Australia’s agricultural innovation system
- A leaky boat adrift in a sea of opportunity?

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www.csiro.au
Main Messages

• **Opportunity abounds, but can our agricultural innovation system respond?**

  • Strong foundations for our agricultural RDE system but cracks appearing.

  • Some progress in national coordination but systemic “innovation systems” challenges remain.

  • Doing more, better, with less (hence differently) is the name of the game.

  • CSIRO is transforming itself to adapt to unfolding national needs.
Global drivers

- 50-80% growth in food demand between 2010 and 2050
  - Population
  - Economic growth and diet shifts
  - Bio-energy?

- Real food prices rising (with high variability)
Plethora of studies / reports
National opportunities

- Prospects for a doubling of commodity exports by 2050

- Cumulative value of additional exports of $1.7 trillion postulated

ANZ “Greener Pastures” Insight Report
Australian agriculture – looking back

- Output doubled from 1965 to 2000
- Millennium Drought

Output doubled from 1965 to 2000

5 times N fertiliser
3 times irrigation water in Murray Darling Basin

Data Source: ABARE 2008
Australian agriculture – looking forward

Output doubled from 1965 to 2000

Millennium Drought

New sources of production and productivity

Maintaining existing productive capacity

Is our agricultural innovation system up to the task?

Data Source: ABARE 2008

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Some strong foundations ...

• Australia produces 3.6-5.0% of global papers in agricultural / plant&animal sciences*

• These are cited 17% more than the world average

• RDC model with strong industry commitment to R&D

• We have a CSIRO, a global “top 10” research institution in agricultural sciences and plant/animal sciences

• Collectively strong University sector and history of productive agricultural CRCs

* Source: Thomson Reuters InCites, Articles & Reviews, 2008-2012, Data retrieved 27 May 2013
But some “cracks” appearing ....

• Productivity plateaux ?
• New or enhanced sustainability challenges
• Scientific capabilities and infrastructure under pressure.
• R&D costs rising faster than income.
• Public sector extension disappearing.
• Heavy reliance on public sector funding remains.
• R&D weakly linked to wider “innovation system”.
A productivity plateau?

Source: ABARES.
The timelags are long ......

“... productivity consequences of public agricultural R&D are distributed over many decades, with a lag of 15 to 25 years before peak impacts are reached and continuing effects for decades afterward. “ .......

  Julian Alston, Matthew Andersen, Jennifer James, and Philip Pardey

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**Uptake of no-till in Australia**

From D’Emden, Llewellyn et al (2009)
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A “traditional” top down view of Australia’s Agricultural Knowledge and Innovation System

Funding

Procurement

Supply

SCOPI – PISC

All necessary but not sufficient!

Reproduced in Grant (2012)
National coordination is not new ... Melbourne, 1917

Seems a long way from the “paradigm shift we have been discussing !
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Gross Domestic Expenditure on R&D

- Strong growth in non-Ag sectors
  - minerals, energy, manufacturing, services

- Ag R&D approx 4% of total
  - Down from 10% in 2001

- Compound rates of growth around 1.5% p.a. (< inflation)
Some deeper systemic issues ...

• An overarching issue
  • Better linking the R&D system to the wider “innovation system”
    – Includes the challenge of “re-inventing” extension

• Some structure and function issues
  • The “tragedy of the commons” problem (w.r.t. foundational science capability)
  • The “leveraging to death” problem
  • The “short term, fragmented, small project” problem
  • The “high transaction costs in contracting” problem
  • The “if in doubt, create a new institution” problem
  • Balancing private and public interests
  • and others .....
“Innovation systems” view

Adapted from A. Hall (2012) Partnerships in agricultural innovation - Who puts them together and are they enough? In OECD Conference on Improving Agricultural Knowledge and Innovation systems
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CSIRO represents around 15-20% of Australian agricultural R&D (in publication output)

a little higher in citations

similar estimates come from funds invested

Fields in which CSIRO is > 10% of Australian publication
CSIRO and agricultural R, D & E

- CSIRO research investment: 1926 - 2010
CSIR’s / CSIRO’s total R,D & E expenditure

• After 50 years of rapid expansion, CSIRO stopping growing in 1990.

• Reliance on competitive externally sourced funds has grown.
  • Means internal funds are highly leveraged (30-50%)

• Internal flexibility to invest in underpinning science capacity is shrinking
CSIRO’s role?

- large scale, multi-disciplinary, mission-directed science and technology;

- trusted advisor to the nation - scientific preparedness - deep research capabilities;

- connections across the innovation system - access to global knowledge

- long term national facilities - supporting national priorities.
CSIRO’s reinvention post 2001

National Research Flagships

- BIOSECURITY
- CLIMATE ADAPTATION
- DIGITAL PRODUCTIVITY AND SERVICES
- ENERGY TRANSFORMED
- FOOD FUTURES
- FUTURE MANUFACTURING
- MINERALS DOWN UNDER
- PREVENTATIVE HEALTH
- SUSTAINABLE AGRICULTURE
- WATER FOR A HEALTHY COUNTRY
- WEALTH FROM OCEANS

2001/2002

2011/12
Sustainable Agriculture Flagship

• The agricultural productivity and food security challenge
  • Improving farm technologies and practices
  • Enhancing resource use efficiency
  • Building healthy soils and agro-ecosystems

• The carbon challenge
  • Reducing greenhouse gas emissions
  • Improving carbon balances in soils and vegetation

• Underpinned by:
  • Delivering information systems for better decision making
  • Fostering international partnerships
A case study ...
National Water Use Efficiency in Grains

16 partners investing $17.6 M over 5 years
Aim: Improve WUE by 10%

<table>
<thead>
<tr>
<th>Innovation</th>
<th>WUE Increase</th>
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<tbody>
<tr>
<td>Break crops</td>
<td>16 to 83%</td>
</tr>
<tr>
<td>Summer weeds</td>
<td>60%</td>
</tr>
<tr>
<td>Early sowing</td>
<td>21 to 33%</td>
</tr>
<tr>
<td>Irrigation timing</td>
<td>12 to 23%</td>
</tr>
<tr>
<td>Variable N rates</td>
<td>91%</td>
</tr>
<tr>
<td>Gypsum</td>
<td>54%</td>
</tr>
<tr>
<td>Wider rows</td>
<td>-6 to -13%</td>
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Key ingredients for success

Globally relevant science
With global science foundations and quality

Nationally coordinated by CSIRO / GRDC
Underpinned by long term investment in farming systems science (>20 years)

Regionally led projects by partner agencies
University, State, Farmer Organisations

Locally delivered by all,
but in particular farmer organisations, associated consultants and GRDC
“Collective enquiry”

- Dual-purpose crops – graze and grain
  - Cereal and canola crops grazed without yield penalty
  - Increase flexibility, profitability and reduce risk
  - Increase animal and crop production from mixed farms
Back to the “leaky boat” in the “sea of opportunity” - do we paddle harder or fix the leaks?
Some elements of a better agricultural innovation system?

• Deep connections between CSIRO and the Universities to deliver a “mission directed” science base ... with an eye to long term capabilities.

• Greater use of the “collective enquiry” / national initiative model

• Evolution of the RDCs and private sector services to reinvent “extension” in the 21st Century

• Industry leadership on innovation in value chains (virtual industry innovation precincts ??)

• Recognition that government input is finite and industry will have to “step up” where the “value proposition” exists.

• Continuing to advance the PISC agenda (including COAG roles)
  • Deeper levels of inquiry on innovation system functionality
Thank you

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