Public report

AgTech Impact Assessments – Public Report

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Abstract

MLA conducted Agtech impact assessments over Digital Agriculture MLA Donor company (MDC) investments that were in flight and close to completion at the end of calendar 2022. Three were reviewed and a fourth has been deferred.

In conjunction with the impact assessments, this project also explored knowledge absorption and timelines to adoption, any on farm practice changes to be considered and alignment to the MLA MER framework. Through case study development there was considerations around ESG metrics within the projects then the work was tested against the MLA Agtech Cost Benefit Estimator tool.

The primary impact assessment results of this work were qualified noting that baseline data was not fully available, however this is expected to evolve in the next 12 months. The qualitative assessments were insightful, especially the ESG considerations and the extended time frame for project delivery allowed further dialogue with the project participants around these considerations.

Initial outputs from this project have demonstrated positive returns for the assessments that were able to be completed under selected assumptions, underlining the value of the investments. Equally two projects are evolving beyond the initial scope to explore synergies with emissions reporting and links to sustainable finance, both of which will have significant benefits to industry.

Executive summary

Background

MLA conducted Agtech impact assessments over three Digital Agriculture MDC investments that were in flight and close to completion in late 2022. It was recognised that these projects were still in progress and that in some cases modelling may be challenging when assessing the value proposition, or product. This consideration is also against the backdrop of KPIs attached to these investments via aspiration of 5% productivity lift from the projects (either, via reduced costs, improved yields, premium prices etc.). The key outcome from this work was the testing of this methodology in laying a foundation or framework for future assessments for MLA investments of a similar nature.

Objectives

In conjunction with the impact assessments, the further objectives of this work was to explore knowledge absorption and timelines to adoption, any on farm practice changes to be considered and alignment to the MLA MER framework (to test 5% productivity gains). The opportunity was also taken with the case study development to explore considerations around ESG metrics within the projects. Finally, the work as far as practical, was tested against the MLA Agtech Cost Benefit Estimator tool (a) run standalone modelling assumptions to test outputs and (b) run a live test with one of the project participants to validate key findings and next steps with this tool.

Methodology

Following project inception, the methodology followed a series of sequential phases being rapid analysis and initial consultations; case study development; further consultations and evaluations; review of the MLA Agtech Cost Benefit Estimator tool and reporting.

Results/key findings

The primary impact assessment results of this work were a little hindered through inability to secure baseline data with the projects in flight or full productivity benefits still to be assessed. Whilst not able to be fully completed, the qualitative assessments were insightful, especially the ESG considerations and the extended time frame allowed deeper dialogue with the project participants in this area.

Benefits to industry

Initial outputs from this project have demonstrated positive returns for the assessment that was able to be completed underlining the value of the investments. Equally two projects are evolving beyond the initial scope to explore synergies with emissions reporting and potential links to sustainable finance, both of which will have significant benefits to industry.

Future research and recommendations

1 Revisit these assessments within 12 months to fully assess productivity gains.
2 Test this methodology via a further assessment in 2023 to build the framework for future assessments.
3 Continue to build and evolve the MLA AgTech Cost Benefit Assessment.

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1. Methodology

The project followed a six-phased methodology:

Phase 1	Project Inception
Phase 2	Rapid analysis and initial consultations
Phase 3	Case Study development
Phase 4	Evaluation and impact assessment
Phase 5	Review of the MLA Agtech Cost Benefit Estimator tool
Phase 6	Reporting

This final confidential report for this work gives thought towards objective recommendations on these projects moving forward. It is also noted that the deliverable timelines were extended by mutual agreement owing to availability of information. A positive outcome of the project delays allowed for deeper insights into various qualitative aspects of the work that are detailed in the case studies and summarised below

2. Synthesised Case Studies

2.1 Economic Analysis and Value Drivers

A key finding out of this process were subtle differences between family farming operations and corporate entities when exploring economic analysis and value drivers. Namely:

- There was a clear focus on the family farming operations in understanding detailed costs and return from the investments based on time savings generating efficiencies and productivity drivers.
- Corporate and institutional investors also have a clear focus on investment returns but also had a broader suite of data mapping requirements. These requirements saw projects that were largely data and digital transformation projects that will lead to positive economic impact but will require further analysis.
- All assessments immediately identified time savings through automation that allows for effort (especially managerial effort) to be redeployed and this clearly aligns with the MLA MER Framework.
- Initial rapid impact assessments demonstrated positive returns in line with expectations with final recommendations to undertake deeper dive assessments in 12 months by mutual agreement.

Whilst the value drivers are similar there were also various motivations for the adoption of new agtech solutions that will drive longer term value:

- Ability of IoT devices to improve the overall image of the red meat industry through data support and information that underpins public perception of animal health and welfare.
- Supply chain efficiencies and benefits around identification, quality control and data completeness within their own business.
- The ability to leverage these projects into broader offerings linking to ESG and Sustainability reporting.

The key differences in these case studies were that the family farming operation went out on their own to actively seek agtech solutions to best fit their current landscape and to have the biggest impact on their enterprise. By comparison, the corporate operations were comfortable to adopt new solutions and were

familiar with the approach and requirements adopting a longer-term view. Both however had a clear focus on economic returns and value drivers for their respective operations.

The differences in approaches projects highlights the different approaches required to adopt different forms of agtech solutions across different farming operations.

2.2 Data Collection

A key feature of the case studies was the importance of data, both through efficient collection and interpretation of information to either (a) make informed, risk based, decisions; and (b) seeking monetary reward through use of validated and trusted data.

Increasingly producers will seek technology solutions that allow data to be captured across a wide variety of parameters to provide confidence and assurance across animal welfare, environmental stewardship and contributions to people and community. The assessed projects, whilst all targeting different areas of red meat production, all had this in mind. Table 1 below details key parameters, some of which are easily collected and others that are difficult but all lead to considerations around ESG metrics.

Table 1: Example of data metrics that require confidence and assurance

Parameters	**Example of Data Requirements**
Animal Welfare	Health and wellbeing including vaccination status Husbandry practices including pain relief Fodder and pasture security / availability Water availability Transportation Management of extreme weather events Protection from predators
Environmental	Sources and volume of water use On farm energy sources and usage including fuel use Fertiliser inputs and nutrient management Effluent and waste management Vegetation coverage Greenhouse gas emissions Carbon Sequestration Biodiversity and soil health
People and community	Training and capacity building Fair pay, diversity, and inclusion Skills development, such as new AgTech adoption Injury down time Occupational health and safety

2.3 Knowledge Absorption

A critical feature of these case studies was that both the technology vendors and farming operations (both family farmer and corporate) were well across awareness requirements as defined in the MLA MER framework in knowledge adoption. They were all identified as early adopters, proactive and willing to invest their own time and funding to actively participate in these project investments.

It should be noted though that there was a long lead time in these processes with the family farming enterprise conducting research from 2018. This research sparked curiosity on the capabilities to use data and technology to demonstrate animal health and welfare. Over time further research, field days and conversations with other farming enterprises resulted in the decision to integrate agtech into their enterprise.

At a corporate level there has been a long-term evolving recognition that there are opportunities to use agtech solutions to solve the problems they were experiencing with their captured on-farm data. This led to the implementation and development of adopting new data driven systems, that are continuing to evolve. This evolution equally has not emerged overnight and was borne over a long lead time.

The key takeout is that whilst all projects assessed are recognised as “early adopters”, the real impetus and journey to adoption commenced with knowledge absorption that commenced over five years ago. This is a critical component of long-term success, not necessarily predicting the future but absorbing key knowledge from a variety of sources and applying it to suit individual circumstances.

2.4 Adoption Journey

The adoption journey for the projects all followed a similar timeline for adoption noted in Figure 1 below:

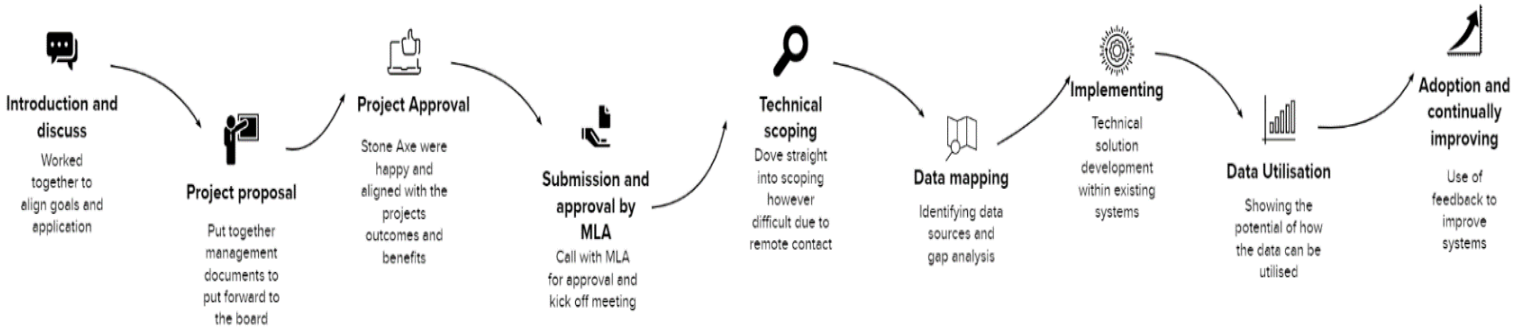

Figure 1: Adoption journey

Regardless of the project, once the decision to implement was taken, the timeline to adoption was circa 12 months and the steps in the process highlighted in Figure 2 follow a similar pathway to that of the “8 Pillars of AgTech” noted in Table 1 below.

In conjunction with an agtech provider, farm 1 have created a step-by-step process of the adoption of new on farm agtech, this framework is called the 8 pillars of agtech. This framework is designed to organise knowledge and experience by developing knowledge bases on the pillars outlined below and understanding how they are all connected to assist with the adoption journey.

Table 2: The 8 Pillars of AgTech – Re-produced with permission of AxisTech and Coolindown Pastoral Company

Step	Action
1. Installation	Installation is about identifying the problem that needs solving and then understanding where that problem is physically located and assessing the physical environment in which an AgTech solution needs to live. The importance of the actual physical installation and key considerations regarding the environment and location is the first step in the process.
2. Sensors	Sensors are the specific component in a device that undertakes key measurements. A device may have one or multiple sensors that may be external or internal. The data output and the nature of the solution is dependent on the sensors that exist within a device. Sensor quality and function is a component of data quality and reliability.
3. Device	The device manages, controls and powers itself and its sensors and communication modules. It manages sensor readings and packages them into messages and transmits them within its programmed format. Devices can also receive commands and perform functions within their physical, technological and power constraints.
4. Connectivity	There is a plethora of connectivity options and terminology, and it all fits together differently depending on where the installation is located relative to the existing or deployed infrastructure and is usually multiple technologies.
5. Data ingestion	Separating data ingestion from storage allows a focus on device messages and how data flows are handled and then becomes meaningful data. It provides a framework for understanding of how batch and historical data can be handled, how farm records can be digitised, and covers the importance of attributes, units of measurement and the importance of data principles and data standardisation
6. Data storage	Covers all the areas in which farm data is currently stored and looks at data management terminology like servers, cloud, AWS, Azure, SQL, databases, and data historians. It allows attention to be given to stored data: where is it, who holds it, who owns in who has access to it, what is it being used for
7. On-Farm Data Consumption	Looks at applications, dashboards and apps with a focus on the farm or individual business level solution layer. Covers consumption of third-party data such as satellite imagery as well vision from drones and cameras. Understanding layers of data can deliver farmer benefit
8. Aggregated data consumption	Aggregated consumption is emerging as the new frontier with developing data sharing, data hubs, grouped displays, grouped machine learning, and 3rd party consumption of data for purposes such as traceability and benchmarking

Whilst the 8 pillars of agtech displayed above cover the adoption journey for physical agtech on farm and is a great way to understand the pathway to follow it is not applicable to software based agtech.

2.5 Skills Adoption

Another key finding from the case studies is the need for individuals and businesses to develop new skills to efficiently use new agtech solutions, regardless of size and scale of operation.

For managers of businesses interpretation of new data sets can take time to evolve and understand.

Equally the need to upskill staff was highlighted as a key consideration. Farm induction for seasonal or permanent labour will be a feature of the farms of the future and these individuals will have different levels of technology and data literacy. Allocation of time in the training and induction of staff to become proficient and digitally aligned with the farms key agtech solutions will increasingly be a critical element to ensure alignment of skills for everyday practices. This may range from data collection, ability to spot problems with or maintenance of sensors and possible basic data interpretation.

For broader operations with multiple locations and high staffing levels there needs to be alignment with staff training and upskilling, especially if the business is undergoing a digital transformation. However, training new employees can also difficult due to the high turnover of seasonal workers who do not have the digital literacy or willingness to work with agtech as a part of their jobs. This leaves the farm managers and owners to manage and collect the data from different agtech solutions, taking away time and effort into the management of the farm and the other aspects of their jobs.

2.6 On farm practice change

The impact that adopting agtech has on a farm is a major consideration to understand any on farm practice change and each operation is different. The ability to plan for and deliver the practice change is a key driver to success instead of being a barrier to efficiency. In the rapid impact assessments completed there were different levels of on farm practice change required – one was already well advanced with sensors and the other was starting from a low base where implementation considerations were required.

Moving forward there is also potential to explore Digital Twins as a means of demonstrating on farm practice change (this may also link to skills requirements and training).

2.7 ESG

Within the case study workshops there was discussion around ESG considerations. Whilst the focus was on AgTech impact there were clear signs that the vendors and producers were focused on ESG as part of normal practice, but it was seen as a natural part of their business and not necessarily recorded.

Through consultation it emerged that all projects had a clear longer term ESG focus and potential moves towards reporting functionality that would support credentials around areas such as:

- Animal welfare reporting for price premiums
- Emissions reporting
- Metrics to support access to sustainable linked loans
- Evidence of natural capital management
- Consideration around risk management within ESG considerations

It is expected that in the future agri-financiers will more robustly consider ESG factors in credit or investment risk assessments that will require validated data that is trusted and secure. There are various aspects to this reporting functionality and these projects are laying the foundations to support ESG components noted in the adopted S&P Global table below:

Table 3: Example ESG Risk Factors

<table>
<tr><th colspan="3">Example ESG Risk Factors</th><th>Example – Finance Risk Assessment</th></tr>
<tr><td rowspan="2">Environmental</td><td rowspan="2">- Land and soil management
- Water quality and quantity
- Climate adaptation and resilience</td><td rowspan="4">Potential assessment criteria linked to highlighted themes identified in case study synthesis</td><td>Business Risk
- Ownership structure
- Business structure
- Management team</td></tr>
<tr><td>Financial Risk
- Cashflow and reserves
- Debt levels
- Security / collateral</td></tr>
<tr><td>Social</td><td>- Biosecurity
- Animal health and safety
- Food safety
- Traceability</td><td rowspan="2">Non-financial Risk
- Management
- Succession planning
- Insurance coverage</td></tr>
<tr><td>Governance</td><td>- Compliance with regulation
- Cyber security
- Risk management
- Succession planning</td></tr>
</table>

This links also to key ESG considerations and common themes that were identified noted below:

Table 4: Case study ESG Results Summary

ESG Parameter	Farm 1	Farm 2	Farm 3	Key Themes
Environmental	- Ground cover - Land management - Soil health - Climate adaption and resilience - Water quality and quantity - Ecosystem productivity	- Emissions reduction - Resource consumption - Ground cover - Biodiversity - Soil degradation - Environmental education and leadership - Chemical pollution - Energy use - Climate adaption and resilience - Water quality and quantity - Ecosystem productivity - Biosecurity	- Ground cover - Land management and clearing - Soil degradation and erosion - Biosecurity	**1 Land management** **2 Soil management** **3 Water quality and quantity** **4 Climate adaptation and resilience**
Social	- Animal health and welfare - Mental health and wellbeing - Food safety and quality - Biosecurity - Traceability - Animal husbandry	- Animal health and welfare - Labour standard - Food safety and standards - Livelihoods of rural communities - Biosecurity - Traceability - Animal husbandry	- Animal health and welfare - Food safety and quality - Biosecurity - Traceability - Animal husbandry - Level of upskill - Improving visibility on things they don't have control of	**1 Animal health and welfare** **2 Biosecurity** **3 Food safety** **4 Traceability**
Governance	- Cyber security - On-farm policy - Risk management - Succession planning - Community engagement - Data ownership	- Cyber security - Risk management - Compliance with government - NLIS	- Cyber security - Succession planning - Compliance with government	**1 Cyber Security** **2 Compliance** **3 Risk Management** **4 Succession planning**

3. MLA AgTech Cost Benefit Estimator Assessment

The MLA Agtech Cost Benefit Estimator tool has been developed to estimate the cost benefit and pay back periods for farmers looking to implement AgTech on farm. The calculator focusses on three use cases - water management, livestock monitoring and pasture management which are currently in the early stages of testing and transitioning into a live tool that will allow farmers to self-assess and receive instant feedback to help guide their decisions around investing in AgTech.

Results from the rapid assessment were leveraged to undertake a technical analysis and review of the estimator to compare the actual costs of AgTech implementation against the results being produced through the AgTech estimator. Other factors that were reviewed and analyses also included:

- The overall user experience of the tool including pains and gains.
- The accuracy of answers being given (i.e. estimation or actual)
- Time taken to answer each question and complete the form
- Determine if the results of the calculator provide the correct information to guide users

Results from the independent assessment indicated that the calculator produced similar result to the rapid assessment. However, the tool proved to be challenging and time consuming to answer questions despite having the calculations from the rapid assessment at hand. Some of these challenges included:

- Time taken to answer questions.
- The data format required by the tool involved several adjustments having to be made to the rapid assessment results to match.
- Input fields restricted by maximum and minimum ranges that didn't fit the results being entered
- Question phrasing considered difficult to understand and could be potentially frustrating
- Difficulty in providing accurate answers to the questions being asked.

Overall, the assessments showed the tool as being fundamentally sound in its calculations, however confirmed where further work will need to be carried out to improve the overall user experience and value proposition for end users to increase uptake and adoption. The next phase of the MLA Agtech Cost Benefit Estimator tool calculator in conjunction with the Southern NSW Drought and Innovation hub will look to seek further validation from farmers and make these improvements and release a web-based calculator. It is noted that this project is currently in flight.

4. Key Recommendations

The synthesised case study has seen evolution in the initial foundation of a common framework that can be applied across the spectrum of related MLA projects / investments in future economic assessments for agtech adoption. This however is not fully formed owing to the requirements to have clear base line data and further evidence of productivity uplift.

It is recommended that this framework be applied to a further assessment to fully test key metrics around the MER Framework and then revalidate against the initial projects in the next 12 months. Central to this will also be the evolution of ESG considerations that this project has explored.

5. Conclusion

5.1 Key findings

The primary impact assessment results of this work were initially slowed by secure sufficient baseline data to allow modelling. This supports the recommendations to review a stand-alone project and these projects again in 12 months to fully test these investments against the MLA MER frameworks.

The qualitative assessments were insightful, especially around:

- Timeline to adoption was consistently evident at 12 months, however the knowledge absorption and decision making for this was evolving over an extended timeframe.
- Upskilling requirements both at a managerial level (to maximise use of the agtech and efficiencies from identified time savings) and for staff who may be required to perform new tasks that may be beyond their initial job descriptions.
- ESG considerations whilst not initially front of mind for the projects, through consultation revealed clear markers. This will be explored further in future work as part of an evolving assessment framework.
- The MLA AgTech Cost Benefit Estimator Assessment is fundamentally sound however will benefit from further user validations and it is noted this is currently in flight.

5.2 Benefits to industry

Initial outputs from this project have demonstrated positive returns for the assessments under selected assumptions that was able to be completed underlining the value of the investments. Despite challenges in securing base line information, each assessment immediately identified time savings and reallocation of this time toward activities that can deliver productivity gains will have broad industry benefit.

It is expected that further productivity gains will evolve as full functionality of the investments are realised and new functionality evolves or is explored. This however will require further assessments, including a stand-alone project assessment to fully refine an assessment framework for MLA in line with recommendations above.

Equally two projects are evolving beyond the initial scope to explore synergies with emissions reporting and links to sustainable finance, both of which will have significant benefits to industry. This is also recommended to be explored further as the potential for broad industry benefit, and the MLA ambition toward CN2030 program, provide clear synergies for this.