm telecommunication options, which is essential for producers to recognise the value and take actions.
- Producer satisfaction with home office internet connectivity was considerably low with only 30% of respondents satisfied.

#### Status of current data collection

- There are variations in the collection rates of various agricultural data. For example, the collection of yield mapping data (51%) and soil mapping data (40%) were the highest in cropping industry, and the collection of veterinary medicine record (63%) and animal breeding data (57%) were the highest in livestock industry. Although improvements may have been achieved, it is still a long way to go for the industries to catch up and fully utilise the precision agriculture technologies.
- The current arrangement of data collection between producers and service providers may impose some potential issues and conflicts. Such concerns were underpinned by three key aspects:

- 1) Respondents had limited knowledge about the terms and conditions in relation to data collection in their agreement with service providers.
- 2) Respondents had very low trust in service providers to maintain privacy and not to share data with third parties.
- 3) The majority of respondents were not comfortable for service providers to make profit out of their data without sharing the profit with them.

Attitude towards data sharing and concerns in the big data context

- Producer survey findings suggest that the development and establishment of aggregated farm data should be centred on the benefits and needs of producers, with other stakeholders (especially farmer organisations and research institutions) playing key roles to enable the development. Further, the value proposition of agricultural data as well as aggregated farm data needs to be clearly communicated to producers.
- Producers need reassurance to address concerns about how aggregated data will be governed and used.<sup>59</sup>

The current digital maturity of the agricultural sector has been rated as 'ad hoc', meaning it does not systematically and consistently use data to drive decisions. The impact of this is that the sector is missing out on opportunities to improve productivity and realise greater profits.<sup>60</sup>

<sup>&</sup>lt;sup>59</sup> <u>https://www.crdc.com.au/sites/default/files/P2D%20producer%20survey%20-%20CSIRO%20Final%20Report.pdf</u>

<sup>&</sup>lt;sup>60</sup> <u>https://www.crdc.com.au/sites/default/files/CRD18001-001%20CRDC%20P2D%20Report%20low%20res.pdf</u>

# Appendix B: Acronyms

AARNet	Australian Academic Research Network
ABRI	Agricultural Business Research Institute
ACFR	Australian Centre for Field Robotics
ACRI	Australian Crop Research Institute
AGBU	Animal Genetics and Breeding Unit
ANU	The Australian National University
BBRF	Building Better Regions Fund
BOM	Bureau of Meteorology
BRII	Business Research and Innovation Initiative
CBRIN	Canberra Innovation Network
CRC SI	CRC for Spatial Innovation
CRC-Ps	Cooperative Research Centre - Projects
CRDC	Cotton Research and Development Corporation
CSU	Charles Sturt University
D2D CRC	Data to Decisions CRC
DAWR	Department of Agriculture and Water Resources
DEDJTR	Victorian Department of Economic Development, Jobs, Transport and Resources
DIIS	Department of Industry Innovation and Science
DNA	Digital Network Architecture
DSE	Dry Sheep Equivalent
ERA	Excellence in Research in Australia
ESVCLP	Early Stage Venture Capital Limited Partnerships
FAO	Food and Agriculture Organisation
FBN	Farmers Business Network
FIAL	Food Innovation Australia Ltd
FMS	UNE Facilities and Maintenance Service
FTE	Full Time Equivalent
GATE	Global Ag Tech Ecosystem
GIL	Global Innovation Linkages Program
GiSC	Global Information Services Cooperative
GNSS	Global Navigation Satellite Systems
GRDC	Grains Research and Development Corporation
GVP	Gross Value of Production
IoT	Internet of Things
ITD	IT department (in UNE)

JCU	James Cook University
LoRaWAN	Low Power Wide Area Network
LPP	Livestock Productivity Partnership (between UNE and MLA)
NBN	National Broadband Network
NDVI	Normalised Difference Vegetation Index
NFF	National Farmers' Federation
NRM	Natural Resource Management
NSW DPI	NSW Department of Primary Industries
P2D	Accelerating Precision to Decision Agriculture
PARG	Precision Agriculture Group (in UNE)
PBI	Plant Breeding Institute
PDS	Producer Demonstration Site
PISC	Primary Industries Standing Committee
PPP-RTK	Precise Point Positioning Real Time Kinematic
QAAFI	Queensland Alliance for Agriculture and Food Innovation
QDAF	Queensland Department of Agriculture and Fisheries
QUT	Queensland University of Technology
QUT	Queensland University of Technology
RDCs	Research and Development Corporations
RJIP	Regional Jobs and Investment Packages
SABL	UNE Faculty of Science, Agriculture, Business and Law
SBAS	Satellite-based Augmentation System
SFIC	SMART Farm Innovation Centre
SMART	Sustainable, Manageable, Accessible Rural Technologies
SMEs	Small to Medium Enterprises
SRI	SMART Region Incubator
STEM	Science, Technology, Engineering and Maths
TIAR	Tasmanian Institute of Agricultural Research
UNSW	University of NSW
USQ	University of Southern Queensland
USyd	The University of Sydney
UTS	University of Technology Sydney
UWA	University of Western Australia
VCLP	Venture Capital Limited Partnerships
VHR	Veterinary Health Research consultancy, Armidale
WISE	Women in Science and Engineering