

THE FUTURE OF AGRICULTURAL TECHNOLOGIES

SUMMARY PAPER

September 2020

This summary paper is complementary to the ACOLA Horizon Scanning report *The Future of Agricultural Technologies*
www.acola.org

- Australian producers have a strong history in adopting new technologies.
- Australia's agricultural sector faces significant headwinds and threats, across various fronts.
- Addressing current and emerging challenges requires transformation not just incremental gains.
- New technologies – such as sensor, robotic, AI, data, biotechnology, nanotechnology and distributed ledger – if appropriately supported and adopted, can significantly enhance the sector's productivity, diversity and profitability.
- Leadership is needed in workforce training, R&D and regulation to underpin and enable technology adoption.

Australian farmers are among the most efficient primary producers in the world. They have a strong history of embracing innovation and adopting technologies, leading to improved farming practices.

Australian primary producers operate within a range of social, climatic, and agro-ecological circumstances. In the coming decade, the agricultural sector will continue to face trends and pressures, including:

- intensified climate variability
- environmental and sustainability challenges
- global competition
- biosecurity risks, and
- changes in consumer preferences.

The growth of advanced technologies can help Australia respond to these challenges and pressures. This includes through the further development of drought-resilient crops, improved resource management and the ability to better predict and understand climate variability.

Advanced technologies also have the potential to significantly transform decision making, farm practices, farm labour and productivity. They represent opportunities to develop and commercialise new and enhanced products, differentiate Australian produce within the global market, verify quality, and increase the profitability of agriculture while protecting social, cultural, health and environmental values.

TECHNOLOGICAL TRANSFORMATION

Many avenues of technological growth are emerging across the agricultural sector today. However, efforts are needed to increase the capacity to adopt advanced technologies at scale to realise opportunities in the sector. In addition, these efforts should enable transformational changes, to maximise the benefits of technological innovation. This will involve facilitating the exchange of knowledge, trust and cooperation to secure major progress in the future. Thus allowing both incremental and transformational changes.

Technological innovation has influenced both agricultural products and practices.

New products: Over the past decade, the study of genetics has become a key enabling technology in agriculture. Biotechnology coupled with AI can enable accelerated plant and animal breeding, gene editing and gene silencing, which means that food crops could become more climate resilient, and new foods (e.g. plant-based 'meat') could be produced at an increased scale.

New practices: Similarly, farming practices have been invigorated by the possibility of sensory devices and systems. The 'Internet of Things' will likely play a central role in future farm management strategies, allowing farms to track resources, monitor animal and plant health, support farm labour activities and enable precision agriculture with the help of technology. These systems can provide the oversight and knowledge for expanded capacity, as well as the fine-tuning of techniques.

The creative application of technologies will likely prove most powerful to the agricultural industry as a whole, where there is confidence and flexibility to adapt to varied priorities and environments. To benefit from these innovations, there is an amplified need for the agricultural sector to engage across the supply chain, and communicate new developments to the broader community.

AGRICULTURAL TECHNOLOGIES



Sensor technologies and the Internet of Things (IoT) collect data in real-time and play a fundamental role in increasing productivity through improving farm management. Real-time information enables a more efficient use of inputs on farm and tracking through the value and supply chain.



Biotechnology and more affordable DNA sequencing technologies will continue to enable the genetic modification and editing of crops and animals to increase resilience to drought, pests and weeds.



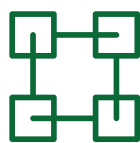
Robotic systems help automate tasks, reduce costs and increase on-farm efficiencies.



Nanotechnology has the potential to be used on farm as fertilisers or to improve the health of soil and crops.



Artificial intelligence, machine learning, data fusion and large-scale optimisation perform tasks that would normally require human endeavour as well as complementing a farmer's existing knowledge and experience about weather and crop yields.



Distributed ledger technology (DLT), such as blockchain can help track and trace agricultural products and securely transfer important information to consumers about the origin of products. Improving tracking and tracing of food products could help minimise food safety breaches and streamline a number of certification obligations across the supply chain.

ROLE OF STAKEHOLDERS

There are a wide range of stakeholder perspectives in the agriculture sector, and introducing new technologies can complicate these relationships. Just as primary producers work towards saleable products, consumers are increasingly interested in information about location and conditions of food production, and frequently want the opportunity to customise products and services. End-user preferences are influencing technology adoption on-farm as well as consumption patterns on the shelf. In times of

change, there needs to be holistic engagement between government regulation, primary producers, the community and interest groups to establish trust in new processes and technologies. On a broad scale, the innovation ecosystem requires revitalisation to provide more opportunity for open stakeholder engagement. The steps to adopting new technologies should be sensitive to this range of needs, and actively consider stakeholder perspectives to maintain the delicate supply chain balance.



Producers

The role of primary producers in the innovation ecosystem is paramount. New technologies will require sharing of knowledge and skill resources through farm expertise to ensure usefulness, efficiency and maximise productivity.



Significant landholders

Technological development processes should provide Indigenous landholders the opportunity to participate in and benefit from new industry practices. There is also the potential for landholders to enhance decision-making on environmental resilience, sustainability and land management.



Consumers

Consumer values, preferences and expectations are a core reference point for agricultural development and adoption. Implementing technologies across the sector should include consultation and engagement with these attitudes.



Government

National leadership and regulation will be needed to harness the value of data and foreground enabling infrastructure for agricultural industries. Policy settings should protect privacy and support progress through transformational change.



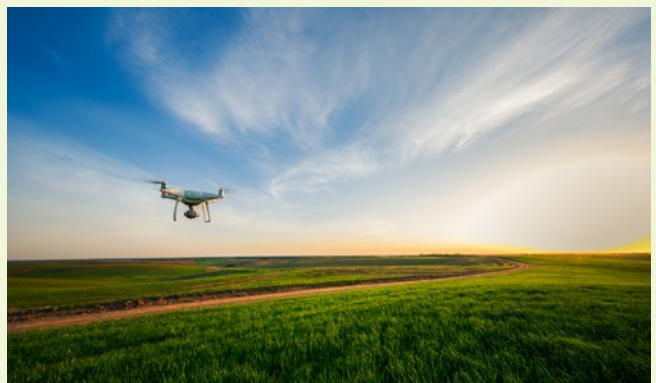
Regions

Empowering Australia's regions through investment in local technological solutions will increase capacity, facilitate transformational change, and provide spill-over social and economic benefits.

AGRICULTURAL TECHNOLOGIES AND THE FUTURE

Transformational change in the face of new challenges will not be easy to achieve and emerging technologies alone will be insufficient to generate such change. It will require empowering people within Australia's regions to use a mix of technologies coupled with investment by the public and private sectors in an enabling environment. There is a role for all stakeholders in supporting incremental and transformational change in Australian agriculture.

New technology, thoughtfully implemented, will be critical to helping the sector meet the many challenges of the coming decade.



HORIZON SCANNING SERIES

We live in a time of rapid change; change that is driven by developments in science and technology and challenged by our capacity to adapt in the present and prepare for the future. ACOLA's Horizon Scanning reports present independent and timely analyses to guide decision makers through the decade ahead.

ACOLA's full report on *The Future of Agricultural Technologies* was commissioned by Australia's Chief Scientist, Dr Alan Finkel AO, on behalf of the National Science and Technology Council with funding support and in partnership with the Australian Government through the Department of Agriculture, Water and the Environment.

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"We are confident that the future of agriculture in Australia will be one in which advanced sensing, automation, the internet of things and other emerging technologies are as at-home on the farm as they are in any other high-tech industry – a future in which the use of data analytics and artificial intelligence are no more remarkable than tractors and quad bikes are today."

Professor Stewart Lockie FASSA
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