Appendix D: Examples of advances in technology in Australian agriculture

Submissions to the inquiry provided the following examples of advances in technology that have benefited agriculture in Australia:

- Mechanisation;¹
- Fertilisers² such as superphosphate³ and nitrogen,⁴ and broader plant nutrition;⁵
- Crop rotation⁶ and fallowing;⁷
- Nitrogen fixing;⁸
- Animal genetics and breeding;⁹
- Crop protection products such as fungicides, herbicides and insecticides¹⁰
- Plant genetics and breeding;¹¹

¹ University of South Australia, Submission 7, p. 1; The Warren Centre for Advanced Engineering, Submission 43, p. 2; CSIRO, Submission 55, p. 11.
² CSIRO, Submission 55, p. 9.
³ Mr David McKeon, General Manager Advocacy and Policy, Grain Growers Ltd, Committee Hansard, Canberra, 22 February 2016, p. 6.
⁴ ADF-DA, Submission 65, p. 5; GRDC, Submission 87, p. 9.
⁵ Warren Centre for Advanced Engineering, Submission 43, p. 2; GRDC, Submission 87, p. 9.
⁶ Professor John Hamblin, Submission 3, p. 3; Grain Trade Australia, Submission 21, p. 3.
⁷ GRDC, Submission 87, p. 8, p. 16.
⁸ GRDC, Submission 87, p. 9.
⁹ ADF-DA, Submission 65, p. 4; CCA-SCA-ALFA, Submission 84, p. 7.
¹⁰ CropLife Australia, Submission 50, p. 4; Bayer CropScience, Submission 78, p. 5.
¹¹ The Australian Plant Genomics Facility, Submission 42, p. 2; Tasmanian Institute of Agriculture, Submission 44, p. 1; ACIAR, Submission 60, p. 4.
- Disease resistance;\textsuperscript{12}
- Minimum or no tillage;\textsuperscript{13}
- Genetically modified crops;\textsuperscript{14}
- Integrated management practices\textsuperscript{15} and best practice programs;\textsuperscript{16}
- Animal monitoring, including oestrus detection, temperature recording, body condition and weight measurements;\textsuperscript{17}
- Carcass classification and traceability;\textsuperscript{18}
- Animal tracking, using GPS, RFID,\textsuperscript{19} and UAVs;\textsuperscript{20}
- Controlled traffic farming;\textsuperscript{21}
- Precision agriculture;\textsuperscript{22}
- Sterile insect technology;\textsuperscript{23}
- Remote sensing for yield mapping,\textsuperscript{24} soil, water and pasture monitoring and measurement;\textsuperscript{25}
- Drone or UAV use for crop assessment,\textsuperscript{26} weed detection and tree and vegetable crop analysis,\textsuperscript{27} and pest management;\textsuperscript{28}

\textsuperscript{12} Charles Sturt University, Submission 17, p. 4; Department of Primary Industries and Regions South Australia, Submission 19, pp. 3-4; GRDC, Submission 87, p. 9.
\textsuperscript{13} Grain Trade Australia, Submission 21, p. 3; CropLife Australia, Submission 50, p. 6; ATSE, Submission 56, p. 4; Ag Institute Australia, Submission 73, pp. 5-6.
\textsuperscript{14} Grain Trade Australia, Submission 21, p. 3; AusBiotech, Submission 33, p. 2; CropLife Australia, Submission 50, p. 2.
\textsuperscript{15} Southern Farming Systems and the Australian Controlled Traffic Farming Association, Submission 61, p. 3; Cotton Australia, Submission 72, p. 1.
\textsuperscript{16} GrowCom, Submission 67, p. 3; Cotton Australia, Submission 72, p. 1.
\textsuperscript{17} ADF-DA, Submission 65, p. 4; CCA-SCA-ALFA, Submission 84, p. 7.
\textsuperscript{18} Australian Pork Limited; Submission 70.1, p. 1.
\textsuperscript{19} ADF-DA, Submission 65, p. 4; CCA-SCA-ALFA, Submission 84, p. 7.
\textsuperscript{20} Australian Centre for Field Robotics, Submission 94, p. 4.
\textsuperscript{21} Southern Farming Systems and the Australian Controlled Traffic Farming Association, Submission 61, p. 2; GrowCom, Submission 67, p. 3; Australian Sugar Milling Council, Submission 68, p. 2.
\textsuperscript{22} Southern Farming Systems and the Australian Controlled Traffic Farming Association, Submission 61, p. 2; The Warren Centre for Advanced Engineering, Submission 43, p. 2; Tasmanian Institute of Agriculture, Submission 44, p. 1.
\textsuperscript{23} GrowCom, Submission 67, p. 3.
\textsuperscript{24} Australian Sugar Milling Council, Submission 68, p. 2.
\textsuperscript{25} ADF-DA, Submission 65, p. 4.
\textsuperscript{26} DAWR, Submission 88, p. 7; Falcon UAV, Submission 103, p. 1; Mr Kim Russell, Chairman, Southern Farming Systems, Committee Hansard, Canberra, 22 February 2016, p. 1; Dr Joanne Luck, Research Director, Plant Biosecurity Cooperative Research Centre, Committee Hansard, Canberra, 22 February 2016, p. 16.
\textsuperscript{27} Australian Centre for Field Robotics, Submission 94, p. 2.
Variable rate technology;\textsuperscript{29} Robotics,\textsuperscript{30} including robotic milking\textsuperscript{31} and robotic crop monitoring;\textsuperscript{32} Automation,\textsuperscript{33} including harvesting,\textsuperscript{34} planting,\textsuperscript{35} irrigation\textsuperscript{36} and spraying systems,\textsuperscript{37} and automated livestock weighing and handling;\textsuperscript{38} Driverless or GPS guided vehicles;\textsuperscript{39} and Use of big data.\textsuperscript{40}

\textsuperscript{28}Department of Primary Industries and Regions South Australia, Submission 19, p. 7.
\textsuperscript{29}Ag Institute Australia, Submission 73, p. 6; RIRDC, Submission 74, p. 3; Vanderfield Pty Ltd, Submission 79, p. 11.
\textsuperscript{30}Tasmanian Institute of Agriculture, Submission 44, p. 1.
\textsuperscript{31}ADF-DA, Submission 65, p. 4
\textsuperscript{32}University of Sydney, Submission 40, p. 4.
\textsuperscript{33}Tasmanian Institute of Agriculture, Submission 44, p. 1.
\textsuperscript{34}Agromillora Australia, Submission 38, p. 2; University of Sydney, Submission 40, p. 4; Southern Farming Systems and the Australian Controlled Traffic Farming Association, Submission 61, p. 2.
\textsuperscript{35}Australian Sugar Milling Council, Submission 68, p. 2.
\textsuperscript{36}ADF-DA, Submission 65, p. 4; Australian Sugar Milling Council, Submission 68, p. 2; CCA-SCA-ALFA, Submission 84, p. 7.
\textsuperscript{37}Australian Sugar Milling Council, Submission 68, p. 2.
\textsuperscript{38}University of Sydney, Submission 40, p. 4.
\textsuperscript{39}Tractor and Machinery Association of Australia, Submission 54, p. 2.
\textsuperscript{40}The majority of submissions to the inquiry discussed the use of big data.