



# Critical Technologies Discussion Paper: Agriculture

The Critical Technologies Policy Coordination Office (CTPCO) was established in the Department of the Prime Minister and Cabinet to provide coordinated, whole-of-government advice on technology developments, opportunities and risks, and to recommend actions to promote and protect critical technologies.

The Australian Government defines critical technologies as:

*“current and emerging technologies with the capacity to significantly enhance or pose risk to Australia’s national interest, including our economic prosperity, social cohesion and national security.”*

Australia’s ability to harness the opportunities created by critical technologies has significant impacts on our economic success, security and social cohesion.<sup>1</sup> As a coordination policy office, the CTPCO takes a balanced, national interest approach to critical technologies assessment, considering national security risks, opportunities for economic prosperity and impacts on social cohesion objectives. The CTPCO aims to:

- ensure Australians have access to cost-effective, safe, secure and inclusive technologies;
- promote Australia as a trusted partner for investment, research, innovation and collaboration;
- support regional resilience and competitive, trusted and diverse technology innovation and international markets; and
- maintain the integrity of our research and capabilities, enable Australian industries to thrive and maximise our sovereign IP.

The work of the CTPCO complements other government initiatives, including the Digital Foundations for Agriculture Strategy being developed as a part of the Government’s National Agricultural Innovation Agenda.<sup>2</sup>

## Aim of consultation with the agriculture sector

The Australian Government, through the CTPCO, is working with a broad range of stakeholders in key sectors to understand which current and emerging critical technologies are key to Australia’s future prosperity and stability. The agriculture sector has been identified as an initial focus area for the CTPCO, with further exploration of biotechnology and photonics as specific critical technologies due to the pervasiveness of these technologies across sectors.<sup>3,4</sup>

We are seeking input from stakeholders, including State and Territory governments, industry leaders and professionals, academia, and international partners to better understand the impact of critical technologies on the agriculture sector to help shape future government policy and decision-making. The purpose of this

---

<sup>1</sup> Social cohesion is the combination of common purpose, shared values (including overarching ethical, regulatory and social frameworks), shared challenges, equal opportunity, and a sense of community ([Department of Home Affairs](#)). In the context of critical technology, how does the identified technology contribute to, create or enhance the sense of community and shared purpose for all Australians.

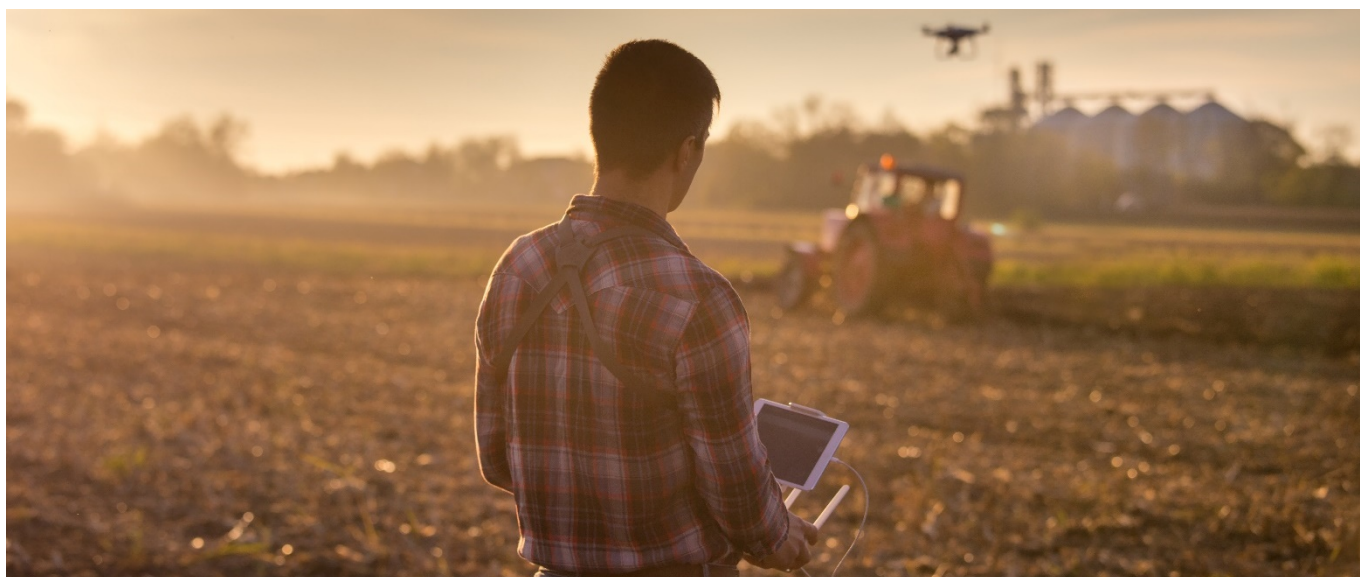
<sup>2</sup> [National Agricultural Innovation Agenda](#).

<sup>3</sup> Biotechnology is the use of biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use (*United Nations Convention on Biological Diversity*).

<sup>4</sup> Photonics is technology that uses light, creates light or modifies light (*European Photonics Industry Consortium*).

---

consultation process is to identify key critical technology developments, assess risks to and opportunities in Australia's national interest, and examine the approach of academia, industry and government to critical technologies.



## Our current understanding

Agriculture is an important part of the Australian economy, accounting for 2.2 per cent of GDP and 2.6 per cent of employment in 2018–19.<sup>5</sup>

According to the Australian Bureau of Statistics, *Characteristics of Australian Businesses* survey, in 2018–19 the agriculture, fisheries and forestry industry had only 34 per cent innovation active businesses, which was the lowest of the industry sectors reported.<sup>6</sup> However, there are clear examples of novel applications of critical technologies in the industry, for example development of agricultural robots and autonomous vehicles

Critical technologies have the potential to revolutionise Australia's agriculture sector and society as a whole. In the future, critical technologies could significantly enhance agricultural productivity, reduce costs for industry and the impact of severe weather events, create new employment streams and improve social, economic and environmental outcomes.

While these technologies present many possible opportunities for Australia to exploit, there are also risks that will need to be considered.

## Critical technologies in the agriculture sector

The CTPCO has identified eight priority critical technologies for the agriculture sector that are likely to have a major impact on Australia's national interest in the next decade. The technologies are at different stages of development: some already have established practical applications, while others are still in the early stages of research. We are seeking input on whether these eight technologies are the right priorities, their likely development and deployment timeframes, challenges to their adoption, and what opportunities and risks they may present.

---

<sup>5</sup> Australian Bureau of Agricultural and Resource Economics, [Snapshot of Australian Agriculture 2020](#).

<sup>6</sup> [Australian Bureau of Statistics](#).

<b>Technology</b>	<b>Description</b>	<b>Application example</b>
<b>Artificial Intelligence (AI) planning</b>	Automation of the reasoning required for formulating, implementing and revising plans of action.	Streamlined and faster crop planning.
<b>Autonomous vehicles, drones, micro-drones and micro-robotic systems</b>	Autonomous Ground Vehicles (AGV), Autonomous Surface Vessels (ASV), Autonomous Underwater Vehicles (AUV) or Autonomous/Remotely Piloted Aerial Systems (RPAS), and miniaturised robotic systems, including autonomous vehicle sensor integration.	Autonomous seed sowing, pesticide spraying and harvesting vehicles to reduce labour costs.
<b>Bio-composites</b>	Combining naturally-derived and other materials to yield new materials with improved performance.	Building materials made of bio-composites providing new markets for existing crops.
<b>Biological sensors</b>	Sensors to detect and identify biological materials. These sensors are used to counter biological threats in biosecurity and national security.	Quarantine enforcement through detection of biological material movements.
<b>Computational chemistry</b>	Computational prediction of the properties of chemicals used for the discovery of materials, drugs, chemical compounds and reaction mechanisms/synthetic routes, including using quantum computing.	Computer designed fertilisers and pesticides with enhanced effectiveness.
<b>CubeSat space-based sensors</b>	Sensors allowing rapid and continuous observation of large areas for environmental, natural disaster, defence and national security purposes.	Small, cheap satellites to monitor forestry growth and fire management.
<b>Gene technology</b>	Introducing foreign genetic material, reorganising existing genetic material, or constructing the entire genome of an organism from fragments of synthetic DNA. Includes technology related to stem cells.	Modifying crops to enhance speed of growth, disease resistance and reduce impact of soil contaminants.
<b>a. Genomic and genetic engineering/ analysis/ editing</b>		
<b>b. Synthetic biology</b>	Biology enabling the production of new synthetic biological compounds and systems that can be designed to behave according to a defined specification.	Designed microorganisms which clean pollutants from fields or waterways to increase future crop yield.
<b>Global positioning systems (GPS)</b>	Jamming resistant and authenticated PNT technologies allowing civilian applications to authenticate their PNT to protect critical infrastructure operations.	Systems to allow GPS-guided harvesting systems to continue to operate when signal is jammed.
<b>a. Civilian jamming/ spoofing resistant position, navigation and timing (PNT)</b>		
<b>b. Global Navigation Satellite System (GNSS) augmentation</b>	Technologies to improve the accuracy of GPS to support automation in transport, industrial and societal applications.	Increased planting density through greater accuracy and reduced variance in planting and harvesting, thereby increasing overall yield.

*Note: The above technologies are in alphabetical order.*

---

## Discussion questions

The CTPCO is seeking your insights on the future of critical technology in the agriculture sector. We are particularly interested in hearing whether you believe we have identified the key critical technologies in the agriculture sector, what you consider to be major opportunities and risks, and how government, industry, academia and end-users can work together to approach critical technologies.

The questions below indicate some of the key issues that the Government are considering. We welcome your input in response to the questions, via written submission to [ContactCTPCO@pmc.gov.au](mailto:ContactCTPCO@pmc.gov.au) or via the [CTPCO Stakeholder Consultation Survey](#).

1. What are the priority critical technologies, current and emerging, in this sector over the next 10 years? Are these reflected in the list provided in the discussion paper?
2. Have you identified or experienced any supply chain issues associated with critical technologies?
3. How fast are critical technologies taken up in this sector? What are the barriers to uptake?
4. Which critical technologies present the best opportunity for commercialisation in Australia?
5. What will happen if we do not adopt critical technologies in this sector?
6. What impact do you think critical technologies will have in the future in this sector? For example, on national security, economic prosperity and social cohesion.
7. How should government, industry, academia and end-users work together to assess the impact of critical technologies in Australia?
8. What opportunities and risks do you see from biotechnology and/or photonics?
9. Is there anything else you want to say about the approach to critical technologies in Australia?

For more information, please contact the CTPCO at [ContactCTPCO@pmc.gov.au](mailto:ContactCTPCO@pmc.gov.au).

## Privacy Collection Notice

The Department of the Prime Minister and Cabinet (the Department) is collecting your personal information, as part of the stakeholder consultation being conducted by the Critical Technologies Policy Coordination Office (CTPCO) to understand which current and emerging technologies are key to Australia's future prosperity and stability and inform whole-of-government policy development.

Participating in the stakeholder consultation and providing the requested information is voluntary. Information you provide in your response, including personal information, may be disclosed to the Australian Government and third parties who provide services to the Department, for the purposes of informing and supporting the work of the CTPCO. This information may also be used to communicate with you about your response and the consultation process

Personal information contained in your response may be included in CTPCO reports to the Australian Government and related briefings within the Australian Government. Aggregated information received from responses, including key themes and statistics about responses received, may be included in CTPCO reports, such as the Stakeholder Consultation Summary and other reports published by the CTPCO.

You will be provided with the option to select in the stakeholder consultation whether you prefer to remain anonymous in any public materials. If you elect to remain anonymous, no identifying information will be published in public materials.

---

The Department will only use or disclose your personal information for a different purpose where we have obtained your consent, or where we are authorised or permitted to do so under the *Privacy Act 1988* (Cth).

The privacy and security of your personal information is important to us, and is protected by law. The Department's [Privacy Policy](#) explains how the Department handles and protects the information provided by you. Our Privacy Policy also explains how you can request access to or correct the personal information we hold about you, and who to contact if you have a privacy enquiry or complaint. If you require a copy of our Privacy Policy contact the Privacy Officer at [privacy@pmc.gov.au](mailto:privacy@pmc.gov.au).

Lastly, documents held by the Department may be the subject of a request under the *Freedom of Information Act 1982* (Cth) (*the FOI Act*). The Department determines requests for access to documents under the FOI Act in accordance with that Act.