Submission to the House of Representatives Inquiry into Agricultural Innovation

Prepared by the Department of Primary Industries and Regions South Australia

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SOUTH AUSTRALIA

Government of South Australia

Introduction

The growing world demand for high quality food and wine, combined with our strong reputation for food safety, biosecurity and product integrity, creates significant opportunities for South Australia and Australia more broadly.

Agribusiness in South Australia, which includes food, wine, fisheries and forestry generates $19.7 billion in revenue, employs one in five working South Australians and accounts for over 40 per cent of the state's merchandise exports. Agriculture, forestry and fishing have been the fastest growing segments in the South Australian economy.

The state needs to ensure that our food and wine producers are competing in global markets on more than just cost. South Australian food, wine and beverages are world class and the unique regions, products and the clean, green environment that they come from provide the competitive edge required to secure and maintain premium status in our markets of choice.

The adoption of new technologies as well as further growth and investment in primary production and processing, expansion of existing and emerging markets and realising increased value for our high quality products will be a major economic driver for the state.

The South Australian Government has several economic priorities relevant to agricultural innovation. These include:

- Priority 2 – Premium food and wine produced in our clean environment and exported to the world;
- Priority 4 – The knowledge state – attracting a diverse student body and commercialising our research;
- Priority 6 – Growth through innovation.

Four objectives under the Premium food and wine produced in our clean environment and exported to the world economic priority are related to technology and innovation:

- Increase international exports of differentiated and processed food and wine from $2.8 billion in 2013-14 to $3.2 billion in 2016-17;
- Establish the SA Food Innovation Centre;
- Establish a global reputation for our food, wine and clean technology expertise; and
- Simplify and modernise regulatory arrangements to support innovation and job creation.

This submission responds to the terms of reference by highlighting South Australian technology related activities which contribute to improvements in agricultural productivity. These activities support agricultural producers in adopting new technologies in our collective pursuit to be at the forefront of productive efficiency. The submission also outlines some issues for consideration in addressing barriers to the adoption of technology and the practices in place in South Australia for this.

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

Agriculture is one of the most efficient industries in Australia due to a long history of adopting new technological innovation. From 1989-90 to 2013-14, multifactor productivity in agriculture had been increasing annually at 2.7%, considerably higher than the market sector average[1].

South Australia's primary industries agency, Primary Industries and Regions South Australia (PIRSA) is involved in many activities which accelerate the adoption of new and more efficient agricultural practices. Some key activities related to technology are highlighted below.

It should be noted that these activities are usually conducted and invested in partnerships, with South Australian industry, the Australian Government and other research organisations such as universities or the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

1a) Technology advancing the efficiency of agricultural practices

The South Australian Research and Development Institute (SARDI) arm of PIRSA delivers robust scientific solutions to support sustainable and internationally competitive primary industries. Scientists create knowledge platforms, technologies and products to promote the growth, productivity and adaptability of food, aquatic and bioscience industries, while ensuring they remain ecologically sustainable.

Some of the key SARDI capabilities in place in creating technologies are summarised below.

Sustainable Systems

SARDI's Sustainable Systems science programs support improved productivity and sustainability of primary industries. The programs work collaboratively at national and regional levels to deliver targeted research outcomes.

Crop Improvement – molecular genetic tools are used to understand key traits in species of importance to cereal and legume improvement. The main focus is on identification of genes and linked molecular markers for quality, disease resistance and abiotic stress traits. A pasture improvement program is also developing improved varieties, agronomic practices and management systems for farming and the environment in South Australia.

New Variety Agronomy – integrates new variety evaluation, pulse pre-breeding, breeding, agronomic research and market quality evaluation capabilities to facilitate adoption of high-yielding and profitable grain varieties which are well adapted. The group has a network of regional research teams based at Struan, Clare, Port Lincoln and Waite.

Soil Biology and Diagnostics – develops strategies to better manage soilborne pathogens and understand the role of beneficial soil microflora in cropping, horticulture and pasture industries. This includes development of world-leading DNA-based testing services for quantification of fungal and nematode pathogens, weed seeds, beneficial soil microflora and plant roots in soil. The technology delivered includes the Predicta B root disease test for cereal and pulse crops and PredictaPt for potatoes, and associated training.

[1] Productivity Commission 2015, *PC Productivity Update*, July

Plant Health and Biosecurity – provides targeted research and development to reduce losses from plant disease across cereal, pulse, pasture, viticulture and horticulture industries. This includes delivery of plant health diagnostic services to growers, consultants, state and national plant biosecurity authorities. The group collaborates closely with breeding companies, pre-breeding programs and the private sector to develop disease resistant plant varieties.

Two key examples of how South Australian research is creating and using technologies to improve agricultural practices are provided below.

Soil Testing

SARDI will add to its suite of soil diagnostic tests for the horticultural and cropping industries, with research to develop a rapid soil DNA test to help keep the state's grapevines free of phylloxera. Grape phylloxera is an insect that feeds on grapevine roots, with the use of tolerant rootstock the only way to manage infested vineyards. South Australia is one of the few places in the world which is free of the vine destroying pest phylloxera. This status ensures the state has some of the oldest grapevines in the world – with 160 year-old gnarled vines producing wine that is internationally recognised for its superior quality and taste.

At present, there is no cost-efficient testing for its presence in soil. The three-year research project is funded by the Plant Biosecurity Cooperative Research Centre, in collaboration with the Phylloxera and Grape Industry Board of SA, Grape and Wine Research and Development Institute, Government of SA primary industries research institute SARDI, Victoria's Department of Environment and Primary Industries, Department of Primary Industries NSW, University of Adelaide and technology company Rho Environmetrics. The $1.8 million project, entitled "Sampling strategies for sensitive, accurate cost effective detection of Phylloxera for quantifying area freedom" has attracted additional support from the State Government to accelerate its commercialisation and investigate ways to apply the system to other pests and diseases that impact on vital agricultural industries. SARDI scientists first identified the potential for an accessible and rapid soil test for phylloxera more than 10 years ago. This new research project aims to refine the testing and take it to growers in a highly effective and low cost form after comprehensive testing in the next three years.

Crop Sequencing

Intensive field trials of 40 different break sequences have been investigated by SARDI in collaboration with farming systems groups across the state, including the SA-Victorian Mallee.

Pastures and break crops - such as pulses, canola, brown manure vetch and oaten hay – have been grown for up to two seasons and have produced encouraging results.

The $2.1 million five-year Grains Research and Development Corporation (GRDC) funded Crop Sequencing collaborative science program commenced in 2010 and involves farming groups from the upper Eyre Peninsula and Upper North to the Murray Mallee. Back-to-back cereal cropping, particularly during the millennium drought, led to an increase in disease and weed levels, as well as a decline in soil quality. This led to grassy weeds such as barley grass, brome grass and rye grass adapting to the timing of the regular cereal productions systems, so break crops and even long-season wheat types are now needed to smother them. The trial also measured improvements in soil nitrogen, soil disease and plant-available water. Low-rainfall zone crop sequencing projects have brought critical changes to local farming systems with yield increases up to 1.25 tonnes higher per hectare, after taking a two-year, non-cereal break phase. Other technologies, such as drought tolerant, short-season field peas and other break crop options, were also supporting the trend.

Capturing on-farm efficiencies

Government has a key role in supporting technology for efficient agricultural practices. Three examples below highlight key technology developments associated with water use, soil management and biosecurity where governments have been pivotal in instigating novel advancements and investing in technologies in partnership with industry.

The South Australian River Murray Sustainability Program (SARMS)

SARMS is a $265 million funding package resulting from collaborative efforts between the Australian and South Australian Governments and the water industry. It comprises two areas of investment: $240 million Irrigation Industry Improvement Program (SARMS-3IP) which will be delivered over five years and recover 40 gigalitres of water access entitlement from the SA River Murray Prescribed Watercourse to help meet water recovery targets under the Murray-Darling Basin Plan; and $25 million for a suite of regional development, research and innovation programs that includes the redevelopment of the Loxton Research Centre. SARMS is being delivered by the South Australian Government and has been designed to achieve the outcomes sought by the Water Industry Alliance in their original River Murray Improvement Program proposal. It is expected that this investment of $265 million in the South Australian River Murray region could result in around $1 billion of economic activity in the region and is expected to create more than 500 jobs in the long term.

The Program complements outcomes sought from the Murray-Darling Basin Plan by facilitating improved water efficiency operations with many producers choosing to roll out new water infrastructure such as: drip irrigation systems, solar powered automated pumping stations and computerised fertigation facilities.

New Horizons

New Horizons is a PIRSA initiative designed to significantly increase South Australia's agricultural production through the application of advances in soil science and management. This collaborative program is building on many years of preliminary research work on subsoil constraints by PIRSA, the Department for Environment, Water and Natural Resources (DEWNR), Natural Resources Management (NRM) Boards, the University of Adelaide and the University of South Australia. The adoption of new practices would represent a new revolution in farm management, from cultivating only the top 10 centimetres of soil to managing the top 50 centimetres of soil. New Horizons aims to achieve an $800 million increase in the value of food production per annum in South Australia, long-term storage of carbon, a significant reduction in soil erosion risk and the opportunity to initiate a new high-value manufacturing industry in agricultural machinery. The program involves a mix of fundamental and applied research, regional site demonstrations and extension to develop an effective soil management package and guidelines to fast track adoption.

Trials are underway across three sites on the Eyre Peninsula, the Mallee and Upper South East regions with initial results showing increases between 50 and 100% in yield.

Sterile Insect Technology

South Australia remains the only Australian mainland state that is fruit fly free ensuring access to exclusive citrus and almond export markets in the United States, New Zealand and Japan worth about $120 million a year.

To help maintain this status, the South Australian Government is constructing $3.8 million Sterile Insect Technology (SIT) facility that will support a five year $50 million national research and development collaboration to produce a sterile line of male Queensland fruit fly (Q-fly). Construction is expected to be completed in late 2016. The State Government is working closely with Horticulture Innovation Australia (HIA Ltd), New South Wales Department of Primary Industries, CSIRO Biosecurity Flagship and Macquarie University in maximising the benefit of this landmark facility nationally. When completed, the facility will have the capacity to produce 50 million sterile male Q-fly each week, providing a great benefit to eliminating this major pest from agricultural growing areas around Australia.

1b) Scope for further improvements in the efficiency of agricultural practices

South Australia has recognised the state needs to ensure that our food and wine producers are competing in global markets on more than just cost.

Product innovation that involves agriculture and informs improved agricultural practices in realising increased value for farmers and the state is a key component of South Australia's approach. Some of the programs underway in South Australia in this product innovation and technology area are presented below.

Potatoes South Australia is a not-for-profit membership-based incorporated association for all stakeholders in the potato industry's value chain. The Association received assistance from PIRSA to transform underutilised potatoes into pure, nutritious food products. In collaboration with the University of Adelaide's FOODplus research centre and the South Australian Fishermans Co-Operative Limited (SAFCOL), a new food product range is under development to transform under-utilised 'waste' potatoes into food products targeted at the paediatric, geriatric and convenience market segments.

Flinders Ranges Premium Grain produces high quality flour using high protein wheat and pulses. The company received assistance from PIRSA to increase the shelf life of whole grain cereals and pulse flour for export and domestic markets. They will collaborate with the University of Adelaide, School of Chemical Engineering and TAFE SA Regency Campus, School of Bakery Studies to investigate the use of an environmentally-friendly system, which aims to increase the shelf life from three to four months up to nine months without compromising on taste or quality of the baked goods.

South Australia Cattle Co. has been dry aging Hereford beef from its Lucindale farm and from other Limestone Coast farmers. It received assistance from PIRSA to develop new production methods and create more export opportunities for their dry aged Hereford Beef. It is partnering with research agencies in South Australia and Denmark, and engaging the services of a local engineering firm to help develop a high value product that will be distributed internationally.

Solar Eggs grows and supplies over 50,000 fresh eggs in South Australia weekly. They received assistance from PIRSA to develop a new range of eggs featuring an enhanced level of Omega 3 in collaboration with scientists from the FOODplus team at the University of Adelaide. The research will be commercialised to increase the level of Omega 3 in eggs by incorporating selected natural plant oils into the diet of laying hens. Once the eggs are available for purchase they will contribute to higher intake of the much important Omega 3 oils.

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

Primary industry sectors are among the most capital intensive industries in the economy and this intensity has increased over time. The relative scale of agriculture within South Australia means that even modest applications of new technologies will result in substantial improvements to the efficiency of these sectors and the wealth of the state more generally. Areas such as robotics and automation are key to productivity in the primary sector, where Australia can claim significant technical leadership.

Unmanned Aerial Vehicles

PIRSA is currently investigating the use of Unmanned Aerial Vehicles (UAV) technology for the control of wild dog populations in South Australia's Far North. The Department has identified the potential use of UAVs as a cost-effective tool for the management of wild dog populations, particularly in terms of monitoring the integrity of the Dog Fence, and the location of wild dog populations. Wild dogs, including dingoes and their hybrids, are a major predator for livestock in pastoral regions, particularly sheep. The Dog Fence is the single most important protection for the livestock industry against wild dogs, with $1 million spent each year in improvements and maintenance. Low-cost UAVs are an emerging tool in an increasing number of civilian applications, including natural resource management. In terms of wild dog management, UAVs could potentially be used to monitor the Dog Fence and dog populations themselves. The research objectives and deliverables of the trial are:

- Conduct trials at selected Dog Fence sites to monitor fence integrity and condition at different spatial scales (10 m, 100 m, 1 km, 10 km, 100 km)
- Conduct trials to assess feasibility of using UAVs, equipped with visible spectrum and thermal imaging sensors, to estimate population of wild dogs
- Validation of UAV acquired data with data from conventional surveys (fence condition)
- Communicate lessons learnt in UAV operation in terms of flight parameters (altitude, speed, flight path), sensor parameters (spectral range, resolution, focal length)
- Communicate lessons learnt in data processing and interpretation

Drones with advanced sensor, web-based and wireless technology are also among the options being considered for early detection of crop pests and diseases in a new research project underway in South Australia. The South Australian Government is contributing towards a $5.5 million, five-year research project backed by the Grains Research and Development Corporation (GRDC) and the Plant Biosecurity Cooperative Research Centre (PBCRC). Research by SARDI will look at the use of technologies such as UAVs fitted with near-infrared, laser, acoustic and biosensor detectors for grain and other crops, and also for fisheries and environmental management. The research aims to significantly reduce crop losses and safeguard the biosecurity status of grains destined for export markets. The first phase of the project is looking at existing surveillance technologies and the

second phase will trial the most promising technologies and apply them to Australian farming systems.[2]

Technology in support of weather information

Several automatic weather station (AWS) networks have been installed in South Australia. The South Australian Murray-Darling Natural Resources Management Board (SAMDNRMB) has installed about 40 AWS since 2006. The SAMDNRMB is responsible for the operation and maintenace of the network. The South East Natural Resources Management Board has installed 20 AWS and the McLaren Vale network has nine.

AWS provide contemporary and useful decision-making aids being accessible to farmers through a range of activities and media are key drought preparedness measures. Broader benefits include: increased safety for emergency services personnel during extreme weather events such as bushfires, and reduced damage to biodiversity.

The South Australian Government is investigating the use of AWS and believes the Australian Government should give further consideration to supporting the CSIRO and the Bureau of Meteorology to research and deliver information on seasonal climate variability and climate change across Australia. This information may enhance government support in the dissemination of climate projections in a manner that assists farmers to understand the information, its limitations and how to best use it in their long-term decision-making. The South Australian Government believes providing additional radar sites to track real time weather conditions is important for short-term decision-making. Improved radar infrastructure on the Eyre Peninsula would advance agricultural competitiveness in a strategically significant agricultural region of Australia and support a range of other regional marine and land based public purposes.

Telecommunications technology can also support a range of productive activities - at the farm level, and to inform agribusiness.

Rural Connect

Rural Connect is an online one-stop-shop of information for primary producers and is the result of a collaborative project between Primary Producers SA (PPSA) and PIRSA. The interface includes a calendar of local events, industry events and Commodity Association events and is provided to subscribers both as a web browser version and as a mobile app. As a part of the calendar function, producers can: book a place at events and save them into their personal planner; receive reminders for events they have added to their personal calendar – and get alerts for forthcoming events or emergencies direct to their mobile phone; and receive and respond to surveys circulated by PIRSA, PPSA or selected associations to the broader industry. Rural Connect also publishes industry-wide or selected news, market reports, weather and other industry-specific information. Content management, data security, secure booking and payment functions are also provided.

AgInsight South Australia

Australia's first interactive agricultural mapping and economic data online portal has been launched in South Australia and provides a wealth of up-to-date data that will help identify potential business opportunities in the state's primary industries. The portal is part of the Agribusiness Accelerator Program, a four year commitment that aims to capitalise upon the increasing global demand for food, wine and other beverages. The key feature of the portal is multi-layered mapping which

[2] High - tech checks on crop health' GRDC, 5 May 2014

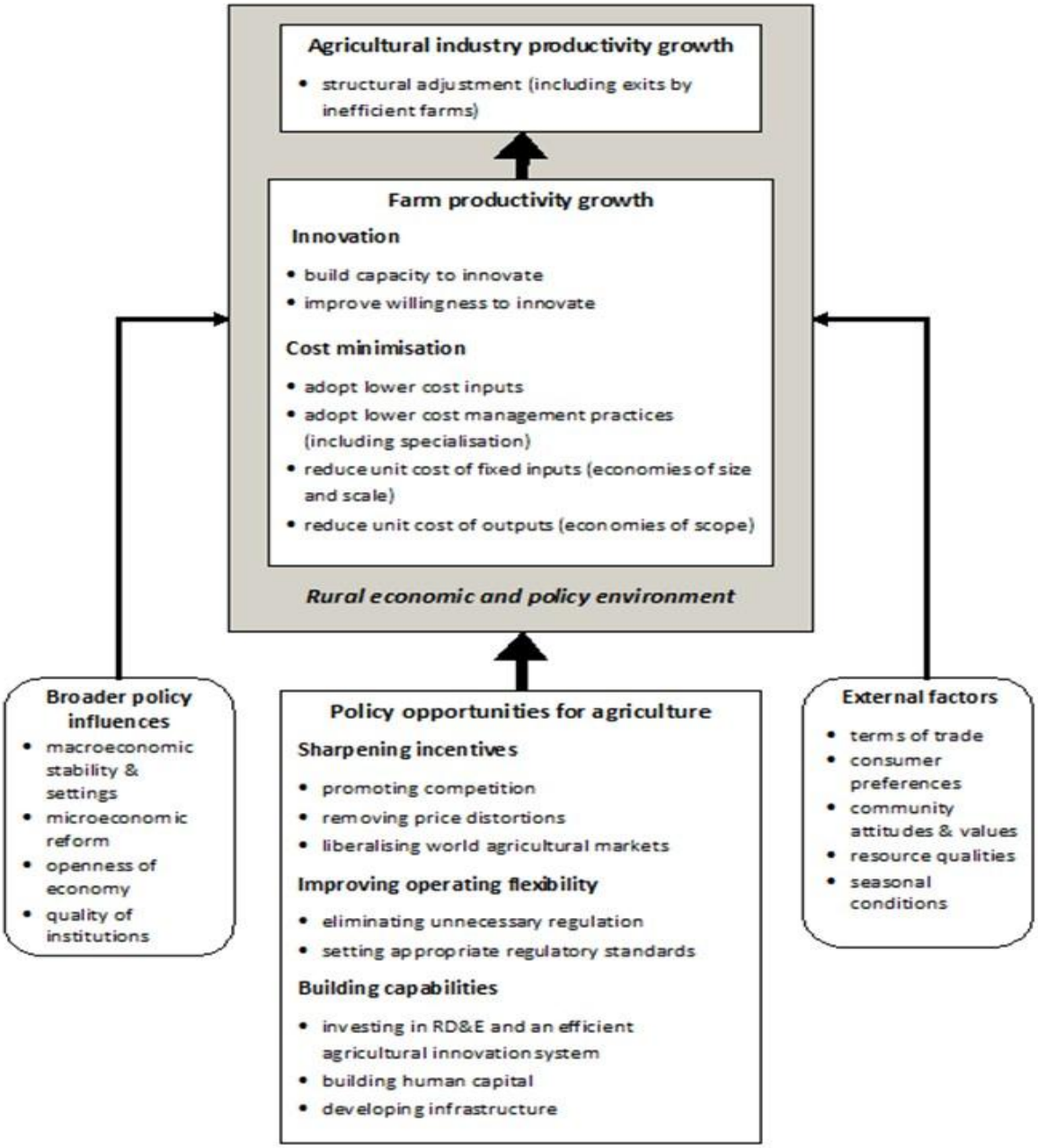
allows the user to zoom in from a statewide level to property level and display information about infrastructure, land type, land zoning and land parcels, climate, rainfall, temperature, frosts and water availability. The diverse range of information available on AgInsight South Australia can help build a business case for potential development or investment opportunities as well as investigate commodity options and their best production locations.

The multi-platform portal offers easy online access to economic and market data on South Australian agribusiness commodities and processed food and beverages, and a map based picture of important location factors.

3. Barriers to the adoption of new technology

The Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) framework for major productivity determinants (Figure 1) provides a useful framework for considering barriers to adoption of new technology.

Figure 1 ABARES' framework for major productivity determinants[3]



[3] Gray, EM, Oss-Emer, M and Sheng, Y 2014, *Australian agricultural productivity growth: past reforms and future opportunities*, ABARES research report 14.2, Canberra, February.

Several issues relating to technology barriers are worthy of consideration, including:

- the importance of a connected, open economy;
- an efficient agricultural innovation system inclusive of research, development, extension and use;
- building the capability of farmers in their use of technology;
- government roles in building capability by investing in or coordinating technology with public good characteristics; and
- improving flexibility by addressing potential regulatory constraints.

A Committee for Economic Development of Australia (CEDA) 2013 report[4] noted that a major problem in Australia is that the growth in Research and Development (R&D) spending did not seem to be translated into improved innovation outcomes. CEDA noted that small sized firms were particularly affected by impediments to innovation.

Recent ABARES research has found that large farms achieve higher productivity through changes in production technology rather than through changes in scale[5]. Gray et al (2014)[6] observed.

'In some industries, technologies may be better suited to larger farms because of the lumpy nature of investment in, for example, cropping machinery and dairy shed technologies. However, in other cases, farm size itself may not be the constraint, if smaller farms do not have the capacity to adopt technologies suited to their size. For example, smaller farms may be constrained by access to skilled labour or available cash flow'.

The ABARES' framework identifies the importance of an open economy to provide Australian farmers with access to new technology developed in other countries. Gray et al (2014) state:

'In addition to innovations generated domestically, Australian agriculture has also benefited from knowledge and technology developed overseas. ABARES research found that spillovers from foreign R&D (proxied by investment from the United States) have accounted for average broad-acre TFP growth of around 0.63 percentage points annually[7]. Moreover, the relative contributions of foreign and domestic research (including domestic extension) to broad-acre TFP growth have been roughly equal, suggesting that Australian agriculture relies heavily on international research spillovers.'

The framework also identifies the importance of quality institutions. From Gray et al (2014)

'Given Australia's small domestic capacity for R&D relative to larger economies realising benefits from international collaborations and research spillovers remains a priority. While some organisations, including RDCs (for example, the Grains Research and Development Corporation and Dairy Australia) have developed strong international research linkages, more can be done. For example, in considering opportunities to enhance public extension initiatives, decision-makers could consider the scope for emphasising extension initiatives directed at accelerating foreign knowledge and technology spill-ins, rather than limiting the concept of extension simply to indigenously

[4] CEDA 2013, 'Australia Adjusting: optimising national prosperity', November, p95.

[5] Sheng, Y, Zhao, S & Nossal, K 2011c, 'Productivity and farm size in Australian agriculture: reinvestigating the returns to scale', paper presented to the Australian Agricultural and Resource Economics Society Conference, Melbourne, Australia, 9–11 February.

[6] Gray, EM, Oss-Emer, M and Sheng, Y 2014, *Australian agricultural productivity growth: past reforms and future opportunities*, ABARES research report 14.2, Canberra, February.

[7] Sheng, Y, Gray, EM, Mullen, JD & Davidson, A 2011a, *Public investment in agricultural R&D and extension: an analysis of the static and dynamic effects on Australian broadacre productivity*, Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.

generated knowledge. At the same time, Australia's rural RD&E system will need to invest in maintaining sufficient capacity and developing networks to identify, adapt and exploit technologies and knowledge developed outside Australia'.

Earlier in this submission, government involvement to build capabilities through technology development and use has been highlighted. Supporting telecommunications infrastructure such as AgInsight and Rural Connect or weather information infrastructure, coordinating and investing in novel technology where additional benefits are involved such as SARMS, New Horizons and SIT are all essential for new agricultural technology to be efficiently developed and utilized.

The elimination of unnecessary regulation was also identified by ABARES as an area where policy developments could assist agricultural productivity growth. Recently South Australian primary producers noted that road regulations had not kept pace with changes to farm machinery and heavy transport technology. As a result PIRSA, in partnership with the Department of Planning, Transport and Infrastructure (DPTI) and Primary Producers SA (PPSA) developed a 90 day project to identify, prioritise and find solutions for issues in relation to access for and regulation of heavy vehicle transport http://www.pir.sa.gov.au/__data/assets/pdf_file/0004/245128/Modern_Transport_System_for_Ag_A4.pdf

The project investigation included a review of restricted access vehicles (B Doubles, Road Trains) and the movement of oversize and over-mass agricultural machinery on public roads (grain harvesters, air-seeders, field bins). The project recommendations have been endorsed by the Regional South Australian Cabinet Committee and the implementation process has commenced.

Already the State Government, through PIRSA has provided PPSA with assistance to design and deliver a program to increase awareness among farmers of the code of practice for the movement of oversize agricultural machinery. It has also changed the system of common registration dates for farm vehicles enabling farmers to register all machinery and vehicles at the same time each year saving them time and paperwork. The State Government has also introduced tri-axle dollies for use in road train combinations.

Other recommendations already implemented include the use of BAB and ABB quad road trains from Port Augusta to the Northern Territory border and from Pimba to Olympic Dam, and increasing the travel radius beyond which producers must fill out a heavy vehicle work diary.