# final report

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## Investigate potential Augmented Reality and Virtual Reality applications within Australian Agriculture and Food Supply chains

This is an MLA Donor Company funded project.

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# Executive Summary

This report will discuss the Rural Research and Development for Profit proposal assembled by MLA and Wiley, successfully submitted November 5 2018. The submission entitled “Real Time Information for the Improvement of Human Performance” was developed with the dual goals of providing better, more current information to workers and providing superior education experiences.

This final report will give an overview of the project itself, the partnerships developed for the project and the project proposal itself.

The total project value was $3,960,000 with contributions from the following RDCS:

1. MLA
2. AMPC
3. Dairy Australia
4. Agrifutures
5. Grain RDC
6. Cotton RDC
7. Australian Wool Innovation
8. Australian Pork Limited
9. Forestry and Wood Products Australia

In addition to these parties, partnerships were developed with:

1. Hitachi
2. Softcorp
3. National Farmers Federation
4. QUT
5. FountX
6. University of Missouri, USA
7. Ipswich City Council
8. Teys
9. ACL

With the final submission, a total of 12 letters of support were submitted, a substantial number given the nature of these projects.

The methodology of the project was broken into 3 main parts, with an additional project management section.

1. Adoption and communication activities
2. Value opportunity studies
3. Off-the-shelf product trials

These three sections were chosen out of rigorous debate as the best way to approach the project.

The methodology of the project was developed out of a high level need to understand the space before committing to a particular development path. This need manifests in the value opportunity investigation. This gives all partner RDCs the chance to investigate their sectors in depth with regards to this technology. Once these investigations are done, the total value of the technology to industry will be estimated.

In addition to the value opportunity studies, the project will have a strong adoption and communication segment. This part of the project is aimed at ensuring the research performed in this project doesn't go to waste when the project comes to an end. This will be achieved by engaging with industry stakeholders both at the executive and production levels.

Finally, the project will perform "Off-the-Shelf" technology investigations. These investigations are intended to take the learnings from the value opportunity study and implement them in more realistic circumstances. This section will take technology which is purpose built or close to purpose built and investigate their effectiveness in solving problems for the food industry.

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# 1 Project objectives

At the core of any RRPD proposal is the partnerships. This section will discuss in some detail the partnerships developed for the current project and the benefits derived from each.

The following table summarizes the RDC partnerships, the reasons for interest and the total contribution by each party.

| Contributor | Contribution | Reasons for contributing |
|---|---|---|
| Meat and Livestock Australia & partners | ROI analysis and development and trial of prototypes | Primary contributor, interested in safety, efficiency and thorough understanding of industry needs |
| Cotton RDC | ROI analysis only | Primary interest safety in very complicated facilities |
| Dairy Australia | ROI analysis only | Interested in safety and vet services to sick animals |
| Forest and Wood Products Australia | ROI analysis only | Interested in safety in saw mills |
| Grains RDC | ROI analysis only | Interested in understanding the potential for real time information in all applications |
| Agrifutures | ROI analysis only | Interested in understanding the potential for real time information in all applications |
| Australian Meat Processor Corporation | ROI analysis and development and trial of prototypes | Interested In facility based applications, especially safety and efficiency implementations |
| Australian Pork Limited | ROI analysis only | Interested in exploring the technology to understand its potential impact in a variety of applications |
| Australian Wool Innovation | ROI analysis only | Interested in exploring the technology to understand its potential impact in a variety of applications |

Other partner organizations are as follows:

Hitachi, QUT, University of Missouri, Teys & ACL, Ipswich City Council

# 2 Methodology

The methodology for the current project was developed over the 10 months that went into producing the proposal, countless conversations with potential stakeholders, consultations with industry experts and in depth estimating.

The project methodology went through a number of drafts to reach its final form. The first major finding through the stakeholder consultation process was that the stakeholders needed more concrete information on the possible implementation of real time information before substantial investment could be permitted.

**Value opportunity study**

With this in mind, the project was sculpted to include the Value Opportunity Study. This study investigates the potential economic benefit of the technology on an industry wide basis through uncovering a large number of applications of the technology. In order to find these applications the study will include a large number of interviews with industry members from all parts of the supply chain and all participating sectors.

These interviews will be used to uncover the problems which real time information can solve. These insights will then be fed into an economic analysis. This economic analysis will take the applications uncovered, estimate the economic value of solving a single instance and multiply by the number of instances in industry.

The study will be performed by highly reputable consulting resources to ensure realism, accuracy and implementable findings. The economic analysis will produce a detailed ROI analysis for each application uncovered, a broad, industry wide economic benefit analysis and finally, a list of possible implementations for entrepreneurs to take advantage of.

**Off the shelf implementations**

The off the shelf implementations take the findings of the value opportunity study and transfer them into real life implementations of technology. This part of the RRDP is critical to getting a thorough understanding of the realities of the technology.

This section of the project will consist of 45 implementation trials of off the shelf technology. Each implementation will cost around $50,000 and include the purchase of new equipment, tailoring, experimental design and oversight and scientific analysis.

These studies will be delivered to the major funders of the project (MLA and AMPC), to accelerate the development of real time information to these key stakeholders.

An example of an implementation might be the implementation of an off the shelf technology for remote mentoring of vets in the dairy sector. A farmer with a sick animal will be equipped with real time information systems and connected to a vet with the appropriate software. The vet will guide he farmer thorugh any appropriate actions and hopefully prevent the need for a house call a long distance away.

This experiment will be planned and followed up by the researchers from QUT who will establish the effectiveness of the technology in the implementation, perform any tweaks necessary and trial the technology in a new application.

This highly rigorous, scientific approach is designed to deliver reliable results for further decision making regarding real time information for industry in future, beyond the scope of the value study.

# 3 Results

Improving Human Performance through Real Time Information

This project seeks to establish the value proposition for the use of real time data for improvements in human performance - leveraging technologies such as Internet of Things sensors, algorithms and augmented or virtual reality.

Augmented Reality (AR) is predicted to be the next disruptive tech and will be as common as smartphones in 5-10 years. Australian farmers are currently struggling with use of data and deployment/adoption of sensors and are lagging behind the US and other nations leading to a productivity gap. Nine RDCs will invest in developing the value proposition of real time information systems specific to their industries, surveying industry stakeholders and performing detailed economic and ROI analyses to identify the best opportunities to implement this technology. Based on the results of these analyses off the shelf technology will be deployed or prototypes developed and adoption activities undertaken.

In a 2017 investigation, PWC analysed the business impact and commercial viability of more than 250 emerging technologies to zone in on the "Essential Eight." These are the core technologies that will matter most for business, across every industry and are the technology building blocks that PWC believe every organization must consider. This project addresses 4 of these essential 8 technologies (the others being robotics, drones, blockchain and 3D printing).

The first part of this project will be an opportunity analysis. This project is not prescriptive regarding which precise mechanisms to be used to enhance human performance but some parts or the real-time information system are as follows:

1. Gather information from the environment including head mounted cameras and other sensors (IoT)
2. Process information streams (using analytics, AI and machine learning as required)
3. Display information in an easy to interact with and temporally relevant way (Augmented or virtual reality)

Drivers for this project include the economic position Australia holds in the global market and the associated living standards; the labour costs carried by Australia's primary industries are disproportionately high when compared to our global competitors. In an increasingly competitive international marketplace Australia is overrepresented in terms of labour costs and real time information represents a real opportunity to realise significant productivity and profitability improvements for primary producers.

In Ag industry roles and tasks people make determinations on a range of inputs and act accordingly. These actions are inspired by information available which may or may not be contextually relevant, timely or complete.

For example these might include:
- The weather information a pastoralist uses may be incorrect for their actual location and when complete information from an in-situ weather station is combined with soil sensors, the farmer may make better judgements, leading to higher yields
- When a meat product is being graded, the grader may not have a perfect view of the colour or could be fatigued, this process can be enhanced with head mounted cameras to make the grader more accurate
- The movements of an animal may be imperceptibly different today as compared to yesterday suggesting sickness this information can be enhanced with special animal welfare collars and displayed to the farmer in a range of ways

If these information streams can be enhanced, updated, contextualized with advice or delivered in situ the effectiveness and efficiency of the individuals undertaking the action can be improved and as a direct result, efficiency and productivity can be increased.

These improvements in productivity and efficiency will come from the enhanced collaboration between humans and machines which, will enable the following:

- Increase in objectivity in actions and determinations by staff
- Decrease time lost through indecision
- Diminish inaccuracies in qualitative assessments
- Improved workforce skills and utilisation
- Improved output of operations

Furthermore, this project will use a Design Led Thinking Methodology, involving 3-4 producers/user groups from each represented industry and spread across the whole of Australia. The likelihood of appropriate R&D being undertaken, deployed and discussed through a network of cross industry producer groups and ultimately adoption of the resulting technology is exceedingly high.

This project addresses advanced technology innovation and adoption of, Real-Time information technologies. These include Artificial Intelligence, Internet of Things, large scale precision agriculture and Augmented and Virtual Reality. A continuing theme throughout this project is identification of world class use cases from other industries and translation into the Australian agricultural environment so that primary producers can increase yields, reduce costs and manage risks.

This project lays the groundwork for development in this field by investigating the ROI and path to adoption of these technologies. Through interviews with primary industry members, collaboration with advanced technology experts and thorough economic modelling, this project will produce a value proposition and a roadmap to adoption for Real Time Information technology.

This investigation will produce a collaborative, overarching approach to the rollout of real time information systems, the benefits of this approach are as follows:

Maximum per dollar return
- From reduced redundancy of development and collaborative benefits between participants
- From clear identification of high value low cost opportunities
- From industry's increased visibility over available technology, techniques and the implementations thereof

Accelerated adoption, collaborative marketing and demonstrations
- Design led thinking methodologies used in project selection to ensure that the end result is genuinely addressing a primary producer need (and not just development and deployment of 'cool tech') and that there will be a demonstrable ROI.

This project will likely also address the priorities of biosecurity, soil, water and managing natural resources. A preliminary list of potential uses were brainstormed during RDC and industry discussions:

1. Ability to see things a human cannot
. Sub-clinical illness based on behavior, temperature/pH sensors via ear tag/bolus/implantable
. Use of hyperspectral/NIR cameras to detect issues a human cannot (eg. Post mortem health inspection), leverage Health to Wealth project

2. Decision making based on real time measurement, trends/historical knowledge
. Production planning based on infeed measurements - eg Forestry quality and forecasting, using 'woodeye' scanner and machine learning algorithm
. Use of IoT devices on farm – visual representation and alerts in situ – feeding issues, temperature (heat stress), sensor data – can look at issue on the spot saving time.
. Smart glasses and use of drone imagery -identify areas that need weed eradication, additional fertiliser, fence line checked etc.
. Pest/Disease identification – create/use knowledge library – also remote assistance, via smart glasses the specialist in city could view the on-farm animal/plant/disease.
. Logistics. Smart glasses could be used to unload container appropriately ie. strawberries with three days of shelf life sent out immediately.
. Wool classification
. Sorting and grading of produce
. Identification and resolution of production bottlenecks

3. Mistake Proofing/License to operate
. Inspections – do all inspectors look in the same places? How do you know? Record of HACCP/control point inspections.
. Record of biosecurity assessment carried out.
. Proof of humane animal conditions/inspections.
. Mistake proofing – inventory management - assist human operator (Forestry - highlight different beams in different colours instead of relying on label).

At present, there exists a large number of tasks which cannot be fully automated but could be better performed when a human collaborates with technology. This project directly targets these tasks to drive dramatic return on investment for food, agriculture and manufacturing sectors.

The collaboration between humans and technology is at the core of this project. The scope seeks to define opportunities to realise economic benefit to industry.

The uptake and adoption of innovative technologies is inextricably linked to competitiveness. Globally the Augmented Reality and associated industries are investing in excess of USD $2.5 billion (2018) in the development of hardware systems to allow the display of real-time information. A subset of this technology will be targeted at commercial and industrial applications. Literature and industry press indicates that in 10 years, smart glasses will be as ubiquitous as smartphones are today. When this point of ubiquity is achieved Australian agriculture and food sectors will need to be positioned to leverage this technology to remain competitive.

At present, there are a number of case studies in which real time information has been implemented to great effect. International third party logistics firm DHL have implemented this technology in warehouse operations achieving a 15% increase in human labour efficiency. This example application is relevant to the agriculture and food industries as a 15% increase output from aspects of the human labour cost across industry warehousing in the target vertical would represent significant savings.

According to PwC, the data collection and aggregation elements of Real-Time Information are likely to save 4.6% of total costs in the American forestry industry in the next 5 years. That means the whole US forestry industry will save 10 billion dollars annually.

This project seeks to develop a roadmap for Australian Agriculture for the adoption of Augmented Reality and other solutions aimed at improving outcomes through the provision of real-time contextual information.

What differentiates this project from others, and shows it to be new and innovative, is that it does not stop at high level statements about what should or shouldn't be developed and adopted. Instead, the project will work with producers and technology providers to uncover real business opportunities for genuine return on investment.

These opportunities will be further explored by small scale investigations within the project, these investigations will use off the shelf technology to verify the return on investment in a given situation. It is envisaged that a range of service providers will be involved. We have been scoping this project with input from startups such as Bondi-Labs, to university departments such as the University of Sydney and QUT through to international corporations such as Hitachi and Softbank (see letters of support).

There is without question a knowledge gap, through discussions with RDC members and industry participants, awareness of Augmented Reality and real-time display technology can be characterised as 'uninformed'. Few, if any, members of the industry were aware of the concept and even fewer were aware of the substantial efficiency gains possible through implementation.

Upon learning of the technology and value to be realised industry participants have indicated a willingness to engage to gain access to the future value.

The Real-time Information project builds upon a small investment by MLA in a project centred on Computer Vision and Augmented Reality and the potential of these technologies to enhance the qualitative grading of red meat. The project was in part an investigation into the effectiveness of augmented reality in the abattoir environment to reduce subjectivity in assessing the attributes used to support MSA grading. Among key findings of this investigation was the identification of the value of innovations in the computer vision and augmented reality area and their potential for industry. Subject to the value proposition analysis this MSA grading work may be further developed and deployed.

This Real-time Information project is a more in-depth investigation into the possibilities of augmented and virtual reality exploring the areas of safety and human efficiency, and develops these ideas further into economic studies of opportunity, prototypes and fleshed out business cases including return on investment analyses. The project also uses, in some sections, the findings from Precision to Decision Rural R&D for Profit project however it does not deal with the same issues. MLA and CRDC have collaborated closely in developing the scope of this project and the scope of Precision to Decision 2. The two projects are complementary and are not duplicative.

The project also uses findings from an investigation by AMPC (2016) into the scope for Wearables in the meat processing sector. This includes the usefulness of AR in the food processing industry and uses findings from that report to uncover more fully developed applications of augmented reality in industry.

Agrifutures have in the last month published "Accelerating the development of agtech solutions worth adopting". This report highlighted the challenges and opportunities facing agtech in Australia, the proposed project was developed using the findings from this report. The proposed project addressed the following challenges and opportunities:

Challenge 1 - Lack of domain expertise: addressed through the thorough investigation into the technology and how it can be implemented for our farmers

Challenge 2 - Lack of industry networks: addressed through our thorough collaborations with technology providers and relevant industry members

Challenge 3 - Iterative development takes time and time is money: addressed by prioritizing the development of technologies which have the most value and doing do in a professional, well structured way

Opportunity 2 - Build awareness of emerging technologies and capabilities for assessing them: addressed through the project as a whole, a primary part of the project is the assessment of emerging technologies

Opportunity 3 - Get out in the bush and talk to producers: feedback is critical to the project and addressed through the industry interviews section and therefore appropriate resources will be allocated in order to conduct industry members/producers or producers groups interviews, as identified by the nine participating RDCs, and analysing their businesses

Opportunity 6 - Define and amplify industry problems: once the interviews are held, the challenges uncovered will be clearly illustrated using the publication mechanisms of the project

Opportunity 9 - Embrace entrepreneurs as a new and critical stakeholder: addressed through the publication of high value opportunities and the engagement with the entrepreneurial industry

This project will be led by MLA - and managed by Michelle Ford. An engineer with 15 years experience in a range of industries and a background as a management consultant in deploying lean manufacturing, problem solving and decision making. As the manager of RDI Operations and Australian innovations, Michelle has oversight across all of the program areas from soil science and pasture growth to value adding at food processing and retail operations. She is also supported by the MLA team, including Darryl Heidke, the Program Manager for Technology and Automation (including Digital Agriculture).

MLA has engaged Wiley to project manage. This dedicated resource will ensure that the project is delivered on time, to budget and meets the scope set out in this application.

Wiley have a century of experience in delivering and managing complex projects, making them the trusted choice for many of the world's leading food brands—and a uniquely qualified advisor to the increasingly complex food industry. Nobody knows food like Wiley. They are unrivalled for advice, project management and consulting services for food and agri-projects in Australasia.

In the rapidly changing food and agriculture industries, Wiley pair best business planning and strategic thinking with highly technical food and manufacturing expertise to deliver world-class, customised solutions. Wiley specialists are industry leaders—some of the best in the world—and their list of peer awards is long.

Brett Wiskar, R&D and Innovation Director, Wiley. Brett has spent the last 20 years in digital, technology and innovation in Australia and UK. Prior to joining Wiley his entrepreneurial approach to innovation was used to drive business change and digital platform adoption across large corporates and government agencies across Australia. He has worked with some of the largest brands in the country on their digital roadmap and innovation programs. He is a recipient of numerous awards and is a frequent speaker on the topics of innovation & technology.

At Wiley Brett's role is to work with clients and project teams on diverse subjects such digital enablement, innovation, data (big & small), strategy, business models and the future of food industries and markets. He is responsible for Wiley's Technology, Innovation, R&D and Data Consulting services and works with clients to drive efficiencies across their operations.

Ryan Harvey, project co-ordinator, Wiley, will support Brett in the day to day co-ordination and administration of the project.

Provider of the industry interviews, assessment and analyses, has not been selected. There are many interested parties, from international accounting and consultancy firms such as KPMG to small boutique providers such as IP Active (a boutique IP and technology commercialiser and evaluation consultant). A Terms Of Reference will be created in consultation with the other eight RDCs and go out to tender. QUT or equivalent will participate in assessment of the productivity gains associated with deployment of off the shelf technology. The scope of specific proof of concepts or deployment of off the shelf technologies will be a result of the value proposition work. A variety of companies - from startups to international conglomerates have expressed support and interest in participation in this project.

This project will uncover the precise ways in which real-time information can benefit the productivity and profitability of primary producers. In order to achieve this, the project will engage a large number of primary producers and other supply chain participants (e.g. manufacturers), their requirements, situations and challenges. This design-led thinking process will facilitate the accelerated development and implementation of real-time information systems.

Examples of work that could be undertaken are:

1. Remote assistance: During the care of animals a vet is needed but the travel and cost of skilled vets visiting a remote property are prohibitive. To overcome the outlined scenario, real-time information systems can be deployed where technology allows the skilled vet to directly view the situation (audio and video) and instruct the cattleman as they tend to the needs of the animal. This would permit the vet to care for animals more quickly and easily without incurring the cost and time associated with a journey to the site.
2. In the process of sorting produce, for example potatoes, computer vision equipment can be used to identify potatoes which are not fit for further processing. A light could be projected onto the suspect potato (to track the item) in order to increase the speed of human picking. In this situation the human pickers no longer have to both 'identify' and 'pick' and can instead use their entire mental effort to pick the unfit potatoes off the production line. This example would diminish the number of staff required to maintain quality standards in the facility.
3. Calf loss in Queensland and the Northern territories can be up to 30% and due to the vastness of northern systems limiting regular animal observations and producers have very little information on when losses occur. IoT (Internet of Things) sensors carried by, or implanted in, a pregnant cow could flag an impending birth of a calf, monitor the birth and allow a pastoralist to have staff attend and manage the animal's welfare.

There are many examples like the ones featured above across the spectrum of industries. To determine the value to industry a number of assumptions regarding the value of the economic impact must be made. It is a safe metric to assume that human inefficiencies and poor qualitative determinations open opportunities for an improvement greater than 1% of the economic value created in industry. In the red meat sector represented by Australian Meat Processors Corporation and Meat and Livestock Australia this return alone would represent $170,000,000 annually. When examining the opportunity to reduce labour headcount (FTEs - Full Time Equivalents) on cattle and sheep properties through task automation and providing access to real-time insights on conditions for animals etc. it is clear that;

1. Labour savings would be significant, or
2. Operators could manage larger herds and/or properties with existing labour

With identified real-time information case studies from other industries (examples being Boeing, Bosch, Lockheed, Georgia Tech, Medtronic, Welsh Water, PNB Metlife India Insurance and Melbourne Water) showing labour efficiencies of greater than 25% in some tasks and extrapolating a conservative 1% labour efficiency for the Australian agriculture and food space it is clear this technology has the capacity to deliver returns several orders of magnitude beyond traditional investment priorities.

The project is explicitly designed to increase adoption with this cutting edge technology centred around Augmented Reality, Artificial Intelligence and Internet of Things sensors. Issues identified in Precision to Decision showed industry lacks trust in digital technology. This Real-time Information project seeks to address this through the development of prototypes with key industry partners (technology providers) and deploy these to industry in on the ground industry specific solutions. This approach is designed to shorten the subsequent path to commercialisation of solutions for broad industry adoption and empower all industry participants to gain access to disruptive and powerful innovations.

The initial value study will show value to industry. The prototypes will then demonstrate key areas of value creation. These areas will then be studied and the learning shared with industry to show competitive advantage for industry participants that become early

adopters.

An industry engagement program aimed at educating the market on the value creation opportunities will provide repeated exposure. This is designed to enhance trust for industry members, accelerated uptake and ensure maximal development of the industry.

The project is not only designed to accelerate adoption but to do so in a way which ensures maximal return for the federal funds invested. This is achieved through opening further development opportunities to private enterprise and commercialisation of the project outcomes.

We consulted with 15 RDC's on the proposal and 9 RDC's have committed to investing in the project. The other RDC's were supportive however not in position to contribute financially at this stage. The purpose of this project is to facilitate adoption of technology that will increase productivity and profitability. This will be developed using a network of industry groups and international groups such as AREA (Augmented reality for enterprise alliance), a UK based, non for profit whose mission is to accelerate adoption of enterprise Augmented Reality by supporting growth of a comprehensive ecosystem. We will also make use of existing demonstration sites, such as the five MLA digital farms around Canberra, or the Victorian Government's Connecting Victoria initiative program - a two-year On-Farm Internet of Things (IoT) Trial being rolled-out across the state which will result in IoT enabled farms across four farm types and regions.

This is a project that should not be funded through the usual RDC funding model, or pursued by individual RDCs for their members as this would lead to duplication and wasted effort. Even with the best intent regarding collaboration, if RDCs take on development of this real time information technology alone the benefit of seeing what is applicable in other sectors and copying would not be realised.

There is significant industry support for this project, as evidenced by meat processing companies such as Teys and ALC offering money and in-kind in order to be involved in the project. Others such as Fletchers have suggested ideas they would like investigated - such as the use of Virtual Reality to improve the quality and effectiveness of training of unskilled and non-English speaking workers. Furthermore, many existing use cases, such as the DHL/Amazon logistics examples, would be applicable across all Australian Agriculture.

The partners involved in this project agree that emerging technologies are a critical area for investigation over the coming years. This project will not only strengthen the collaborations between RDCs involved in the project but perhaps more importantly ensure a unified approach to understanding and developing emerging technologies in a cross-industry approach.

The proposed project will uncover opportunities ranging across a variety of sectors and geographical locations. The project will plot these opportunities by impact and cost, giving the collaborating parties a clear understanding of this emerging technology, the potential applications and most importantly, which projects to invest in. If at all possible, projects which benefit the whole of Australian agriculture will be referenced, further enhancing collaboration.

The Precision to Decision project was groundbreaking as it involved all 15 RDCs. This project will be funded by 9 RDCs and will sustain those collaborations in the area of digital agriculture. The benefit to all of the RDCs participating is that they will be part of the steering committee and will have the opportunity to take part in the value proposition work with a focus on their industry. AMPC and MLA who have independently invested in this technology previously via normal RDC funding mechanisms will further invest in off the shelf technology and deployment of solutions. The learnings will be shared with all 15 RDCs. This project will build upon the existing investments in Precision to Decision and will have synergies with ALMTech and Health for Wealth.

Innovation happens when industries, academia and government come together. The global nature of the potential industry providers, the variety of sizes of companies (from start-ups to international corporations) together with the inclusion of agricultural industry representatives (producers), universities and research organisations, and the focus on the problems to be solved rather than the technology will ensure that this project will deliver ongoing innovation and growth for Australian agriculture.

The contractual agreement between the parties in the project will be defined in the project agreements that include:

- The Head agreement between MLA and the Department of Agriculture and Water Resources (DAWR);
- The Project agreement between Wiley and MLA that appoints Wiley to manage the project; and
- The Collaboration agreement between the parties involved in research activities.

A Project Governance Plan will outline the functions, processes and procedures for the appropriate governance and management of the project. The Plan will also define the Terms of Reference of a Project Steering Committee (PSC) that will be established to ensure successful delivery of project deliverables and outcomes.

The PSC will be comprised of representatives from the DAWR RR&D4P and each RDC as well as producer representatives from these sectors. The steering committee will have teleconferences on a quarterly basis and meet face-to-face every 6 months in conjunction with theme leaders who will provide updates on thematic activities, and forward planning within and beyond the project time frame. Independent expert reviewers will also be invited to annual reporting workshops to ensure transparency and value is provided throughout the life of the project.

The Wiley project lead and project coordinator will hold monthly teleconferences with the consultant engaged for the value proposition work as well as regular site visits. Wiley will oversee partner activities through regular teleconferences and site visits and be responsible for delivery of specific milestones and outcomes.

The contractual agreement between Wiley and partners will include detailed project plans (which have already been completed in the development of this proposal) and will also include individual budgets, milestones, risk management procedures, MERI and contractual obligations associated with the successful delivery of the project activities. Project proponents will have monthly teleconferences to ensure activities are on track and/or require additional resources.

This project management model has proven to be highly successful in the implementation and delivery of existing MLA RR&D4P projects.

The appointment of Wiley as the project delivery company is designed to ensure on time and on budget completion. In addition, the service provider used for the ROI and economic analyses section of the project will be selected based on a thorough tender. Throughout this process emphasis will be placed on the timely and on budget development of an outcome.

Wiley's experienced project managers will be the backbone of the timely and affordable project delivery model. With their proven track record of delivering projects up to $120M it is almost certain the project will be delivered to specification.

Moreover, governance structure used successfully in previous MLA led RR&D4P projects will be implemented including a project steering committee and project management group. Members will be appointed from the participant organizations, designed to ensure timely delivery of outcomes.

The greatest risk to this project would be the failure to engage appropriate consultant(s) for the opportunity analysis and calculation of return on investment work.

We are unlikely to find any consultant who has in-depth knowledge across of all of the nine industries represented in this project, to investigate the possible implementations of this emerging technology through interviews with primary producers, consultation with experts and economic modelling. We need a specific skill set and desire to do this work - and not to just churn out a high level report based on other previous high level reports.

We will be very specific in the terms of reference for this work, we may engage a consultant to evaluate one industry as a proof of their capability before awarding the whole contract. We will work with the industry and consultant to structure the investigative procedure and set it up for success. To address a lack of content knowledge, we will engage industry specialists to provide this input. We will ensure that producers are actively engaged in the identification of opportunities and are part of the design (feasibility meets desirability). This phase will return information on which opportunities are have a high value to effort ratio.

We envisage that the opportunity analysis and calculation of ROI will be most effective we use a cross functional team comprising of consultant, RDC representative, industry representatives, research organisation representative and Wiley representative.

The second greatest risk is due to the fact that the opportunities for development are yet to be defined - as are the associated risks to successful deployment, demonstrable ROI and adoption. These will be addressed through good governance and project management practices. If the work by the investigating party is thorough, then genuine opportunities will be taken through the off the shelf trials and finally, if these trials are found to be successful, adoption and extension activities will be carried out.

Lastly, while hardware and software companies are investing billions in developing this AR and VR technologies, the holy grail of lightweight smartglasses with desktop processing capability, infrared and hyperspectral cameras that can withstand the harsh, humid processing environments is still likely to be years away.There is a risk that the expectations for the technologies exceed what the technologies can actually deliver these expectations must be managed; projects will focus on what can be delivered today with current tech to improve productivity and profitability.

# 4 Conclusions/recommendations

Rural Research and Development for Profit proposal assembled by MLA and Wiley, successfully submitted November 5 2018. The submission entitled "Real Time Information for the Improvement of Human Performance" was developed with the dual goals of providing better, more current information to workers and providing superior education experiences.