Widgets matter: So do people and policies

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Australian Export Grains Innovation Centre

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GOVERNMENT OF WESTERN AUSTRALIA

GRDC Grains Research & Development Corporation

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Motivation for paper

Concern about key components of the agricultural innovation system in Australia

Concern about Australia's ability to design and embrace efficacious change in its agricultural innovation system

Agricultural Innovation

As a process, innovation can be purely technical — making a new or better **widget**.

But as a process, innovation involves human actors responding to a variety of market and social signals; and so **people and policies** matter.

Innovation — a political flavour of the month

From 2000 to 2014 there have been at least 60 Commonwealth Government ministerial policy statements, government commissioned reports, reviews, and information papers on innovation system issues in Australia.

In March 2014, the Senate of the Australian parliament asked its Economics References Committee to enquire into Australia's innovation system. The committee received 185 submissions and released its report in December 2015.

In August 2015 the Minister for Agriculture, the Hon Barnaby Joyce MP, asked the Standing Committee on Agriculture and Industry to inquire into and report on agricultural innovation.

In December 2015 the Australian parliament's Trade and Investment Growth Committee initiated a further inquiry into Australia's research and innovation sector, submissions close on Feb 11 2016.

The AFI Autumn journal issue in 2016 will be devoted to agricultural innovation.

Agricultural Innovation in Australia — what we already know

Investment in agricultural R,D&E is a key pre-cursor for the creation and use of technologies and inventions ('widgets') that help drive agricultural productivity.

Grafton et al (2015) estimate that productivity growth since 1953 accounts for about half the value of agricultural production in 2013.

Sheng et al (2011) find that public investment in R,D&E has a significant positive effect on agricultural productivity. The relative contributions of foreign and domestic research (and extension) to broadacre TFP growth have been roughly equal (0.63% per annum and 0.60% per annum, respectively) and accounted for the bulk (1.23% per annum) of average annual broadacre TFP growth of 1.96% per annum from 1952–53 to 2006–07.

Formal assessments of Australian agricultural R&D investments often show the returns are highly variable, but mostly are strongly positive (Mullen and Cox, 1995; Brennan and Davis, 1996; CRRDC, 2010).

Widgets matter — productivity and profitability depend on them

Cross-industry	
	Electronic communication (faxes, mobile phones, radio, TV, computers, internet, tablet devices, electronic banking, decision aids, electronic record-keeping)
	Safer, more reliable, more fuel-efficient vehicles
	Portable, cheaper power tools
	Remote power generation, remote-sensing technologies (cameras, automatic weather stations, satellite imagery)
	Soil mapping, soil monitoring and tissue testing
Grains	
	High work rate machinery (tractors, air-seeders, self-propelled sprayers, harvesters, chaser bins)
	Higher-yielding crop varieties (wheat, barley, canola, pulses, GM varieties)
	Pre and post-emergence herbicides
	Broad and narrow spectrum herbicides
	GPS guidance systems, variable rate technology
	Harvest weed seed control technologies (Bale Direct System, Harrington Seed Destructor, windrow burning)
	Chemical fertilisers and soil ameliorates
	Bulk handling equipment, sealed storage and silo bags
	Deep-ripping of traffic hardpans
	B-doubles for grain transport
Animals	
	Objective measurement for breeding, artificial insemination, more breeds better suited to Australian conditions
	Livestock health products
	Improved shed design for dairying and shearing, improved animal handling equipment, self-feeders
	Improved and new pasture species
	Chemical fertilisers and soil ameliorates for pasture and feed grain production
	B-doubles and triples for stock transport
	Electronic ear tags, electronic weighing, condition scoring

In spite of economic assessments that show the value of investing in developing these innovations (widgets), nonetheless there is a corrosion of our ability and capacity in Australia to create, develop and apply those widgets.

Why?

(i) Cumulative budget deficits

e.g.

(ii)

Budget constraints

Federal and State governments are principal employers or funders of many involved in agricultural innovation.

e.g. WA state government debt is projected to peak at $39 billion in 2019. Hence, cost-savings have been forced on many state agencies, including agriculture. The Department of Agriculture and Food, the State's main employer of agricultural graduates and researchers, is reducing its workforce from 1350 down to an announced target of 700 in 2017.

Structural changes

Many agricultural technologies and business strategies are labour-saving.

Fewer, larger farms which remain mostly owned and operated by farm families.

A greater ease of electronic communication enabling the farm sector to be serviced with fewer highly skilled extension and research specialists.

In such an environment there is no burgeoning population of farmers, nor a strongly growing population of farm advisory and farm management workers, nor are there sustained high growth employment prospects in support industries.

There is an erosion and corrosion of many occupations that otherwise would normally form part of the innovation system.

In his book Conditions of Economic Progress, Clark (1957) recounts how in the USA between 1849 and 1950 the proportion of the labour force working in agriculture decreased from 65% to 12%.

In Australia in 1970 the agricultural sector accounted for 8% of the nation's employment; by 2013 the proportion had fallen to 2%.

In 1970 agricultural exports were 41% of the nation's exports, yet by 2012 that share had fallen to 12%.

The agricultural sector now forms only around 2% of Australia's gross value of production.

In relative terms, but also in absolute terms in some situations, the employment opportunities for agricultural scientists have diminished.

The demand at UWA [University of Western Australia] *has fallen by about a factor of 10 since I started my agricultural science degree in 1980.*

Professor David Pannell

From 2001 to 2012 undergraduate annual enrolments in agriculture and related disciplines in Australian universities have declined by 2,500.

There are 2,500 fewer undergraduate students in agriculture and related disciplines in Australian universities, now compared to a decade ago.

This decline in undergraduate student numbers potentially translates into a decline in university funding for agricultural schools or departments and a rationale for shedding some of their staff, unless there is offsetting income from other sources such as post-graduate numbers or competitive research funds.

Compounding the reduction in agricultural undergraduate student numbers and the downward pressure on university appointments in agriculture are other general trends affecting universities.

Universities face budgetary pressures and growth ambitions that lead universities to seek income. So university managers:

(i) switch resources into low-cost courses that attract large student numbers (i.e. not agriculture) and focus on attracting full-fee paying overseas students.

Since 1990 total student numbers in the higher education systems have grown by 183% from 485,000 to 1,373,000 students in 2014.
Fee-paying overseas student numbers have increased from 10,944 in 1990 to 294,000 in 2014. International university rankings, largely based on publication eminence, play an important role in attracting these students.

(ii) appoint or reward staff who will lift the university's international ranking and thereby attract more fee-paying overseas students. These staff are those able to regularly publish in high-impact overseas journals.

These actions by university managers lead to shrinkage in the absolute or relative importance of agricultural departments and agricultural academics in most universities. It encourages remaining agricultural academics to concentrate on publishing in high impact overseas journals rather than creating beneficial impacts for local agricultural industries.

There is a corrosion of the incentive for university staff to be involved in agricultural innovation.

Other corrosive influences include:
(i) Australian universities' policies relating to 'outside work'. In some universities, consultancy work by their staff is encouraged, whilst in some others it is discouraged (even banned in some cases).

By contrast, academics in the USA are encouraged to work in their consultancy businesses, and thereby often develop and retain strong connections to industry.

(ii) Unfavourable reviews
e.g. The PC recommended less public support for agricultural R&D. The National Commission of Audit (2014) repeated those recommendations and additionally recommended:

- abolition of sector-specific R&D programmes,
- greater government oversight of R&D activity of the CSIRO and
- abolition of Co-Operative Research Centres (CRCs)

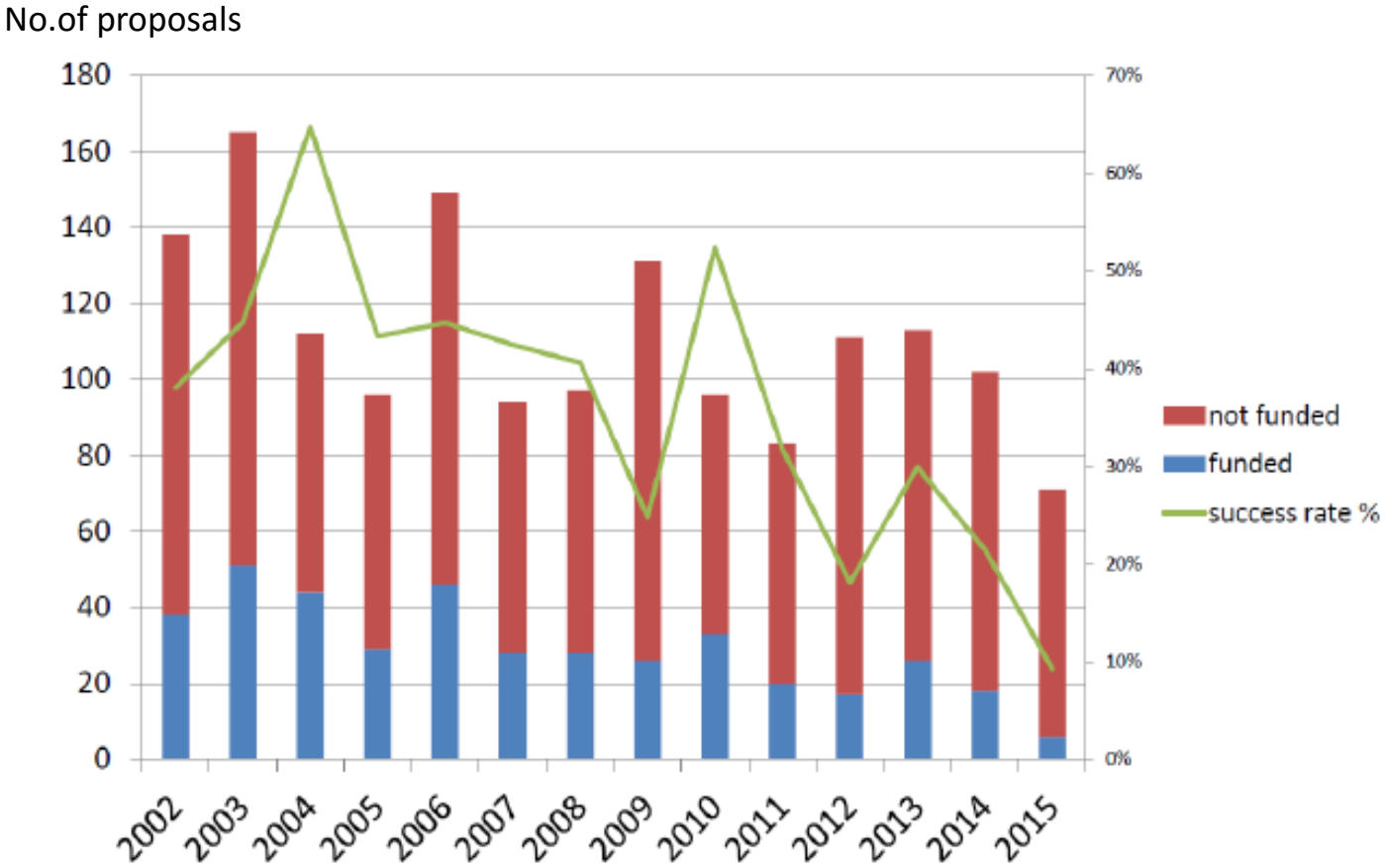
Australian Nobel laureate Professor Brian Schmidt (2014) comments:
At the moment a culture of innovation is absent in large parts of the academic research sector of Australia. There is little contact with industry, role models for moving ideas out of the academic environment are rare, and therefore few industry players are interested in partnering with universities. Nor are academics rewarded for moving between industry and academia. Indeed the system strongly discourages such mobility through tenure, hard-to-transfer superannuation, and research quality measures.

This lack of connectedness to industry endangers Australian agriculture. Unlike the USA where academics employed in the land grant universities have a requirement to be engaged with industry, academics employed in Australian university agricultural faculties are prone to being isolated from the sector, driven by incentives that place little value on industry engagement, other than that required to win industry research grants. Australian university promotional systems reward publications, and largely ignore the economic, social or environmental impact of that research.

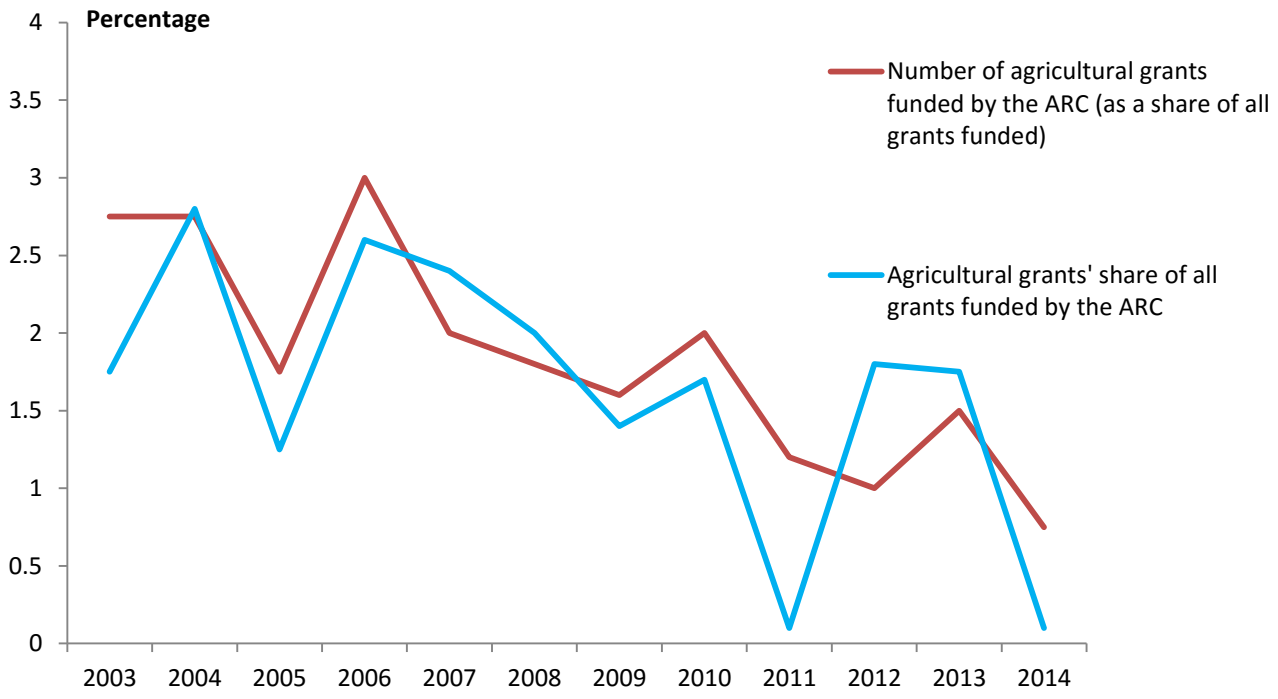
Even where an agricultural academic wants to stay connected to agriculture by engaging in publishable ‘blue sky’ research with a possible relevance for agriculture, gaining funding support is difficult.

For example, the ARC, a main funder of ‘blue-sky’ R&D, inadequately supports agricultural ‘blue-sky’ R&D in universities, further limiting university staff’s role in the agricultural innovation process.

Australian Research Council funding of agricultural and veterinary science proposals 2002 to 2015



ARC funding of agricultural proposals 2003 to 2014



Employment prospects in agricultural innovation are not only affected by structural change and public policy regarding the tertiary sector.

Private sector investment in agricultural R,D&E also affects employment prospects.

Studies of agricultural investment In Australia point to very low levels of business investment in R&D in Australia.

Businesses in Australia face disincentives for investing in agricultural innovation; and innovation in general.

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So, what to do?

The comments of King (2012) at this point are worth noting as they outline a role for economists in helping create useful responses:

> Economists also design economic artifacts (e.g., markets, contracts, organizational structures, public policies) that reshape economic systems in order to better meet human needs. This work, which I will call economic design, is complementary with but differs fundamentally from economic analysis. While economic analysis is motivated by a question or a puzzle and focuses on explaining what is and predicting what will be, economic design is motivated by a problem or opportunity and focuses on what can be and ought to be or on what will yield a satisfactory outcome. (p. 276)

Policy innovation and organisational innovation are part of essential ‘economic design’ to improve agricultural innovation in Australia.

Options for Australia?

1. Change academics' incentives. Reward industry interaction and impact. Underway but difficult.

2. Change business incentives. Underway.

3. Re-organise rural R&D corporations to ensure they better deal with farm business, farming system, and value-chain and supply chain innovation opportunities.

4. Form effective public-private innovation networks; re-visit agricultural tertiary education, research training, entrepreneurship training.

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Australian Export Grains Innovation Centre

The Company was established in November 2012 by the Grains Research and Development Corporation (GRDC) and the WA State Government (through the Department of Agriculture and Food, Western Australia).

Each founding Member agreed to contribute $20 million to AEGIC over five years.

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Thank You

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