

A background image of a vast agricultural field with rows of green crops stretching towards the horizon. In the distance, a red tractor is visible, spraying a fine mist of white liquid across the field. The sky is a pale, hazy blue.

The current state and challenges facing Australian agriculture

Angie Sassano
Monash University

Snapshot of Australian Agriculture

**\$82 billion
(gross value)**

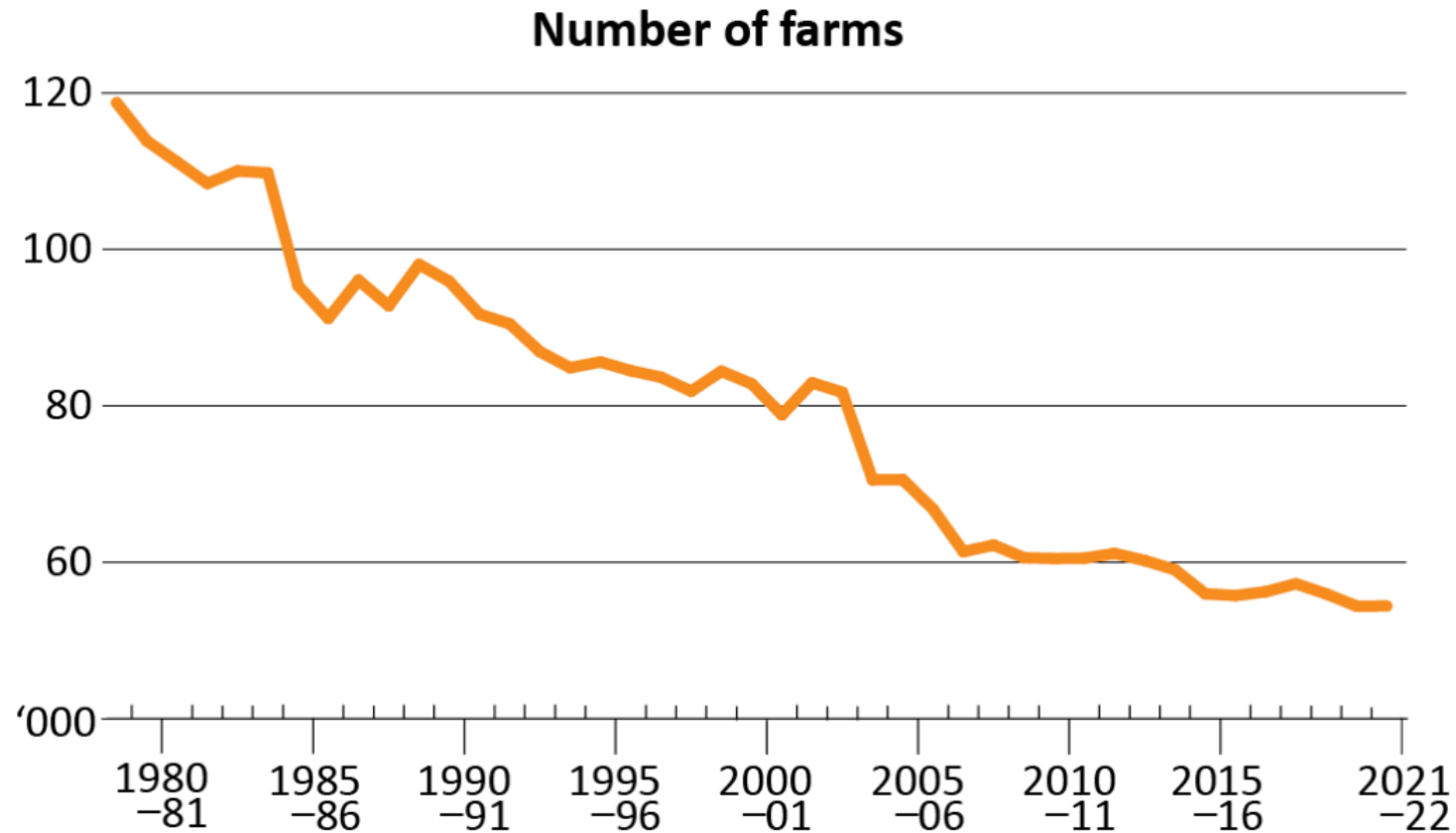
**13.6%
Australian
exports**

**72% of
produce
exported**

**74% total
water
consumption**

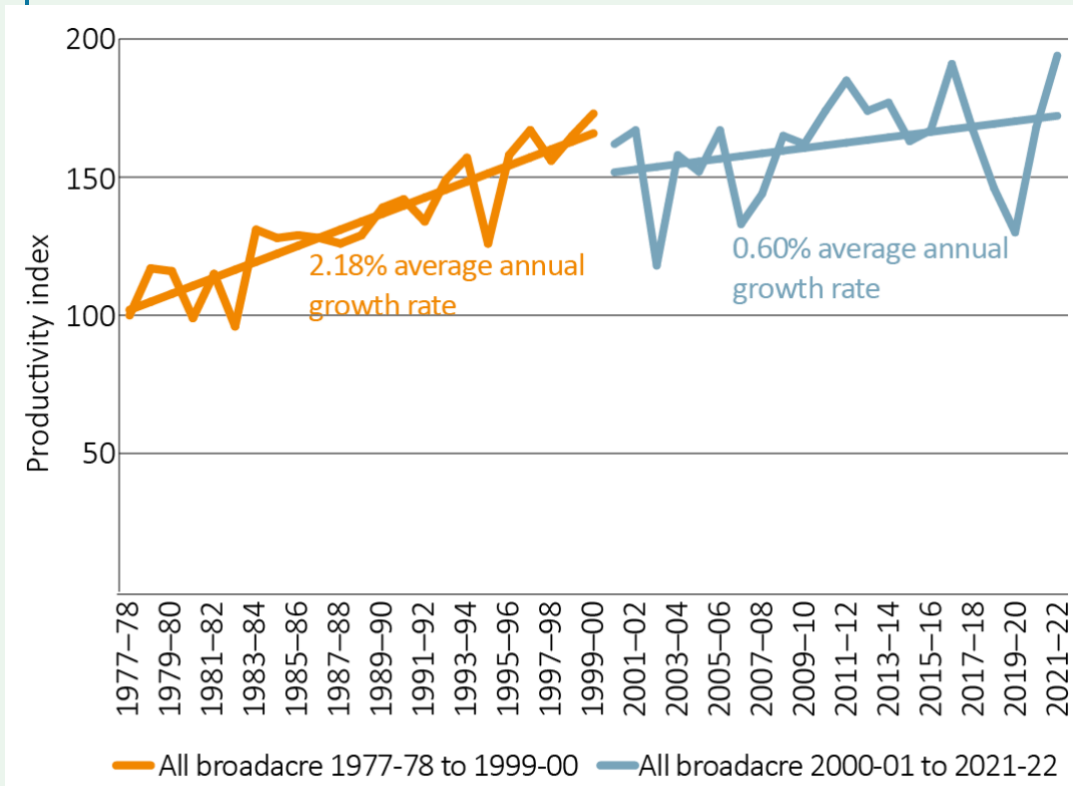
**55% total
land use**

Farm demographics

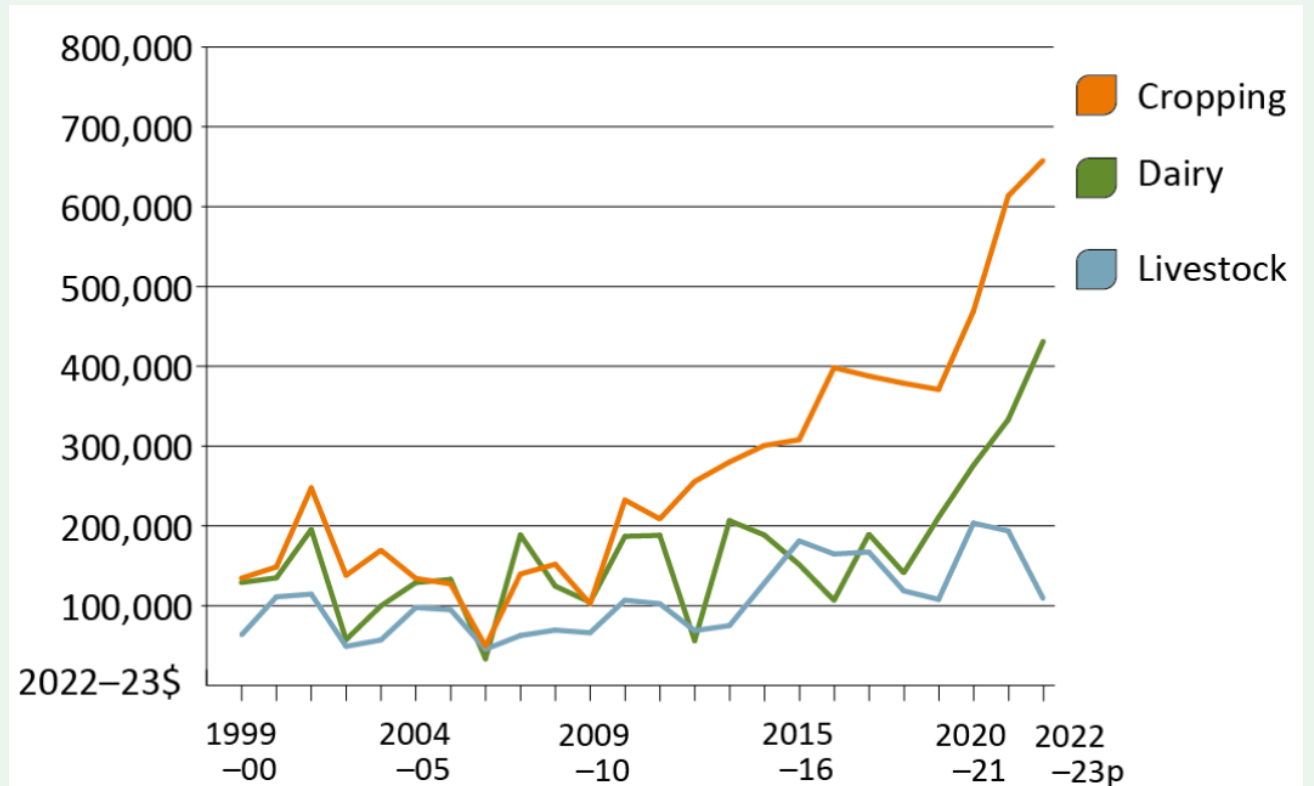


Note: ABARES' counts of farm numbers rely on the definition of a farm business according to the ABS measure of EVAO (ABS 2023b). The EVAO threshold used for ABARES' farm surveys has changed over time with shifts in industry structure and output value. Farm numbers in this graph relate to those farms with an EVAO of \$10,000 or more until 1987-88; \$20,000 or more from 1987-88 to 1990-91; \$22,500 or more from 1991-92 to 2003-04; and \$40,000 or more from 2004-05. Source: ABARES

Price and income



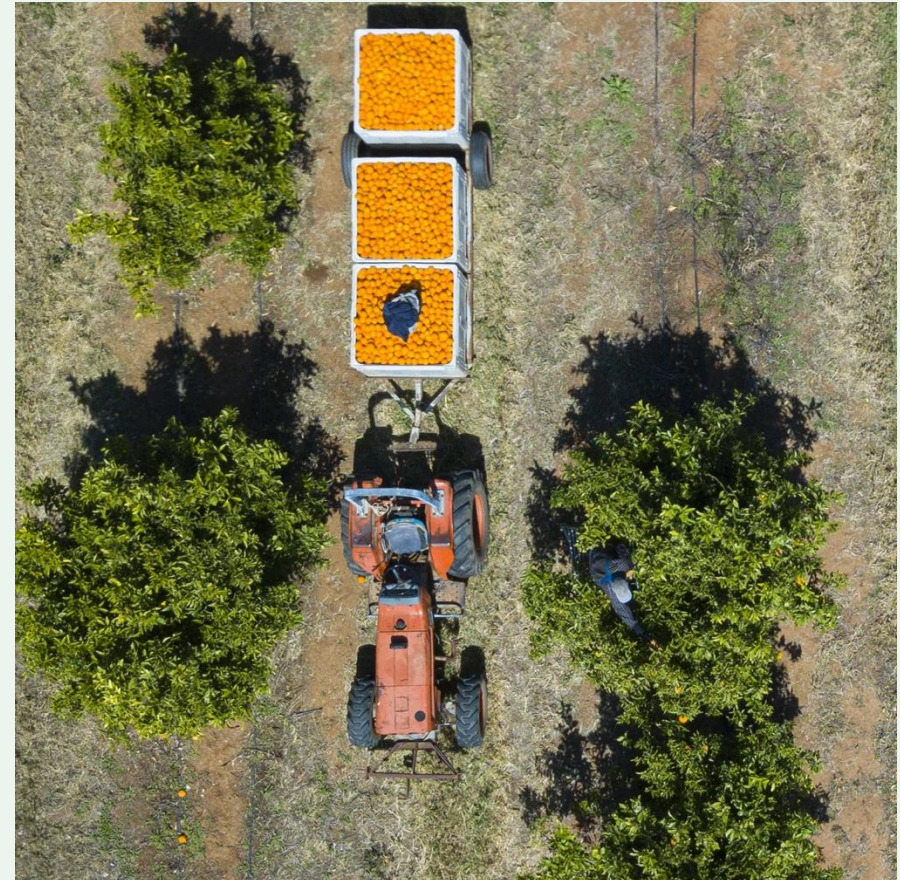
Broadacre productivity, pre and post 2000



Average farm income, by industry, 1999-2000 to 2022-23

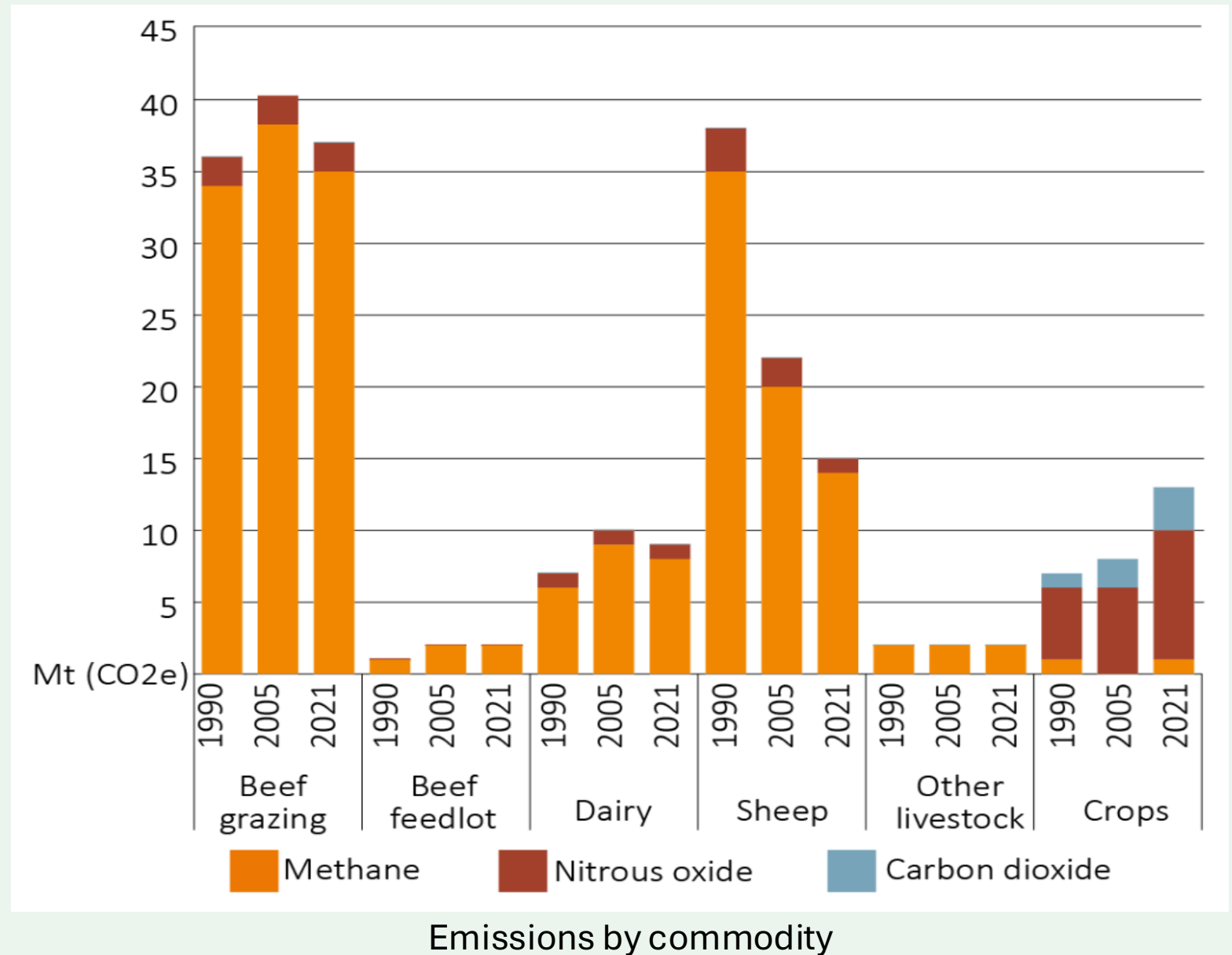
Labour variability

- Average of 257,000 people employed, 2022-23 (excl. overseas workers)
- Dependence on casual and contract labour
- Seasonal variability
- External pressures (ie. COVID-19 pandemic)



Climate and sustainability

**Expected increase
in agricultural
emissions from 17%
(2022) to 25% (2035)**



Biosecurity

Continued management of established pests estimated to cost agricultural producers **\$5.3 billion** (82% of costs attributed to weed management)

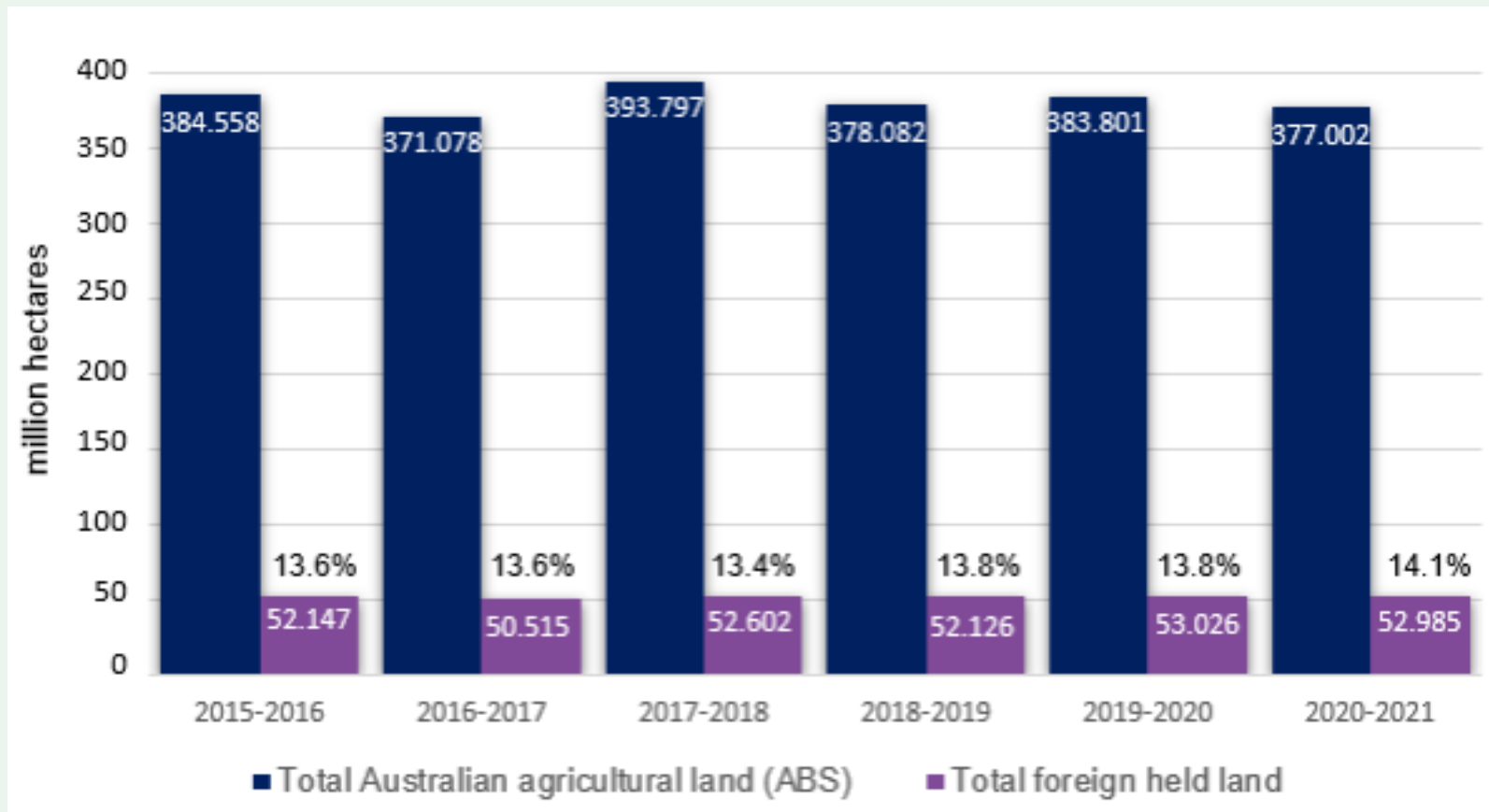
Potential economic costs:

- Multi-state outbreak of foot-and-mouth disease est. cost of **\$80 billion over 10 years**
- Estimated cost of between **\$0.4 to 2.5 billion** to control an African Swine Fever outbreak



Foreign Investments

- Q1, 2022: \$1.6 billion in foreign investments
- Foreign investment for technological innovation



Level of foreign ownership of agricultural land (ATO, *Register of foreign ownership of agricultural land*)

AI and robotics are **one possible** solution in mitigating and responding to these challenges...





AI in Agriculture: The key to farming's next revolution

Ashley Rootsey
AI & Robotics Lead
Food Agility

WHO IS FOOD AGILITY?

Food Agility funds and delivers R&D projects that aim to boost the profitability and sustainability of the Australian agriculture sector.

These projects bring together diverse teams of researchers, technologists, farmers, agribusinesses, retailers, governments and regulators.



WHO AM I?

I have a background in Agricultural Science and Business, and I now manage Food Agility's portfolio of AI & Robotics projects.

These projects use Artificial Intelligence to increase farming productivity, improve environmental sustainability, and extend Australia's global standard of producing clean, green and quality food.





Smart Farming Data Ecosystem

Overcoming one of the biggest hurdles in modern, data-driven agriculture by securely managing and integrating data from multiple sources.



Framework for Sustainability Reporting

Providing producers with a transparent and credible tool to understand and manage natural capital and Greenhouse Gas emissions.



Pig Welfare and Pork Provenance

Developing a system where information from tags on individual pigs can be used to quickly identify and respond to animal health issues in commercial piggeries, and create a digital record to share



Grazing Intelligence

Empowering sheep and beef producers to confidently make proactive grazing decisions.



Rangelands Carbon

This \$6.5million collaboration will develop an accurate and affordable way to estimate carbon in Australian Rangelands landscapes



Farm-wide Wi-Fi

Tractors and trucks will become roving Wi-Fi devices with a range of up to 5 kilometres, as part of a new Food Agility CRC research collaboration to provide farm-wide internet coverage.



Identifying Value Proposition for AgTech Adoption

Enabling digital transformation by mapping the value of technology for producers



Robotics-ready AI in Viticulture

Pairing robotics and artificial intelligence to improve wine grape growing insights



Water Leak Detection

Reducing the amount of time it takes to discover a water leak through advanced modelling



WA Farm Data Sharing

Helping growers make informed investment decisions using their own data



Clinical Mastitis Decision Support Tool

Scientists, technologists, retailers and farmers are teaming up, using Artificial Intelligence (AI) and creating the equivalent of My Health Records for dairy cows, to better manage clinical mastitis



Sustainable Agribusiness Adaptations

NAB and Food Agility Co-operative Research Centre (CRC) have partnered to provide practical guidance to farmers on how they can use the latest climate and sustainability research to make their



Protecting Data in Digital Agriculture

\$1.5million partnership to improve data privacy and security across Australian agriculture



Haystack Fire Prevention

Using data analytics to prevent spontaneous haystack fires



Optimised Carbon and Nutrient Management

Enabling farmers to better understand soil health through new analytical insights



Kiwi Fruit Yield Prediction

Delivering predictive models of fruit yield count and fruit sizing for kiwi fruit crops.



TRAKKA: Making Data Flow

Developing digital infrastructure to empower producers to control their data flows while enabling service providers to generate more value for the red meat industry through rich and varied data sets.



Transforming Australian Shellfish Production

Delivering real-time, estuary-specific predictive modelling for shellfish farmers to manage and reduce the cost of closures.

Farming is a game of decisions...



...and decisions and decisions and decisions and decisions and decisions and decisions

How do I adjust to the climate and weather forecast this season?

What type and breed of animals should I farm?

When is the right time to harvest my crop this year?

Do I have enough feed for the animals to get through the season?

Are my animals happy and healthy? If not then why not?

Are there pests or diseases damaging my crop?

Are my soils healthy and productive?

Are there any active biosecurity threats?

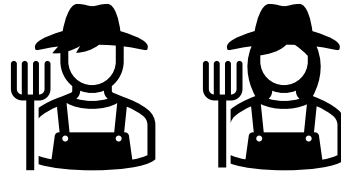
How much extra water and fertilizer should I be using, and where?

Which paddocks should I be keeping my animals in given the weather coming up?

How much crop will grow this year and when will it be ready for harvest?

Are the commodity prices high enough to make a profit?

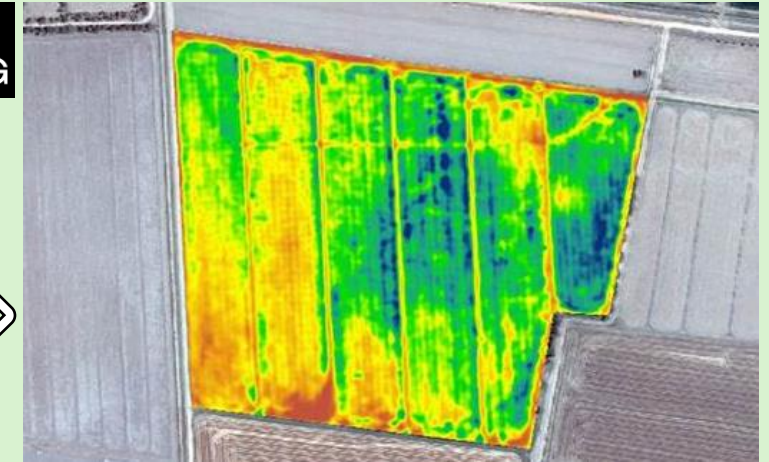
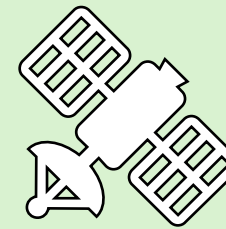
How do I make sure my farm is sustainable as possible?



Without AI

How much extra water and fertilizer should I be using, and where?

With AI



Without AI



How much crop will
grow this year and
when will it be ready
for harvest?

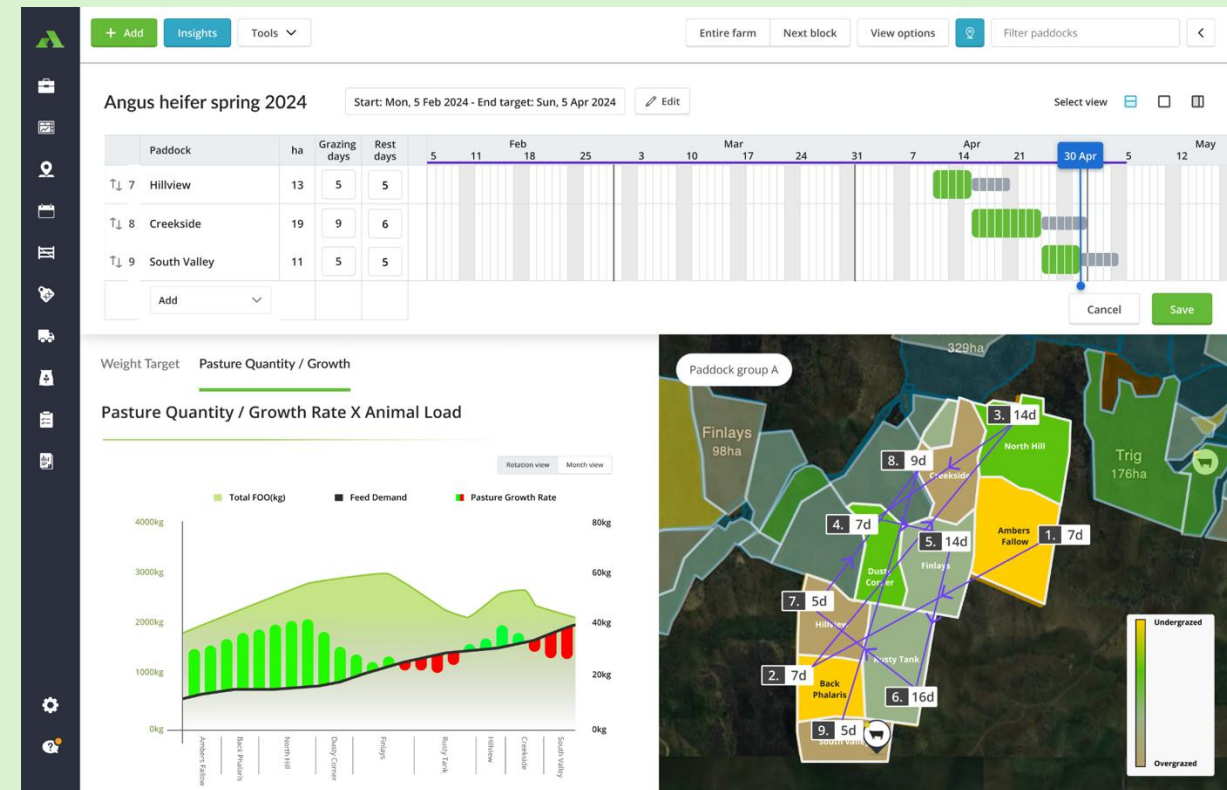
With AI



Without AI

Which paddocks
should I be keeping
my animals in?

With AI



Without AI



Are my animals
happy and healthy?

With AI

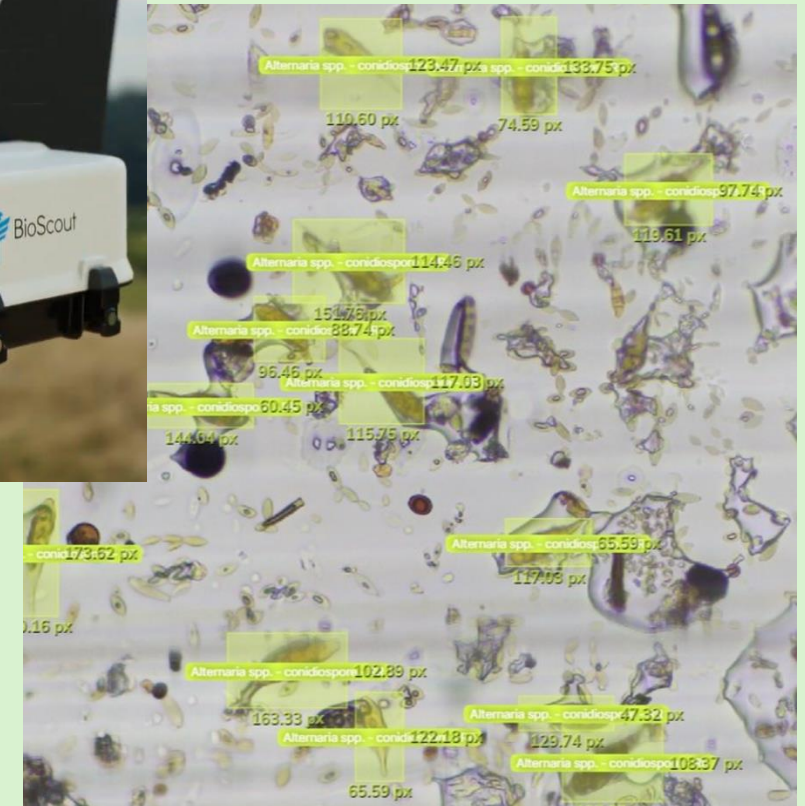


Without AI



Are there pests or diseases damaging my crop?

With AI

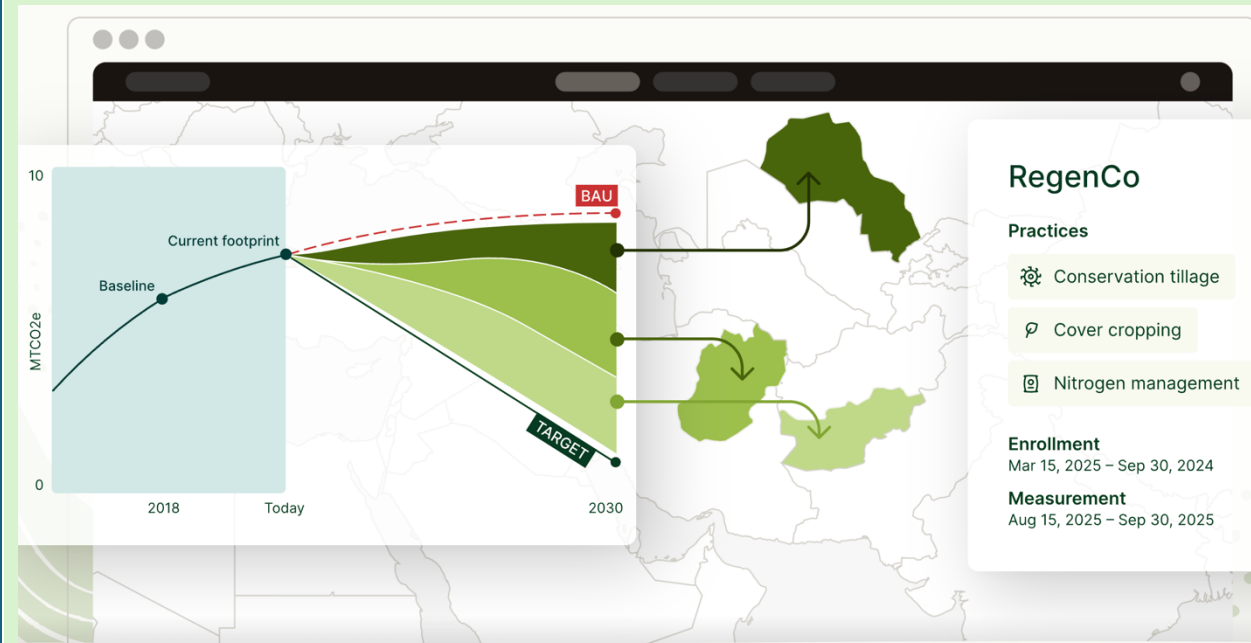


Without AI



How do I make sure my farm is sustainable as possible?

With AI



Key Learnings of AI in Ag so far...

Opportunities:

- ✅ AI can process and understand complex natural farming systems better and faster than humans
- ✅ It works around the clock and doesn't get tired
- ✅ Combined with robotics, AI enables a fully autonomous farming future

Challenges:

- ❌ AI is only as good as the data that drives it, and data can be hard to get
- ❌ AI learns from historical information, so in unprecedented times it can have trouble adapting
- ❌ AI optimizes for what it's told to, so good alignment with farmers is needed

THANK YOU

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Perils of AI and Automation in Agriculture

Leland Glenna

Professor, Rural Sociology and Science, Technology, and Society
Pennsylvania State University



My Background

- Professor of Rural Sociology
- Do research on impacts of science and technology in agriculture and food
- Grew up on a farm in Minnesota (Upper plains of the United States)
- Owned and managed the farm until 2014

Promises and Potentials

- Many potential benefits from AI and automation in agriculture
- Other presenters will cover some of those potential benefits
- However, these promises and potentials are not predetermined



Impacts on Labor



- Labor-saving and labor-enhancing technologies tend to lead to social disruptions
- Proponents often claim that new jobs will emerge
 - Example: Whip and buggy makers became automobile manufacturers
- Losing a job and transitioning to another can be stressful and costly for entire families
 - Globalization led to higher productivity and enhanced economic growth in many nations
 - But many nations also experienced spatial inequality and political disruptions linked to globalization

Impacts on Work

Many people find meaning and a sense of purpose in their work

What will it mean to be a farmer or food producer when technology replaces the worker?



Ownership and Control

Ownership and other dimensions of control over a technology can determine who benefits and who carries the risks

- Farmland ownership may become more consolidated
- In the US, court decisions determined that biotechnology companies would profit from the sale of transgenic crops
- But farmers would be responsible for genetic drift and other unforeseen negative outcomes

Intellectual property policies can enhance spread of innovations, but they can also lead to market concentration and restrict innovation

- Seed and chemical markets became concentrated after biotechnologies
- Many nations now debating revising IP policies to facilitate innovation

Agricultural commodities are converted into food and sold to customers along a value chain

- Power struggles among various actors can emerge along those value chains when new technologies are introduced

Sustainability

Will the new technology enhance environmental sustainability and social wellbeing?



OR

Will it further the extraction and exploitation of resources and people?

- Industrialization has created problems that may not be addressed by adding new technologies
- Making it possible to continue monocultural production is not necessarily sustainable



Institutions

- Neither the promises nor the perils of new technologies are predetermined
- The policies and practices that emerge to distribute benefits, risks, and harms will shape the social and environmental outcomes from AI and automation

growing Plants in Space



Summing the perils of AI in Agriculture

- Potential for social and political disruptions and spatial inequality
- Impacts on human sense of meaning and purpose
- Issues of ownership, intellectual property, value chains and power struggles
- Decreasing or increasing exploitation of resources and people not yet determined
- Sustainability concerns, especially due to monocultural production



Social research on AI and robots in agriculture

*What do we know about people's views
across the world?*

Dr Cheryl Travers
Research Fellow, School of Social Sciences
University of Wollongong NSW Australia



Paper 1: “Consumer perceptions of precision livestock farming”

A 2020 focus group study, 56 people (aged 30-40 years), Netherlands, Finland, Spain

Focus group findings		
Perceived benefits	Perceived risks	Transforming livestock farming
Improved productivity	Increased industrialisation	Detecting diseases earlier than conventional methods
Environmental improvements	data vulnerability; cyber-crime	Increased transparency => improved best practice
More freedom for farmers	Decrease human contact => decreased animal welfare	
Improved farm animal health and welfare		

Paper 2: “Understanding the public attitudinal acceptance of digital farming technologies”

Understanding the public attitudinal acceptance of digital farming technologies: a nationwide survey in Germany

Johanna Pfeiffer^{1,2} · Andreas Gabriel^{1,3} · Markus Gandorfer¹

2020 online survey of 2,012 people in Germany - crop and animal farming

Benefits most highly valued:

- preserving environment for future generations
- enhancing quality of life of farming family
- welfare of farm animals

Main influences on AI acceptance:

- societal attitude toward farming
- trust in farmers



Paper 3: “Positive public attitudes towards agricultural robots”

OPEN Positive public attitudes
towards agricultural robots
Hendrik Hilmar Zeddies^{1,2}, Gesa Busch² & Martin Qaim^{1,3}

2023 online survey of 2269 German residents on crop farming robots

Key finding: Crop farming robots compatible with environmentally-friendly agriculture

Public concerns:

- Cyber security affecting food security
- Expensive technologies causing high food prices
- OK with partial replacement of human labour but not complete replacement



Paper 4: “Drivers and challenges of precision agriculture”

Precision Agriculture (2021) 22:1019–1044
<https://doi.org/10.1007/s11119-020-09760-0>

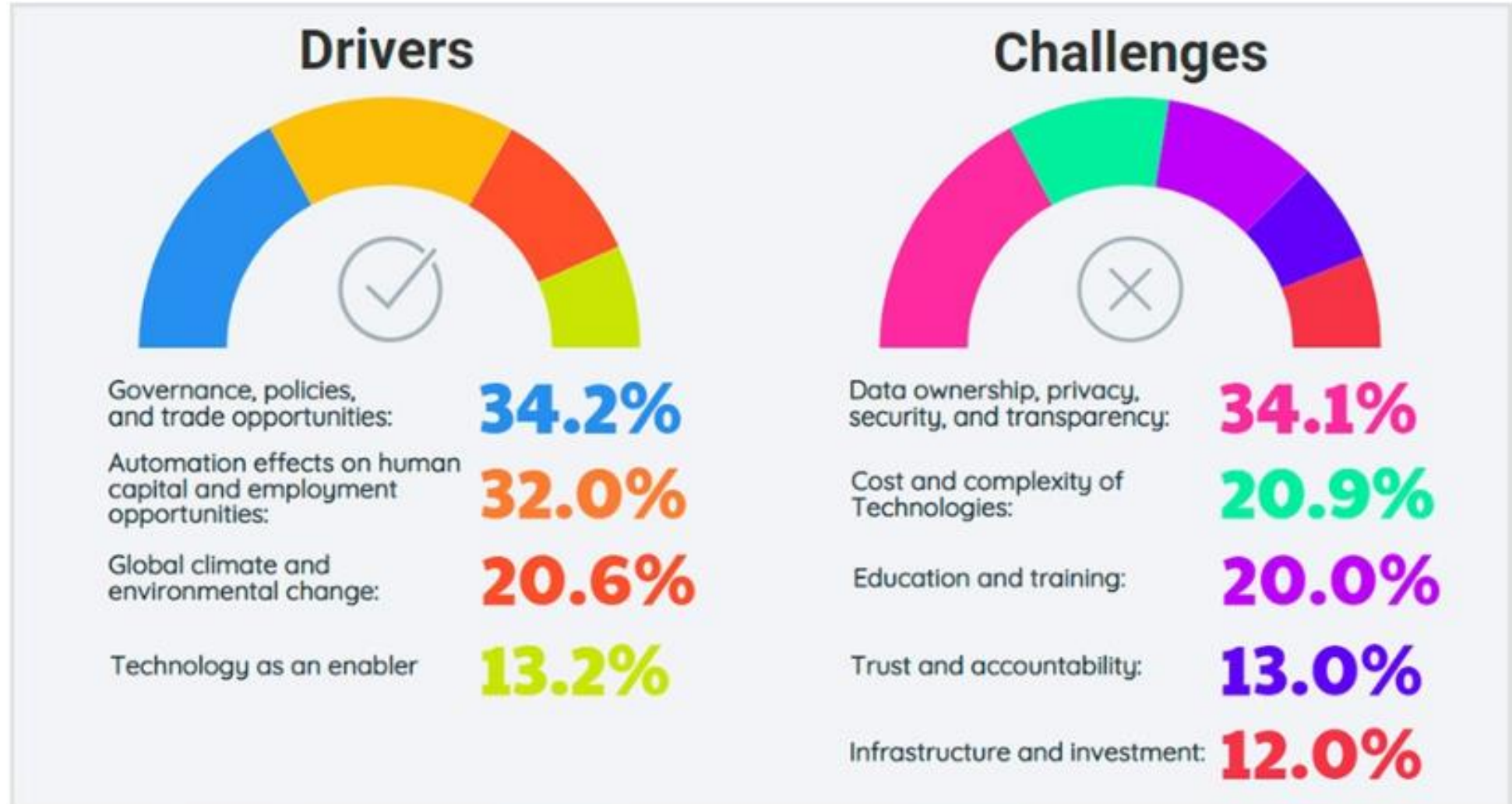
REVIEW

Drivers and challenges of precision agriculture: a social media perspective

Martinson Ofori¹ · Omar El-Gayar¹

Mining global social media - 2010 to 2019

A focus on 4,937 online posts



Paper 5: “Perceptions and acceptance of robots in dairy farming”

A 2021 online study with 1007 citizens of Germany, 18 yrs+

Four clusters of people based on attitudes toward robots:

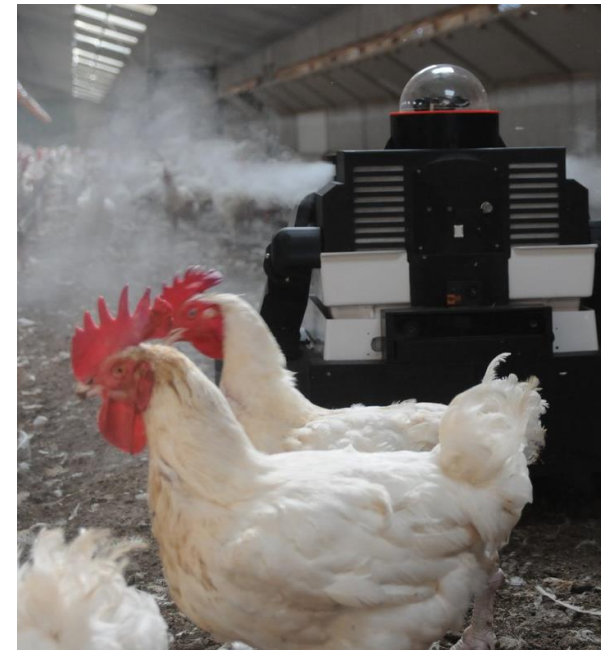
Proponents of robots	see only opportunities and little risks
Critical supporters	see both opportunities and many risks
Indifferent citizens	indifferent attitudes
Sceptical citizens	reject societal opportunities/accept robot opportunities for farmers

AI and robots in agriculture: social and ethical issues

Dialogue Group Study Findings

Adapted from paper (under review) “You’re opening Pandora’s Box”: Public attitudes on AI and robotics in Australian agriculture.

Authors: Angie Sassano, Robert Sparrow, Christopher Mayes, Cheryl Travers, Megan Moss, Chris Degeling

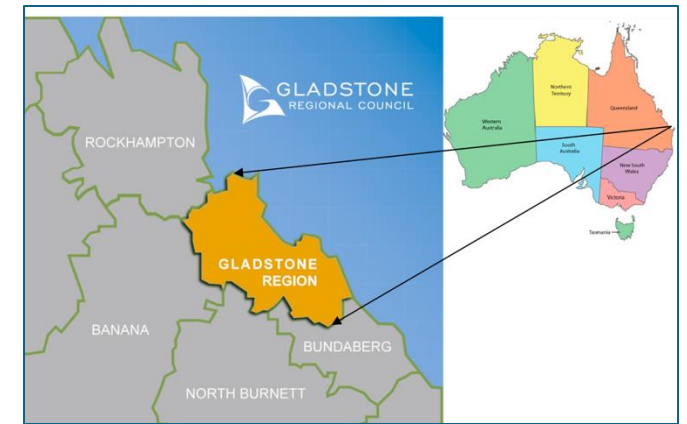


Dialogue Group Study Method

12 groups, total of 67 Australian residents

- 6 metro groups: Brisbane, Sydney, Melbourne
- 6 rural groups: Gladstone, (QLD), New England (NSW), Goulburn Valley (Vic)

90-minute ZOOM sessions



AI and robots - key benefits, risks and trade-offs

Benefits	Risks	Trade-offs
• Productivity, efficiency • Job creation • Environmental sustainability • Prevent exploitation of workers • Improved biosecurity and animal welfare	• Overreliance on AI • Job loss • Environmental harms • Cybersecurity issues • Harms to poultry (<i>e.g. mass confinement, accidents with robots</i>)	• Globally competitive versus the 'good citizen' • Precision AI versus employment • Poultry quality of life versus poultry production

Caveats to acceptance of AI in agriculture

Human oversight and monitoring

"... there'll be obviously humans still there and overseeing ...I'm just saying if how things can go wrong and how that all will be monitored." (Group 8)



Animal welfare at the fore

"... the number one thing is the animal welfare and proper certification" (Group 8).



The “farmerless farm”

Equity issues

- Pricing out small farms and associated businesses
- Costs to consumers with adoption of AI / robots

Corporate power

- Concentration of wealth and power over agricultural land

Control and data security

- Who controls AI-enabled agriculture?
- Cyber-attacks to Australia's food security.

Who is the farmer?

Farmer-technicians?

Generally accepted as the evolution of
“the farmer”



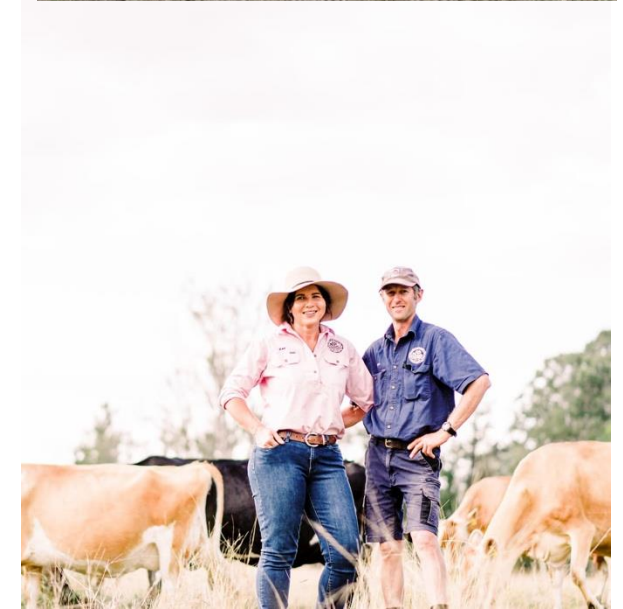
Stewards of the land?

Traditional farming with farmers
“on the land” in stewardship roles



Summing up – *still scratching the surface*

- A diversity in attitudes
- A moving feast of ideas, beliefs and moral insights
- Using the same values to argue for *and* against automation
- Researchers remain unclear on the extent that the public accept automation in different fields of application
- Our dialogue groups were not given information prior to their group session
- As members of a community jury, you are unique in having access to information to generate robust discussions and help make informed and considered recommendations.





Does farming
make us
human?

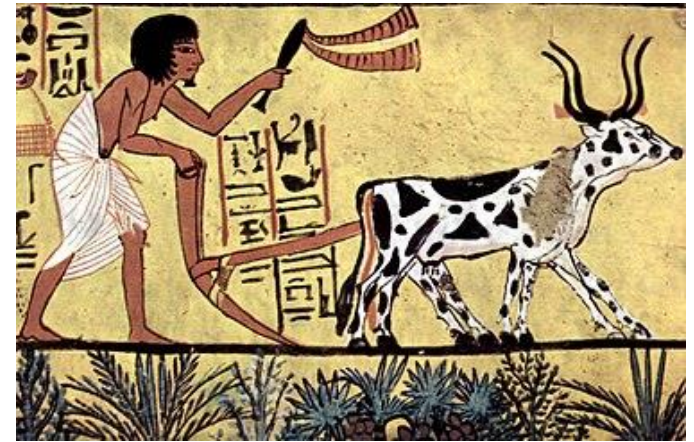
Professor Rob Sparrow
Department of Philosophy,
Monash University
Robert.Sparrow@monash.edu

What could be said for OR against the idea that we need to retain human farmers in order to live fully human lives....

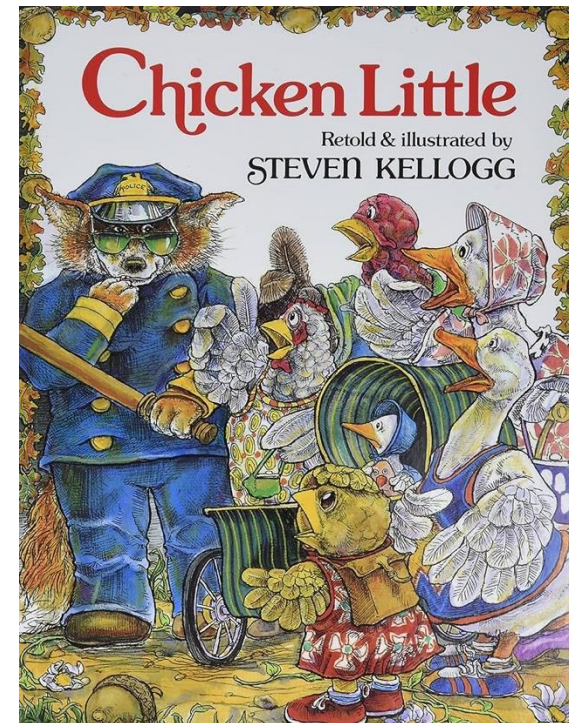


The history of farming

Human beings have farmed for at least 10000 years.



The stories we tell each other about our place in the world and the things that are important in life feature animals – and sometimes plants – that we produce for food, as well as other farm animals.



Farming and justice

- The distribution of food is one of the most fundamental ethical issues.
 - Sharing food at mealtimes is one of the first places where children learn how to behave in relation to others and what it means for a distribution to be “fair”.
 - Societies distinguish themselves by their accounts of what people owe to others in the community and to strangers when it comes to the provision of food.

Our key social and political institutions (governments, taxes, banks) arose to govern the distribution of the goods produced by farming and to increase crop production through investment in infrastructure.



Farming and nature

- Farming is the place where humans encounter, and need to learn to live in relation to, the natural world.
- Farmers deal with matters of life and death on a daily basis.
- Eating teaches us that we rely on other creatures and farms are the place where this relationship is negotiated



What farming teaches us

Farming teaches farmers important virtues.

- Practical wisdom
- Humility
- Temperance
- Sense of justice.

The rest of the community learn these virtues in part from the examples of farmers.



Farmers often come to understand themselves as “stewards” of the land, with a duty to care for it, and to improve it for future generations

Farming connects people to the land on which they live

...the relationship they have with the land is part of what makes them who they are.



**So, if we stop farming,
will this change what it
means to be human?**



... for the worse?

But...

less than 3% of the
Australian workforce work
in agriculture...



Most Australians are
already alienated from
the sources of their
food



**Would it really make a difference to our
lives if our food was produced by robots?**

The future ?



How would it affect our sense of what it means to be human if there were no farms and no farmers?

