Mr Rowan Ramsey, MP
Chair, House of Representatives Standing Committee
Agriculture and Industry
Agricultural Innovation Inquiry
AgInd.reps@aph.gov.au

25 September 2015

Dear Mr Ramsey

It is with pleasure that I forward to you Deakin University's submission to the inquiry into Agricultural Innovation. Deakin University believes this inquiry, in examining the role of technology in increasing agricultural productivity in Australia, is addressing a critically important issue for our nation.

The future well-being of Australia will depend in large part on strong economic development of its regional and rural areas. Agriculture and its related industries substantially contribute to the economic viability of these areas. However, regional and rural Australia face significant headwinds, such as increasing migration of skilled workers to our cities, increased globalisation of agri-industries, competition for limited resources and the need to increase productivity, whilst maintaining our 'clean and green' reputation.

Traditional agricultural practices will not be enough to yield the productivity and efficiency improvements required to maintain a viable and globally competitive agriculture sector. Australia must utilise its considerable strengths in technology, know-how and innovation to ensure its regional areas grow and prosper and its food and fibre industries remain competitive.

Deakin University, as one of Australia's largest and regionally based Universities, has recognised that for regional and rural Australia to prosper we must do things differently. Deakin has recently established a Centre for Regional and Rural Futures (CeRRF), which draws from a wide range of discipline areas to drive an innovation agenda to achieve positive, transformational change in regional and rural communities, and particularly the agri-industries.

I commend this submission to the inquiry and I look forward to its recommendations. Deakin University remains committed to working with all levels of government to ensure that our regional and rural areas remain vibrant and economically strong.

Yours sincerely

Professor Jane den Hollander
Vice Chancellor

Office of the Vice-Chancellor, Deakin University
Geelong Waterfront Campus, Locked Bag 20001, Geelong, Victoria 3220
Tel 03 5227 8501 Fax 03 5227 8500 vc@deakin.edu.au www.deakin.edu.au

Deakin University

Submission

Agricultural Innovation Inquiry

September 2015

Preamble

Deakin University is pleased to contribute to the House of Representatives Standing Committee on Agriculture and Industry – Agricultural Innovation Inquiry. As an education provider with a strong regional and rural focus, Deakin has a clear interest in ensuring that our regional and rural economies remain sustainable and grow into the future. Deakin is applying its considerable expertise and facilities to drive productive outcomes in regional and rural Australia, such as job creation and productivity improvements, and has the capacity to contribute further in these areas.

In this submission, Deakin University's reference to agriculture includes fishing and aquaculture as well as land-based food and fibre production.

Deakin University supports the Committee's intention to examine ways to effectively increase agricultural productivity through the use of new technology. Deakin is well positioned to make a strong contribution due to its regional focus and contemporary digital environment, which already supports the implementation of new technologies across our regions. The university sector, by working more closely with our agricultural industries, can underpin the development of new, high-value enterprises by supplying research and technology solutions that assist industry to develop new products and grow into new markets. Deakin University, through its Centre for Regional and Rural Futures, aims to capitalise on this approach in a consistent and repeatable manner by drawing from the immense intellect and technological know-how across the University and applying this expertise with a clear focus on the desired benefits.

While in some cases cost may be a legitimate barrier to adoption of new technology, in many cases overcoming issues of know-how, interrogating existing data or the development of an appropriate user-interface are often more critical barriers. In other cases, the barrier may be no more than a lack of awareness of a suitable technology, which may be ready for direct application with immediate benefits. An independent third party may be better placed to align the right technological solution to the customer identified need.

In considering the potential benefits of introducing new technologies, we should also be mindful of those high performing farmers who use existing technology with excellent results. Such farmers are often significantly more productive than their peers. The obvious opportunity is to identify who they are, understand what makes their enterprises so productive, and replicate their practice into the broader industry.

Beyond optimisation of existing technologies, there are significant opportunities to yield benefits by introducing technologies from other industries or sectors into specific agricultural enterprises. This presents an opportunity for dramatic productivity improvements by accessing completely new ways of operating. While this is a conceptually simple idea, it often requires a collaborative approach. To succeed requires a solid knowledge of the specific industry and its technological

needs, as well as a broad knowledge of all the available technologies that may address these needs. The breadth of these skill sets and required knowledge rarely reside in one individual.

While it is generally agreed that appropriate use of technology will enhance agricultural productivity, there are also social and policy drivers that may help or hinder this effort. Governments at all levels should develop innovative policies that promote high value farming industries through planning and policy levers that are within their control. This will send the right signals to motivate enterprises to improve productivity and, if designed well, will also increase production at a landscape level. Currently there are some regulatory barriers that may hinder implementation of new technologies. For example, existing CASA regulations may limit the use of some drone technologies, which could provide significant benefits to precision farming practices.

Deakin commends the House of Representatives for addressing this issue and looks forward to further engagement with government and the private sector to increase the productivity of our regional and rural industries.

Deakin University responses to the Terms of Reference

1. Improvements in the efficiency of agricultural practices due to new technology, and the scope for further improvements

Every industry sector has benefited from the introduction of new technology and agriculture is no different. There are numerous opportunities where technologies may benefit agricultural productivity, including:

- **Improved measurement and monitoring**: If you don't measure it, you can't manage it. The development and use of smart phone applications, coupled with an exponentially growing number of cheap sensors, presents the possibility for low-cost, real-time monitoring of resource use in production systems. The combination of smart sensors, real time data analytics and data visualisation techniques can significantly improve many on-farm practices such as resource use or crop yield measurements. This same approach can be extended to include the agri-business manufacturing sector. Improved measurement and monitoring has the added advantage of real time assessment of product quality. Australian produce is world renowned for its quality and appropriate use of technology enables us to support this assumption with data, to ensure a premium price for our products.
- **Agriculture manufacturing, supply chains and logistics**: Manufacturers and logistics companies have long embraced decision support technologies to improve the efficiency, robustness and productivity of their businesses. These technologies can process large volumes of data to identify the best strategy, optimally schedule resources to minimise operational costs and detect changes both on the farm and in destination markets earlier and more accurately. There are numerous examples where the use of advanced data analytics saves cost, improves competitiveness or reduces waste. Some examples include the optimisation of fertilizer application using GPS mapping and soil nutrient profiling; improved reliability and maintenance of equipment through on-line sensors; and improved utilisation of water resources through soil moisture profiling for optimal irrigation. Additionally, digital systems also provide an essential platform to provide the training and education needed to support the rapidly changing technologies in this space.
- **The application of new technologies to farming industries**: Most innovation does not result from a new invention, but rather the adoption of existing technology applied differently. Careful and rigorous mapping of specific farming industry technological

'needs' could be combined with an assessment of available technologies from other industries that address similar needs. The alignment of farming industry needs with technologies from other sectors offers great potential to dramatically improve current practice. Examples of this include a fundamental shift in irrigation technology (e.g. from flood to drip irrigation) or the implementation of robotic machinery to enhance throughput or reduce labour costs (e.g. automatic milking machines for dairy farms or some other on farm automated processing).

2. Emerging technology relevant to the agriculture sector, in areas including but not limited to telecommunications, remote monitoring and drones, plant genomics, and agricultural chemicals

Agriculture will be transformed by the fourth industrial revolution, with smarter machines, intelligent devices, ubiquitous sensors and advanced analytics changing farm technology and the agricultural farm business itself. Intelligent systems, such as intelligent and autonomous robots, mechatronics systems and intelligent decision support systems, have the potential to both transform traditional agriculture and facilitate the emergence of future agricultural systems. The transformation that is happening in manufacturing will also occur in agriculture, with systems becoming more flexible, agile and responsive.

The concepts of 'farm as a factory' and 'farming in a factory' are rapidly emerging. Already in Japan we are seeing the emergence of fully automated lettuce factories, capable of producing thousands of lettuces a day without manual intervention and without the need to wash the product. Farms will also be plugged into their supply chain networks, with consumer track and trace capability back from the plate.

Key technologies:

- smart agriculture, computing and mobile devices, networked and always connected, sensors (real time in soil, crops and livestock)
- automation of machinery, precision systems, intelligent and flexible robotics for actuation, sensing, handling, processing and packaging
- drones as sensors are recognised as having potential in plant research, crop production, crop protection and livestock monitoring. Drones, in particular next generation, low cost mini-UAV's equipped with GPS, will be driven by advanced path planning, control and real time image processing
- technologies that leverage drone sensors including advanced image processing and computational intelligence algorithms are crucial to realise the potential of novel sensor platforms
- human machine interface – usable machines and devices, accessible interfaces, augmented reality, systems designed to minimise retraining
- optimal management systems of farming activities through a variety of remote sensing applications, potentially controlled through user friendly devices (e.g. mobile phone technology)
- training systems that provide real time, cloud learning for specified user requirements and functionality
- genomics for resistance, drought tolerance, production, fertility, longevity, etc
- irrigation and pasture management technologies that enable efficient application of water through smart integration of soil moisture sensors at farm and catchment scales.

Creating a suitable and user-friendly interface for specific technologies is an often overlooked aspect of development and a key barrier to adoption. This situation is exacerbated when multiple technologies require coupling or integration into a large system context before the benefits to the agricultural enterprise can be realised. The ubiquity of the smartphone

provides one obvious user interface platform (i.e. through app development), but other options exist.

In addition to a user-interface, a systems thinking approach is often required to maximise the value of new technologies. While new technologies may provide the opportunity to optimise a single process (i.e. in an iterative manner), far greater efficiency may be gained if the technology can optimise the entire system. For example, suppliers of irrigation water and their customers could reap significant benefits from an automated allocation system that optimises the volume and timing of water requested by individual farms on a network. This utility of this idea could be further enhanced if the 'on-farm' water storages along the supply chain were also integrated into the system to enable them to be used as buffers or additional storage to meet periods of peak demand (and then refilled during low demand periods). Such a systematic approach is not possible when working at the individual farming enterprise level, and yet could have widespread benefits.

Thus, consideration of emerging technologies should be embedded in a systems thinking approach with consideration of pragmatic user-interfaces and their feasibility for adoption.

3. Barriers to the adoption of emerging technology

- **Cost and/or time**: Often cited as the most common reason for the lack of adoption of new technology and systems. In some cases, the cost of technology may be prohibitive, but could be reduced in time with further investment in research and development making it a viable option. In other cases broader adoption of existing technology (through for example government policy frameworks) may increase demand to such an extent that cost is significantly reduced. Similarly, the time and expense required to validate the technology at field scale may be a barrier to obtaining the necessary investment to demonstrate viability.
- **Know-how and user training**: Many new technologies are not widely adopted as they may require specific technical knowledge to implement. Similarly, there may be technologies that could be easily utilised from a smartphone application, but as yet, no one has written an application for their purpose or created the necessary interface. In general, these types of barriers usually require a modest investment in research and development to ensure that available technologies can be easily accessed. An obvious extension to this is to ensure appropriate user training to maximise the benefits from technology deployed.
- **Awareness**: Most industries monitor the performance of their peers (farmers included) and generally understand what is considered 'best practice' for their sector. However, only a minority of industries/individuals monitor technological developments in other sectors and consider how these technologies could be transferred to benefit their industry. There is a body of work to align generic industry 'needs' with available 'technologies' from all industry sectors that could address those needs.
- **Ability to manage and interpret data**: the possibilities for collecting large volumes of low cost data are increasing exponentially, as sensor technologies improve and the cost of data storage reduces. Unfortunately, our ability to interrogate this data to create new knowledge that enhances productivity and drives efficiencies has not kept pace. Smart data analytics, applied for specific purposes, is a key requirement to turn a plethora of data into useful knowledge.
- **Legislation**: There may be current legislation that prohibits the introduction of particular technologies. For example, CASA regulations may restrict the use of the application of some drone technologies that could be employed for real time farm monitoring, mapping or other purposes.

Conclusion and recommendations

The benefits of the application of new technology to the agricultural sectors are substantial. For Australian agricultural industries to prosper, these industries will have to do things smarter and with a stronger focus on high value agriculture, including the use of smart technologies.

While Deakin University has a strong regional focus and is a relatively new entrant to agricultural research, it has one of the strongest digital platforms of any Australian university, which lends itself to the implementation of new technologies. Deakin has significant expertise and capability in the development and application of technology and has approached its regional R&D program with an innovative mindset. Based on this experience, Deakin makes the following recommendations to the inquiry:

- Learn from high performing farmers and processors and share the lessons learnt with their peers through both traditional means (e.g. workshops, field days, etc.) and digital (e.g. on-line learning) pathways, with particular emphasis on understanding existing monitoring of farming systems and areas where technology can assist
- establish easily referenced industry benchmarks (possibly through a phone app) to enable existing enterprises to quickly assess their performance against industry norms
- critically examine the barriers to adoption of technologies, particularly in regards to bridging the divide between the existence of a technology and its useful application to an agri-industry (i.e. the technology interface)
- prioritise the interaction between the agricultural sector and universities to align the customer needs of farming enterprises with the technological possibilities available through the university sector
- support a systems thinking and multidisciplinary approach in the development and adoption of new technologies in agricultural industries
- create a policy and planning environment that promotes the productive use of land and resources for high value agricultural enterprises.

ends