Victoria’s $12m on-farm IoT Trials

Summary Report: Research findings and options for implementation

March 2018
Disclaimer

This summary report is delivered subject to the agreed written terms of KPMG’s engagement with the Department of Economic Development, Jobs, Transport and Resources (DEDJTR).

This report provides a summary of KPMG’s findings during the course of the work undertaken for the Department of Economic Development, Jobs, Transport and Resources (DEDJTR) between September and November 2017, under the terms of the engagement contract dated 15 August 2017. The contents of this report do not represent conclusive findings, which are only contained in the final detailed report.
1. Background and context
Introduction to Victoria’s $12m on-farm IoT Trials

In the 2017-18 State Budget, the Victorian Government announced a $45 million, four year Connecting Regional Communities Program (CRCP). The purpose of the CRCP is to increase digital connectivity and usability in Victoria’s regions.

The CRCP includes a $12 million on-farm Internet of Things (IoT) Trial. The purpose of the IoT Trial is to assess the contribution that IoT makes to farm performance within four selected agricultural sectors - dairy, grains, sheep, and horticulture (fruits, nuts, berries). The regions of Maffra, Birchip, Serpentine and Tatura have been chosen by the Government to represent these sectors as the focus of the IoT trials, respectively.

KPMG has worked alongside the Department of Economic Development, Jobs, Transport and Resources (DEDJTR) to help clarify and better understand the barriers and opportunities that exist across the Victorian agricultural industry in relation to the adoption of IoT and other digital technologies.

Subsequent to a detailed research report, KPMG has assisted DEDJTR in developing an implementation plan for Victoria’s on-farm IoT Trials with the ambitious goal of stimulating state-wide cultural and structural transformation around the application of digital technologies in Victorian agriculture.

IoT’s contribution to farm performance will be evaluated and results made available to Victorian farmers to support practice change. Outcomes of the trials will also help inform the Victorian Government about the viability of a state-wide roll out of one or more of the IoT trial components and other digital agriculture investments, as well as help determine policy options for the Victorian Government in the longer term.

Our Regional Partnerships have told us that improving digital access is an absolute must.

Minister for Agriculture, Jaala Pulford

This investment will help fill some of the existing gaps, and make sure regional Victoria isn’t being left behind in our digital economy.

Minister for Small Business, Trade and Innovation, Philip Dalidakis
The transformative opportunities of Internet of Things (IoT) technology for agriculture

What is the Internet of Things?
The Internet of Things (IoT) is about enabling physical objects to be sensed and controlled remotely, creating opportunities for more direct integration between the physical world and computer-based systems – or simply put, making ‘dumb’ things ‘smart’ by connecting them to each other and to the internet. This results in improved efficiency, accuracy and economic benefit.

— The future is data: IoT is all about the power of data. In a world where everything is digitally connected, data is a critical asset. Faster and quicker insights from real-time data help us to more nimbly respond to what the market wants, be more efficient in how we produce it to ensure less wastage, have speed to market, and show our customers how safe and sustainable our food is.

— Decision agriculture: IoT technology is driving the concept of ‘decision agriculture’. Decision agriculture is the use of technology aimed at improving growers’ decision-making through data-driven insights. It includes software, such as data analytics solutions and farm management tools, as well as hardware, such as sensors, drones and satellites.

The recently published Precision to Decision (P2D) Report estimated a potential $20.3b (or 25%) increase on 2014-15 levels in gross value of production (GVP) by the agricultural sector through unconstrained digital agriculture*.

IoT technology and decision agriculture will be critical in realising this dramatic economic uplift in the coming years...

*Source: Cotton Research and Development Corporation, “Accelerating Precision Agriculture to Decision Agriculture – Enabling digital agriculture in Australia” (2017)

The opportunity: It is widely agreed that if the agricultural community and broader food industry could take advantage and embrace the digital technologies of today including IoT, it could make a significant difference to day to day management, freeing up more of time and capital to invest, and ultimately help create more productive businesses.
The time for action is now.

1. Consumer demand
Food and fibre is going digital with consumers demanding that the food they eat and the clothes they wear have a digital provenance that can support claims to be affordable, safe, healthy, ethical, and sustainably produced – and that means the digital story must start on-farm.

2. Government intervention
Government has a responsibility to address the potential market failure of an essential part of the Victorian economy through bringing together the infrastructure, skills and partner ecosystems to enable farmers to compete in a global digital marketplace.

3. Overcoming historic challenges
Farm trials of this type to date in Australia have largely been focused on research stations and universities or early adopters only. Tackling on-farm implementation at scale has typically been considered too challenging because of the number required to achieve scale, the physical distances, and the individual enterprise nature of farming.

4. Uptake at scale
Digitisation drives but also demands uptake at scale to deliver the greatest return on investment. Countries that have successfully embraced IoT enabled AgTech and FoodTech have all required government intervention to bring together the necessary infrastructure, data sets, regulations, suppliers and incentives.
Focus regions and sectors for Victoria’s IoT Trials

The following four regions and associated agri sectors have been selected by the Victorian Government as the focus of its IoT Trials:

- **Maffra trials** (Dairy)
- **Birchip trials** (Grains)
- **Serpentine trials** (Sheep)
- **Tatura trials** (Horticulture – fruits, nuts, berries)
2. Stakeholder consultation findings
Barriers to the adoption of IoT and other digital technologies across the four trial regions

Community focus group discussions were conducted in the four proposed trial regions to understand the demand for, and uptake of new technologies across the four trial site regions – both now and in the near future. The following issues and key barriers identified by participants are summarised below.

1. **Digital literacy**
   - Digital literacy is a foundational element of on-farm digital enablement – and this was found to be a major barrier to adoption across all regions. This included a general lack of awareness regarding technologies available, the knowledge required to understand the impact of technology, as well as the skills required to implement, effectively use and maintain technology. As a contributing root cause, there was found to be a lack of practical learning and exposure to technology in regional areas, particularly for young students.

2. **Connectivity**
   - Connectivity is another foundational element of IoT and other on-farm digital solutions. Challenges with access to mobile and internet telecommunications infrastructure was found to exist across the four trial regions, to varying degrees.

3. **Cost and investment rationale**
   - A key reason for a lack of IoT uptake in the four trial regions to date was attributed to a lack of proven return on investment (ROI). Farmers are typically unwilling to outlay on new technologies which are largely unproven, and do not have tried and tested economic benefits.

4. **Interoperability**
   - Focus groups highlighted the general lack of interoperability between farm datasets, which makes it particularly difficult for farmers to easily combine and overlay data from different systems in order to access optimal insights with the technology they already have.

5. **Data standards**
   - To realise the full benefits of IoT, farmers need to be able to effectively collect, communicate, analyse and then be comfortable in exchanging data with others along the value chain. There is a general lack of confidence in data privacy and security amongst farmers across sectors, and this is primarily attributed to a lack of industry-wide data standards, protocols and overarching regulation.

6. **Marketplace maturity**
   - The IoT market for agriculture is developing rapidly, particularly around sensors and devices, but is still immature in terms of farm IoT platforms. There is currently no holistic technology platform which exists for agriculture. This is a key cause for interoperability issues and is a barrier itself to supporting & encouraging open innovation.
Key opportunities for Victoria’s IoT trials based on community focus groups

1. **Improve awareness and demonstrate the benefits of IoT and digital**

   Victoria’s IoT Trials present an opportunity to educate and demonstrate to farmers and regional communities the benefits of IoT and other digital technologies and the transformative business models which they can inspire.

   The trials can help foster a greater sense of collaboration and innovation in regional communities and public forums.

   The trials also present an opportunity to demonstrate the return on investment of individual technologies across sectors to promote greater uptake and AgTech competition.

2. **Improve data standards to support innovation**

   The benefits of data exchange between farmers and along the value chain has the potential to be the most transformational aspect of digital agriculture. The trials can be an opportunity to test and develop data standards and regulation to improve farmer trust and confidence around data exchange practices.

   The trials can also be a platform from which to actively encourage and support community data groups/cooperatives, which farmers are generally very enthusiastic towards.

3. **Leverage key market trends to Victoria’s advantage**

   The younger generation coming through is considered to be more ‘tech savvy’ and keen to adopt and interact with new technologies. The trials are an opportunity to attract and retain young talent through the use of digital technology in the farming profession.

   The cost of technology is declining and more and more technologies are being brought to market, signalling an opportune time to promote and encourage adoption.

   Victoria has the opportunity to fast-track the uptake of technology that has already been used and proven in other countries.

4. **Support regional development**

   The IoT trials are an opportunity to create stronger regional communities which are connected through the uptake and use of technology – a critical enabler for attracting and retaining regional populations as well as start-ups and other businesses.

   The trials are also an opportunity to promote Brand Victoria and showcase what regional Victoria has to offer.
3. A bold vision for Victoria’s IoT Trials and a phased approach to implementation
A bold vision for Victoria’s IoT Trial

A two-year trial program involving the installation of IoT technology across four regional areas and focused on four industry sectors to inform industry-wide change and propel Victoria to a world leading agribusiness and food producer.

This program has the potential to:

- Create a local learning cohort, a sustainable supplier network, a growing user base for connectivity infrastructure, and a momentum that can leverage and focus efforts on commercially sustainable IoT enabled outcomes.
- Provide the catalyst for a cultural and market-led transformation of Victorian farming enterprises and the communities they support through accelerating adoption of IoT enabled digitisation at scale, at speed and with impact.
- Create the foundations for a digital-ready, capable and internationally competitive farming sector because it tackles directly the hardest but most essential part of the food supply chain – digitisation on-farm, at scale.
A phased approach has been developed to support implementation and uptake

Proposed trial phases for Victoria’s IoT Trials:

**Year 1**

**Government Reform** Implement a program of accelerated creation/reform of regulation, standards and access to single point of truth data sets. A design-led thinking approach could be applied involving farmers, supply chain, consumers and regulators to rapidly deliver draft standards that can be implemented in Phase 2, refined and adopted in phases 3 and 4. This phase would likely comprise several elements.

**Trial planning & implementation** Identify up to 100 farms (24 per location plus one Research Site per location) to implement on-farm solutions. This will deliver insight at each farm level, the district/industry level, and across all ~100 sites. Each farmer will create a short implementation plan, site specific installation is completed by a market provider, and farmers participate in reporting requirements and working groups to share learning. The objective is to deliver a documented financial and economic benefit model for digital adoption. Potential AV R&D Sites to be leveraged for IoT Research Sites include Horsham (grains focus), Hamilton (animal industries-cropping mixed farming), Ellinbank (dairy) and Tatura (horticulture).

**Year 2**

**Adoption at Scale (aspirational)** Expand program to a further ~500 farms (~125 centered on each location) with a voucher scheme to accelerate adoption and achieve the demonstrated ROI and benefits.

**Year 3 and beyond**

**Expansion** If an evaluation demonstrates that benefits have been achieved, in subsequent years the program could be extended to other sectors and regions.
Ensuring successful IoT trials involves focused investment

To create the necessary cultural and structural market transformation indicated by the research, the trial program envisioned focuses on achieving maximum impact in 2 years. This is to be achieved through community/industry based adoption at scale enabled by direct investment partnership with commercial farmers, wider government connectivity initiatives, and actionable reform of government-led standards, datasets and regulations.

Prerequisites for successful trials:

1. **Broadband connectivity** – Broadband connectivity is needed to enable off-farm data access to the site, particularly backhaul capability.

2. **IoT network connectivity** – IoT network connectivity, namely that provided by low power wide area networks (LPWAN), is needed to allow localised sharing of whole of landscape IoT data to enable community wide data sharing and low/no cost for data movement.

3. **Standards** – IoT standards need to be developed and adopted for all applications across Victorian government.

4. **Consultation** – Community-wide engagement needs to take place to communicate the opportunities of the digital economy for them.

Role of Government for successful trials:

1. **Rapid Adoption** – Government intervention is necessary to accelerate adoption of IoT enabled farming at scale and encouraging a market offering to service the industry and encourage trial participation.

2. **Standards** – Publish standards for food and agriculture IoT on farm implementations to enable market led solutions.

3. **Datasets** – Enable universal access to core data sets as a single source of truth.

4. **RegTech** – Transform regulation through RegTech to drive productivity gains for IoT enabled farms.
Trial success can be measured across four key indicators

1. **IoT enabled farm uptake**

   Victoria becomes the first Australian state to achieve a digitally enabled food and farm sector with numerous IoT enabled farms across four regions/sectors in two years (more if additional funding is available) providing farm level data.

2. **ROI, benefits, standards**

   A set of interactive data insights are published to support the economic, financial and regulatory case for an IoT enabled farm sector supported by universal standards. Linking demonstrable ROI to an approach of ‘planning for future economic return’ will help capture project benefits.

3. **Core data sets are IoT accessible**

   There is government enabled access to single source of truth and user-provided data (API and machine learning compatible and secure). Whilst the Government should utilise this data to inform research and RegTech optimisation, farmer data will not be made available for commercial use without farmer consent.

4. **Supplier marketplace**

   There are businesses supplying the market with goods and services that are affordable, reliable and scalable to meet the needs of a fully digitised and IoT enabled farm sector.
It is proposed that four program elements are required to deliver the trials successfully. Each element represents a scope of work focused on a key market input. Successful trials require all four given they are interdependent.

1. **Trial partner selection process through EOI plus grants process**
   - In Year 1, a total of ~96 trial farm partners (~24 in each location and industry vertical) will need to be identified through an Expression of Interest (EOI) process. Selection criteria should include compliance with a minimum system capability, a commitment to data sharing through the new IoT enabled digital capability, attendance at training and workshops, and access on-farm to share insights. In Year 2 and beyond, the aspiration is for a further ~500 trial farms (~125 per location) to be selected through a grant process with a similar data sharing requirement.

2. **User centric project design in each trial centre**
   - A project framework will be required, which could be populated through a single user-centric design-led process in each location. This process would bring together all ~24 participants plus government, industry, supply chain, consumers and suppliers to design the trial attributes around the specific needs of the industry and ensure that data is collected to inform the economic and financial ROI case.

3. **Supplier pre-selection for installation, site management and technology trial**
   - An EOI process will need to be conducted to identify suitable suppliers to deliver on farm IoT solutions and technologies that meet the needs for connectivity, decision management and specific technology solutions (including devices and network comms). The objective will be to identify a prequalified list of accredited suppliers to the trial that can then participate in a procurement process and agree to interoperability standards determined by DEDJTR.

4. **Establish Government standards, data access and ROI measurements**
   - Design a Government standard for on farm IoT.
   - Establish data standards to enable API and machine learning capable public information.
   - Design a financial and economic modelling tool for each sector to measure ROI.
Key leverage opportunities for government

The trial program provides the Victorian Government with an opportunity to leverage industry, suppliers and whole of government programs to multiply the outcome and impact. The trials can act as a catalyst that focus resources on implementing the on-farm use of IoT enabled digitisation both at the farm level and more broadly along the supply chain into the community.

1. Participant co-contribution
   - While the focus of the trials is on encouraging speed of adoption and achieving a critical mass of market driven digital farms, consideration should be given to co-contribution from participants. Consideration should also be given to a dollar contribution particularly for third phase (grant-supported) participants.

2. Leveraged investment opportunities
   - There are opportunities to leverage Commonwealth Government grant programs and other State Government programs (e.g. Black Spot Program, Smart Farm Grant, Smart City Grants etc.) to build a focused end-to-end solution and extend the influence across wider parts of the community and supply chain.
   - Industry Research Development Corporations may also be approached to leverage funds to resolve industry sector specific issues.

3. Supplier diversity to encourage competing solutions
   - Every effort should be made to avoid creating a technology or supplier monopoly using government funding. A diverse range of connectivity technologies, supplier companies, platforms and devices should be encouraged to grow the market and foster innovation. Most farms will be best served by a hybrid mix of technology solutions. Government should enforce an open source environment that is API and machine learning compatible.

4. Government reform as a priority
   - The Victorian Government must lead by example with the rapid creation and deployment of IoT Farm standards; reform of regulation to IoT digitally enabled compliance across all aspects of farming operations; access to public and shared data that is secure, API compatible and Machine Learning compatible; seek agreement with other jurisdictions as appropriate to enable a seamless government user interface for farming; seek universal access to partner.
### Proposed focus of the trials

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<tr>
<th><strong>BIRCHIP TRIALS (Grains)</strong></th>
<th><strong>TATURA TRIALS (Horticulture – fruits, nuts, berries)</strong></th>
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<tbody>
<tr>
<td>Enable high volumes of detailed location and single plant specific data that is collected across large areas of row cropping to be dynamically managed to mitigate risks. Connectivity will be the key challenge.</td>
<td>Demonstrate end to end intensive orchard management from sensor to analytics and user interface to optimise decisions, manage input costs, establish provenance and drive return on investment.</td>
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<tr>
<td><strong>Trial Focus:</strong></td>
<td><strong>Trial focus:</strong></td>
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<tr>
<td>• Improved timeliness for major decisions (plant, input, harvest)</td>
<td>• End to end intensive orchard management from sensor to analytics and user interface applications to optimise decisions and manage costs</td>
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<td>• Enable preferential over sequential operations</td>
<td>• Micro-management of plant architecture and growth cycles</td>
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<td>• Cost effective connectivity for large scale sensor deployment</td>
<td>• Automated record of inputs, sprays, production by plant, product</td>
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<td>• Data co-operative to resolve interoperability, access, management</td>
<td>• Ethical labour management</td>
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<td>• Risk mitigation through decision transparency with investors, bankers, insurers and buyers.</td>
<td>• Traceability/provenance by piece to packing shed</td>
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<tr>
<th><strong>SERPENTINE TRIALS (Sheep)</strong></th>
<th><strong>MAFFRA TRIALS (Dairy)</strong></th>
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<tr>
<td>Demonstrate the return on investment and the range of benefits that EID systems (beyond mandated tags) and complimentary IoT systems can deliver sheep farming enterprises by moving to whole of life individual animal management.</td>
<td>Demonstrate the value of an IoT-enabled and integrated dairy operation from point of production (cow/paddock/parlour) to point of processing using real-time data to inform milking and management.</td>
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<tr>
<td><strong>Trial Focus:</strong></td>
<td><strong>Trial focus:</strong></td>
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<td>• Real-time data to create a single animal specific management record to drive decision making</td>
<td>• Timely milk quality information to inform farm operations</td>
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<td>• Transparent animal welfare (water, feed, disease management)</td>
<td>• Automated product provenance including ethical farm management practices (animal welfare, environmental)</td>
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<tr>
<td>• Increased lamb survival and birth rates</td>
<td>• Automated animal production records</td>
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<tr>
<td>• Precise feed/pasture management</td>
<td>• Improved reproductive performance</td>
</tr>
<tr>
<td>• Reduced compliance costs (Biosecurity, environmental, provenance)</td>
<td>• Pasture and supplementary feed management</td>
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**R&D Sites:** It is proposed that up to four sites be utilised on R&D control sites simultaneously with the program of ~96 initial commercial farm partners (4 x ~24 farms). The R&D farms do not need to be in the same geographic location as the four trial sites as the focus is on resolving the government specific challenges and informing industry sector solutions.

Note: The geographical diversity of the regions and farming uses will require careful consideration when selecting farms for participation in the pilots, so connectivity infrastructure is optimised.
Across a 12 week period from September to November 2017, KPMG undertook the following activities in order to develop a research findings report and subsequent options for implementation report.

### Key activities:

1. **Desktop Research & Analysis**
   - Conducted extensive desktop research to identify and provide insights into current and emerging digital technologies, key use cases for these technologies, key market players, and global best practice and trends.

2. **Industry consultation**
   - Conducted consultations with industry leaders across the value chain and KPMG subject matter experts to better understand the barriers and opportunities for on-farm digital technology implementation.

3. **Focus Groups**
   - Conducted four two-hour focus groups with 10-15 selected stakeholders in each of the four trial site regions - Maffra, Birchip, Serpentine and Tatura – to better understand the current state in these regions and opportunities for improvement.

4. **NSW DPI Case Study**
   - Visited Orange in NSW to develop a case study on the collaborative IoT project between NSW Department of Primary Industries and Cisco to develop a Farm Decision Platform.

### Outputs:

1. **A research report, including:**
   - a) Current and emerging technology options, market structure, market players and commercial models
   - b) Technology service offerings appropriate to on-farm needs by sector and region to meet future demands and globally competitive standards
   - c) Costs, risks and dependencies (e.g. technology, regulatory commercial, funding and timing)
   - d) Demand characteristics across the four trial regions
   - e) Opportunities for greater use of ICT and future demand potential
   - f) Complementary demand for services and spill over benefits in other sectors
   - g) Economic benefits at a high level

2. **A final options report, including:**
   - a) Current gaps to greater adoption of digital technologies by farmers in regional Victoria
   - b) Guiding principles for Government investment in the IoT Trial
   - c) A bold vision for the IoT trial
   - d) Recommended trial structure and phased approach
   - e) Key measures of success
   - f) Key leverage opportunities for government
   - g) Risks and challenges
   - h) Proposed focus for each trial region/sector
   - i) Scorecards to assess the options provided for each trial region and ensure alignment with Agriculture Victoria and DEDJTR strategic principles.