Final report

Business Cases for Data Use in the Red Meat Supply Chain

Abstract

The purpose of this project is to catalyse adoption of data usage across the red meat industry by showcasing how data and technology can enable practical business outcomes along the value chain. Specifically, this involved the development of three business cases that demonstrate the value propositions that data usage and technology can enable. Four supporting case studies highlight real examples of data and technology usage within the industry.

Interviews were conducted with various stakeholders across the red meat industry over the course of the project to: identify and prioritise focus areas for business case and case study development; gather evidence to develop selected business cases and case studies; and collate evidence of industry adoption and application of solution(s), and the resulting benefits and changes.

The three business case topics that were selected and prioritised in this project were: 1) quality, performance and health data sharing to improve returns across the supply chain; 2) on-farm animal performance and efficiency data to optimise returns; and 3) grazing management, pasture availability and soil quality data to improve performance and sustainability.

Executive summary

One of Integrity Systems Company's (ISC) key responsibilities is the development and delivery of the Meat and Livestock Australia (MLA) Digital Value Chain strategy to ensure that the industry is making the best possible use of existing and new data sources. A key challenge for the Australian red meat industry is that there is an abundance of data available, however, the true value of capturing, sharing, and using data is not always realised by industry given low rates of adoption of data collection and sharing tools.

Clearly articulated business cases that demonstrate the true benefits of data usage have been an important catalyst for change in other industries. However, there is currently a lack of such evidence-based business cases for data usage in the Australian red meat industry.

The purpose of this project is to catalyse adoption of data usage across the red meat industry by showcasing how data and technology can enable practical business outcomes along the value chain. The project sought to do this through the development of three business cases that demonstrate the value propositions that data usage and technology can enable and how, along with four supporting case studies that highlight real examples of data and technology usage within the industry.

Every business in the red meat industry is different, so the business cases don't seek to provide a one-size fits all formula for data and technology usage. Instead, they seek to provide guidance- including evidence, examples, and ideas- to help industry get more value out of data already being collected and technologies and tools available today, to ultimately help businesses more easily achieve their individual objectives.

Interviews were conducted with various stakeholders across the red meat industry over the course of the project to: identify and prioritise focus areas for business case and case study development; gather evidence to develop selected business cases and case studies; and collate evidence of industry adoption and application of solution(s), and the resulting benefits and changes.

The three business case topics that were selected and prioritised in this project were: 1) quality, performance and health data sharing to improve returns across the supply chain; 2) on-farm animal performance and efficiency data to optimise returns; and 3) grazing management, pasture availability and soil quality data to improve performance and sustainability.

The business cases demonstrate: who in the industry the data or technology use impacts the most; specific business objectives it could help achieve; the current state of adoption; the benefits and impact to industry; and any current adoption challenges and potential solutions to help overcome these. The case studies provide real-life examples of how organisations in the industry have approached implementation to date and lessons learned.

Table of contents

1. Background

One of Integrity Systems Company's (ISC) key responsibilities is the development and delivery of the Meat and Livestock Australia (MLA) Digital Value Chain strategy to ensure that the industry is making the best possible use of existing and new data sources. A key challenge for the Australian red meat industry is that there is an abundance of data available, however, the true value of capturing, sharing, and using data is not always realised by industry given low rates of adoption of data collection and sharing tools.

Clearly articulated business cases that demonstrate the true benefits of data usage have been an important catalyst for change in other industries. However, there is currently a lack of such evidence-based business cases for data usage in the Australian red meat industry.

This project seeks to address this gap, and ultimately to catalyse adoption of data and technology usage across, and unlock more value for, the Australian red meat industry.

2. Objectives

The purpose of this project is to catalyse adoption of data solutions across the red meat industry by showcasing how technology and data can enable practical business outcomes. The project aimed to achieve this through the development of business cases that establish what value data and technology solutions can enable and how, with accompanying case studies that demonstrate real examples of change in the Australian red meat industry.

Specifically, the business cases and case studies developed aimed to explore the following factors:

- Identify who in the industry the data or technology use could potentially impact the most, and provide examples of specific business objectives it could help businesses achieve;
- The current state of adoption of the data and technology use in the industry, including who is currently doing this today, what data is relevant, and examples of technology solutions potentially able to help;
- The benefits and impact to industry of the data or technology use, including how it might change for organisations of varying sizes and operating in different areas of the red meat supply chain;
- Current adoption challenges, potential solutions to help overcome these, and future prospects of the data and technology use; and
- Examples of how organisations in industry have approached implementation to date and lessons learned.

The objectives of this engagement have been successfully achieved. Three business cases were developed that demonstrate the benefits of data usage for various stakeholders in the Australian red meat industry. Four supporting case studies were also developed that provide real examples of data and technology usage, and the associated benefits, within the industry.

3. Methodology

Desktop research and consultations with relevant stakeholders across the supply chain were conducted to explore:

- The benefits of data usage for organisations of varying sizes, and operating at various points across the supply chain;
- Available technologies and tools;
- Technology adoption conditions and enablers;
- Factors to consider for successful implementation; and
- Examples of how organisations have approached implementation to date, value gained, and lessons learned.

Key industry stakeholder categories across the red meat industry were identified and interviews were then conducted with 22 stakeholders over the course of the project (refer to Table 1, below). The objectives of the interviews were to: first identify and prioritise focus areas for business case and case study development; gather evidence to develop selected business cases and case studies; and collate evidence of industry adoption and application of solution(s), and the resulting benefits and changes. Table 1, below, provides a summary of the interviews conducted.

Table 1: Expert consultations conducted for the project

Interview Category	Number of interviews
Producer/feedlot/finisher	10
Consultant	2
Solution provider	7
Researcher	3

A total of nine potential business case topics were identified from initial consultations. From these, three were prioritised based on the following selection criteria:

- The current level of adoption by industry - this project aimed to target data and technology usage that aren't widely adopted, but that have been adopted by a subset of the industry (i.e., are "proven" to add value);
- Potential impact for industry from increasing the data usage - the higher the impact the better;
- The maturity of the data or technology - it was determined that more mature data or technology is likely to be better accepted by industry, therefore will have a higher chance of adoption;
- Applicability of the business case to different stakeholders across the supply chain - the breadth of stakeholders along the supply chain impacted by the data solution;
- Sector(s) of the red meat industry impacted - beef, lamb, mixed;
- Size of stakeholder it impacts - small, medium or large; and
- Complexity and cost to implement - the lower the cost and complexity of the data solution, the higher the likelihood of widespread adoption.

The final three business case topics that were selected and prioritised in this project were: 1) quality, performance and health data sharing to improve returns across the supply chain; 2) on-farm animal performance and efficiency data to optimise returns; and 3) grazing management, pasture availability and soil quality data to improve performance and sustainability.

4. How to use this report

4.1 Overview and Context

The world is rapidly changing, and so the way the red meat industry does business also needs to evolve. As an industry, we must be agile and willing to take on new challenges if we are to remain profitable and ahead of the game.

There are a number of factors outside of our control, but one thing we can control, is the way we run our businesses. Data and technology are important tools to help, and these need to be embraced if we are to continue to succeed in the increasingly complex future.

Every business in the red meat industry is different, so the business cases provided in this report don't seek to provide a one-size fits all formula for data and technology usage. Instead, they seek to provide guidance- including evidence, examples, and ideas- to help industry get more value out of data already being collected and technologies and tools available today, to ultimately help businesses more easily achieve their individual objectives.

This report contains three business cases that demonstrate the benefits of data usage for various stakeholders in the Australian red meat industry. Included in the Appendix of this report are four supporting case studies that provide real examples of data and technology usage, and the associated benefits, within the industry.

4.2 Tips for navigation

Figure 1 below provides some guidance on how to navigate this report.

Figure 1: How to navigate this report

Step 1

Start by familiarizing yourself with the 3 business case topics

Business Case 1

Quality, performance and health data sharing to improve returns across the supply chain

Business Case 2

On-farm animal performance and efficiency data to optimise returns

Business Case 3

Grazing management, pasture availability and soil quality data to improve performance and sustainability

At the start of each business case, we provide a brief introduction, and highlight who in the supply chain it will impact the most.

We also provide some examples of business objectives it will help you achieve.

Step 2

Jump to the business case you want to know more about

Here you will learn about who is currently doing this and what value they are getting, as well as what data is relevant, and examples of technologies and tools that are potentially able to help.

You will also learn about the benefits of the data and technology usage to the industry as a whole.

Step 3

Consider the adoption challenges, potential solutions, and future prospects

Read about some of the challenges facing industry today, and learn about ideas for how to overcome these barriers. Plus, gain an understanding of emerging technologies and other factors that may change this business case in the future.

Step 4

Read the relevant case studies

Dig in to the case studies for this business case (located in the Appendix), or any of the others, to learn more from leaders in industry who are getting value from using data.

4.3 Considerations while reading

To help you maximise benefits and learnings while reading the business cases and case studies, consider:

1. What business objectives you are trying to achieve?
   - Considering the example business objectives provided for each business case, think about which are a priority for your business
2. What are you currently doing now to achieve these objectives?
   - e.g., what planning do you do, decisions do you make, or tools or data do you currently use?
3. What data is already being collected that could help that isn't currently being used?
   - It could be that you are already collecting this data (e.g., in your farm management system), and/or that data is being collected by someone else at a different point along the supply chain (e.g., by the feedlot, processor, etc.)
4. Are there any gaps in the information or data you currently collect that, if filled, could help you make better decisions?
   - What data would help you more easily make decisions? Can this information be captured using the tools you already have?
5. What areas within your business could be improved using data and tools to make more informed decisions?

5. Business Cases for Data Use in the Red Meat Supply Chain

5.1 Business Case 1: Quality, performance and health data sharing to improve returns across the supply chain

Type of data: Individual animal performance, quality and health data

Industry outcome: to inform strategic breeding and production decisions, thereby enabling greater returns for all stakeholders along the supply chain. Improved quality and consistency across the entire industry will subsequently increase demand for Australian red meat

5.1.1 Business case introduction, impact and objectives

5.1.1.1 Introduction

Producers do not always receive feedback about the performance, quality, compliance and health of their livestock from finishers or processors, therefore there is a big gap in evidence to help with decision making.

Not having a data feedback loop linking the on-farm with the off-farm performance of livestock limits producers' ability to improve their breeding and management decisions, including improving animal health and disease prevention.

Quality, performance and health data already exists and is being captured at various stages of the supply chain (i.e., on-farm, by feedlots and processors); however the full potential of the data is not often being realised because it is not being shared, or not being shared in ways that can easily be integrated on-farm to inform improved breeding and management decisions.

The importance and value of this data at the farm gate is also not always front of mind, therefore the demand for that information is not as high as it would be if the full benefit of that data was truly understood by industry.

5.1.1.2 Industry supply chain and stakeholder impact

Figure 2 below highlights the degree to which individual stakeholders are impacted by this business case.

Figure 2: Business Case 1 Industry Supply Chain and Stakeholder Impact
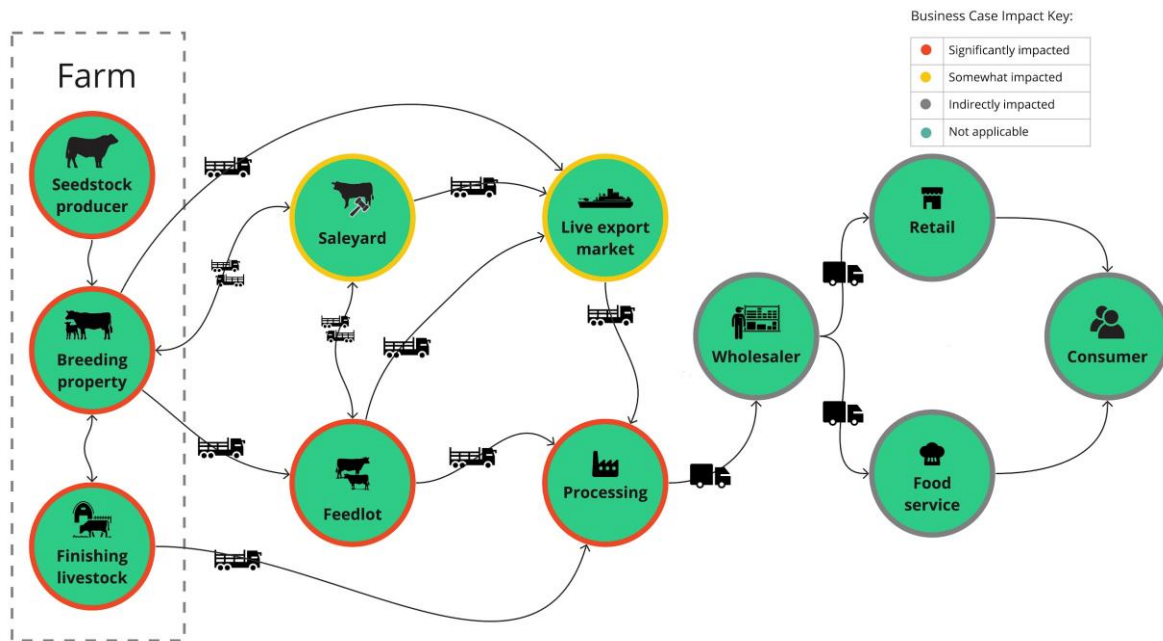
5.1.1.3 Objectives

The overarching industry outcome of this business case is to improve individual animal performance, quality, health and consistency of supply across the entire red meat industry, and consequently increase returns for all stakeholders from increased data sharing and usage.

There are potentially multiple ways individual businesses could achieve this business case outcome. Some specific examples of business objectives for industry stakeholders are provided below in Table 2.

Table 2: Specific examples of business objectives

Data category	Specific examples of business objectives
Performance	Achieving a specific weight for age target for a particular market (e.g., 100 day domestic market)
	Achieving a particular average daily gain (ADG) target on a given feed type
	Breeding livestock that have higher feed conversion efficiency
	Averaging above a certain eye muscle area (EMA) target
Quality	Achieving specific carcase quality attributes to attract a premium. e.g., Lean meat yield (LMY), intramuscular fat (IMF)
	Minimising carcase quality discounts or penalties

Health	Optimising animal welfare by improving animal health, reducing mortalities and minimising animal stress
	Disease prevention in livestock

5.1.2   Current state in the industry

5.1.2.1   Who's currently doing this today?

Based on consultations conducted throughout the project, the following industry stakeholders were identified as being current users of this business case in industry today, including:

- On-farm
  - Large corporate and family pastoral companies with multiple properties that share data across all properties;
  - Producers targeting premium meat labels or markets who sell directly to those markets (e.g., wagyu, grass-fed, organic); and
  - Seedstock producers who request data from commercial breeding clients.
- Off-farm
  - Vertically integrated processors with their own feedlots and/or processing facility

5.1.2.2   What data is relevant?

Examples of the types of data available today, including ways of sourcing the data, that are potentially relevant to this business case are provided in Table 3 below.

Table 3: Examples of potentially relevant data for this business case

Data category	Data source examples	Data examples
Performance	Crushside weighing Walk-over weighing Condition scores Pen feed conversion Abattoir kill sheets Breeding indexes (ASBVs, EBV's)	Birth weight 200 day growth 400 day weight 600 day weight Mature cow weight Eye muscle area (EMA) Average daily gains (ADG's) Feed efficiency Estimated Breeding Values (EBVs) Hot standard carcase weight (HSCW)
Quality	Abattoir MSA and AUS-Meat grading data Breeding indexes (ASBVs, EBV's)	Meat colour Ossification Fat colour Fat depth Lean meat yield Intramuscular fat (IMF) (marbling score) Ultimate pH and loin temperature EBVs

Health	Abattoir animal health, disease and defect assessment data Crushside assessment	Health condition inspection scores

5.1.2.3   What technology solutions are available to help?

Refer to Appendix 1 for examples of technologies available today that are potentially able to help share, consolidate and analyse quality, performance and health data across the supply chain.

5.1.3   Benefits and impact to industry

5.1.3.1   Industry impact of the data usage

The red meat industry will benefit if quality, performance and health data collection, sharing, and usage increases across the red meat industry supply chain, because such data will:

- Improve consistency of quality, and therefore demand, for Australian red meat;
- Provide greater returns for all stakeholders along the supply chain from having better performing, higher quality and healthier livestock; and
- Improve the sustainability of the industry as a whole from having higher performing and more efficient livestock that are also better quality.

Currently, non-compliance with performance, quality, and health specifications costs the Australian red meat industry significantly (refer to Table 4, below). This business case seeks to minimise these costs to industry.

Table 4: Current cost of non-compliance with performance, quality, and health specifications costs to the Australian red meat industry

Category	Current cost to the industry[1]
Performance	- Discounts for out of specification carcases currently cost the beef industry an estimated $51 million per annum
Quality	- Carcase condemns cost the beef industry approximately $64 million per annum - The Australian lamb industry has a potential cost of non-compliance to market specification in an excess of $8.4 million per annum
Health	- Loss of meat and offal value due to animal health and disease currently costs the Australian beef industry an estimated $12 – 49 million per annum, improving animal health will reduce this cost and improve returns - Over $110 million is lost annually on 10 diseases/conditions in sheep, lambs, and goats

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[1] MLA Livestock Data Link https://www.mla.com.au/research-and-development/food-safety/livestock-data-link/#

5.1.3.2 Benefits to producers

Specific benefits from improved visibility over the performance, quality and health of livestock across different levels of the supply chain are shown in Table 5, below. Where possible, a quantitative indication of the potential impact of the benefits is included.

Table 5: Benefits to producers from quality, performance and health data collection, sharing, and usage across the supply chain

Category	Description of benefits	Impact of benefits
Performance	- Allow producers to improve the level of finish (weight and fat cover) on livestock to better meet market specifications - Target different markets more suited to livestock produced - Provide underperforming livestock with additional nutrition (e.g., better pasture, supplement feed) - Cull underperforming livestock - Enable well informed strategic breeding decisions to improve performance and efficiency - Knowledge of better producing properties or paddocks that turn off the best animals	- Make more strategic and faster management and marketing decisions to optimise returns - Consultations with industry indicated that being able to identify your best and worst cattle, based on their off-farm performance and quality data, and making management decisions accordingly, could improve net profit by as much as $100/head, making a difference of over $13,000 per road train for a producer - Longer term contracts, repeat purchases, increased demand for livestock due to proven track record of producing top performing, high quality and healthy animals - Lower feed input costs from having more efficient, higher performing livestock - Reduced dark cutting, penalties, discounts
Quality	- Improved carcase compliance with target grid/market - Ability to target and earn premiums for better quality (e.g., IMF, LMY)	
Health	- Reduce penalties and discounts due to animal health defects - Improved animal health would increase performance and potentially quality - Access to and transparency of food safety, animal welfare and biosecurity data to be audit ready in the event of a Livestock Production Assurance (LPA) audit.	- Improved returns from less health and disease related discounts and penalties - Conversations with industry demonstrated that having access to all of your data in one place can reduce the time required to do an audit by as much as 90% for a producer

5.1.3.3 Benefits to finishers, feedlots and processors

Examples of specific benefits for pasture finishers, feedlots and processors are included in Table 6, below. Where possible, a quantitative indication of the potential impact of the benefits is included.

Table 6: Benefits to finishers, feedlots and processors from quality, performance and health data collection, sharing, and usage across the supply chain

Category	Description of benefits	Impact of benefits
Performance	- Structure pricing grids for suppliers according to performance (e.g., EMA, HSCW, LMY) due to improved transparency of this data with suppliers - Having more consistent supply of more efficient, faster growing and heavier livestock to finish at the right prices	- Improved margins from to having higher volumes of premium meat cuts more in demand by consumers (e.g., rib eye steak) - Higher profit from having higher performing and more efficient livestock that require less feed and achieve desired weights more quickly
Quality	- Improved consistency of the quality of red meat products. This is a particular challenge for red meat versus other proteins. - Structure pricing grids for suppliers according to quality (e.g., LMY, IMF) due to the increased transparency against these metrics for producers	- Increased demand from customers for red meat products due to improved quality and consistency - Improved margins from to having higher quality meat more suited to target markets
Health	- Better performing, healthier animals with lower input costs - Increased flexibility from not having to manage withholding periods - Less supply of unhealthy, diseased meat products that have to be wasted or heavily discounted	- Healthier animals tend to perform better thus resulting in lower input costs (eg., feed) - Reduced handling and health treatment costs - Improved returns from having less waste at the processor due to poor health and disease
Other	- Improved sharing of data on-farm to off-farm and vice versa will provide feedlots and processors with better visibility over the quantity and quality of livestock they will be supplied with so that they can forward plan and risk manage accordingly - Providing valuable feedback to suppliers and custom feeding customers will increase the likelihood of those customers using the feedlot again. This is particularly important when industry flock and herd numbers are down	Supply forward planning, budgeting and risk management to ensure consistent supply of livestock and thus supply of red meat products to consumers

5.1.3.4   Broader and indirect benefits to industry

Examples of additional benefits for the red meat industry include:

- The integrity of the Australian red meat industry will increase if data is better used and shared across different stages of the supply chain, for example because it will provide a more complete and transparent evidence base for industry to communicate with consumers. This will ultimately improve the public perception of the red meat industry, and its social licence to operate, by demonstrating improved efficiency and productivity along with the highest standards of animal welfare;
- There is the potential to link improved lifetime performance and nutrition to higher carcase and eating quality which will only increase the future benefits to industry from this business case;
- Support sustainability and feed efficiency outcomes to ultimately help achieve the Carbon Neutral 2030 (CN30)[2] objective;
- Potential for data to unlock improved financing outcomes for producers. For example, banks might recognise and reward producers for improved productivity and efficiency of their livestock businesses in future; and
- Improved visibility by industry, and related industry and government bodies, over the quantity and quality of livestock available from which to make well informed planning, forecasting and risk management decisions.

5.1.4   Adoption challenges, potential solutions and future prospects

5.1.4.1   Perceived barriers to successful implementation for producers

The following adoption barriers were identified from consultations with industry as potentially limiting the collection, sharing, and usage of off-farm performance, quality and health data for producers:

- The perceived lack of technology solutions (e.g., farm management software; mob or individual animal management software; feedlot software; and abattoir grading data) available to producers to allow their data to be seamlessly and automatically shared and consolidated from different databases;
- Skills, capabilities and willingness of producers within the industry to use the data, exacerbated by the perception that there is no single easy technology solution currently available;
- Currently, data received back from feedlots or abattoirs can be very clunky to integrate with on-farm data, due at least in part to a lack of interoperability and consistency in data formats between different software platforms and databases. For example, data currently needs to be cleaned and sorted to ensure consistency in the formats and categories, and then manually uploaded into and integrated with technology solutions used on-farm;
- The perceived cost and time required to implement the data and technology usage; and
- Concerns around the privacy of data and data ownership. Producers want to feel comfortable that their data is safe and secure, and that they own it. Producers also worry

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[2] Carbon Neutral 2030 (CN30) https://www.mla.com.au/research-and-development/Environment-sustainability/carbon-neutral-2030-rd/cn30/

about any harm that may arise from sharing their data, for example by giving an advantage to another party.

"I usually look at the kill sheet the processor provides, but I don't spend much time analysing it or integrating it with my on-farm record for those animals" - Beef producer

5.1.4.2 Perceived barriers to successful implementation for finishers, feedlots and processors

The following adoption barriers were identified from consultations with industry as potentially limiting the collection, sharing, and usage of data for this business case:

- Lack of willingness to share data due to sensitivity of information being provided;
  - e.g., finishers and feedlots not wanting to compete and pay higher prices for better performing, higher quality livestock, therefore not wanting to share this information, or sharing some information but not all
- The perceived lack of technology solutions able to seamlessly facilitate the easy and timely sharing of data back to producers with no or minimal effort to integrate the data back on-farm;
- The cost, time, and skills required to be able to sort, clean and share the data back to producers in an automated way without the need for any clunky double-handling of the data;
  - e.g., exporting feedlot data from Feedlot 3000, integrating this information with abattoir grading data, and sharing large data files with producers can be challenging, error-prone, and time consuming
- Lack of pressure and demand for data to be shared back to producers and in a format able to be easily digested and integrated with on-farm data - therefore feedlots and processors aren't always sharing it; and
- Livestock are often bought by feedlots from saleyards, therefore not all livestock can be easily traced back to the breeders which presents an added challenge for feedlots.

"Producers don't usually ask for data on how their cattle have performed, so we don't share it" - Beef feedlot manager

5.1.4.3 Insights and potential solutions to help

Based on our consultations with industry, we gained a number of insights potentially able to help the Australian red meat industry overcome adoption challenges.

There are several technology solutions currently available (see Appendix 1), and this number is growing fast. Also, several existing technology companies are looking to add this capability to their software. If the objectives in this business case are relevant to you, but you haven't looked at the landscape of vendors recently, it may be time to "test the waters" and try some of these solutions out to see how they have evolved and whether they can help.

For example, things you could do to make progress include:

1. Start by thinking about what data or information is missing that you need to be able to achieve your business objectives
2. Research some of the technologies currently available to help and consider approaching these and requesting a trial - remember, you don't have to go all in, but rather can start slow and keep it simple

3. Consider approaching the feedlot you supply or processing plant you use to ask for their help in getting the data. Chances are they are already thinking about this problem, too!
4. If you like the look of a tool, or are already using software with similar capabilities, consider approaching the company to ask about their product roadmap. It may be that they are considering new features, or even that you could access a trial or provide feedback to help ensure what they build is fit for purpose.

5.1.4.4   Future prospects and other considerations

Future prospects for this type of data usage are rapidly evolving as technology matures and industry dynamics continue to change. Some specific prospects that may have an impact in the future include:

- Current technology solutions are maturing and quickly adding new features, including improving their ability to assist with automated data cleaning, sharing, and integration across the supply chain;
- The dynamics within the Australian red meat industry are changing and what consumers want is constantly evolving (e.g., transparency from birth to plate, life-cycle assessment, animal welfare concerns, etc.);
  - Currently this data isn't being passed onto consumers in most cases; however, this could change (and soon), meaning that even more pressure for end-to-end transparency will be placed on the industry
  - Having access to so much data is the industry's biggest weapon to help it continue to adapt to these changes in the future. Ironing out the kinks with data sharing and usage now will only help combat future challenges more easily
- Leaders in the Australian red meat industry, such as the large feedlots/grass finishers and processing plants, could potentially help drive this type of data sharing and usage. These companies could look to form partnerships with technology companies, and/or producers on projects to help drive this, and potentially offer incentives for producers to opt into sharing their own on-farm data as well (e.g., through long term contracts or different pricing grids) because this data would help businesses further up the supply chain with their forward planning;
  - A number of large processors, such as JBS and Teys Australia, are already starting to develop their own data sharing portals[3] for sharing livestock health and performance feedback with producers. This will continue to happen, and potentially help with additional data sharing, use and analysis on-farm
- There is also potentially an opportunity for industry bodies to support industry to evaluate existing solutions for data sharing across the supply chain. Additionally, to ensure technology solutions are fit for purpose, there's an opportunity to incentivise collaboration between solution providers and industry (e.g., to co-develop additional features and/or support training and trialling). One way of doing this is ISC could provide access (e.g., via APIs) to their industry data repository, thereby enabling more data sharing and integrations between solution providers, and thus more rapid adoption of these tools by industry.

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[3] Beef Central article "Animal health data next step in advanced producer performance feedback" https://www.beefcentral.com/news/beef-2021/animal-health-data-next-step-in-advanced-producer-performance-feedback/

5.1.5   Case study

Refer to Appendix 2 for a case study showcasing real examples of data and technology usage, and the associated benefits, within the industry relevant to this business case.

5.2 Business Case 2: On-farm animal performance and efficiency data to optimise returns

Type of data: On-farm animal efficiency, performance and health data

Industry outcome: to enable strategic management and targeted marketing decisions to increase returns for producers. Improved data usage in this area will increase livestock production efficiency, quality and integrity, and therefore demand for Australian red meat

5.2.1 Business case introduction, impact and objectives

5.2.1.1 Introduction

Data on individual animal performance, production efficiency, and health is not always captured and monitored on-farm. Most producers currently do some monitoring at the herd or flock level, but most are not doing this at the individual animal level given that data collection and monitoring can be time consuming, costly and complex to implement.

Those that are collecting data on individual animals, have found value because they are facing additional pressures within their businesses, and see collecting and using data as a key solution to help. For example:

- Seedstock producers seeking a premium for superior genetics by achieving high breeding values (EBVs/ASBV's) which are calculated using individual animal data;
- Corporate businesses who have investor pressures for granular data on performance and returns, and therefore need to demonstrate profit optimisation, are more willing to invest in data usage; and
- Businesses with slim margins who either breed and feed their own cattle or buy and finish (livestock traders), therefore have a greater need to use data to help maximise productivity and minimise costs.

These businesses have found that individual animal management (IAM) data has helped them to achieve their business objectives.

The primary focus of this business case is on-farm use of individual animal performance, efficiency and health data, since use of this data is already common practice off-farm (e.g., feedlots, processors).

5.2.1.2 Industry supply chain and stakeholder impact

Figure 3 below highlights the degree to which individual stakeholders are impacted by this business case.

Figure 3: Business Case 2 Industry Supply Chain and Stakeholder Impact
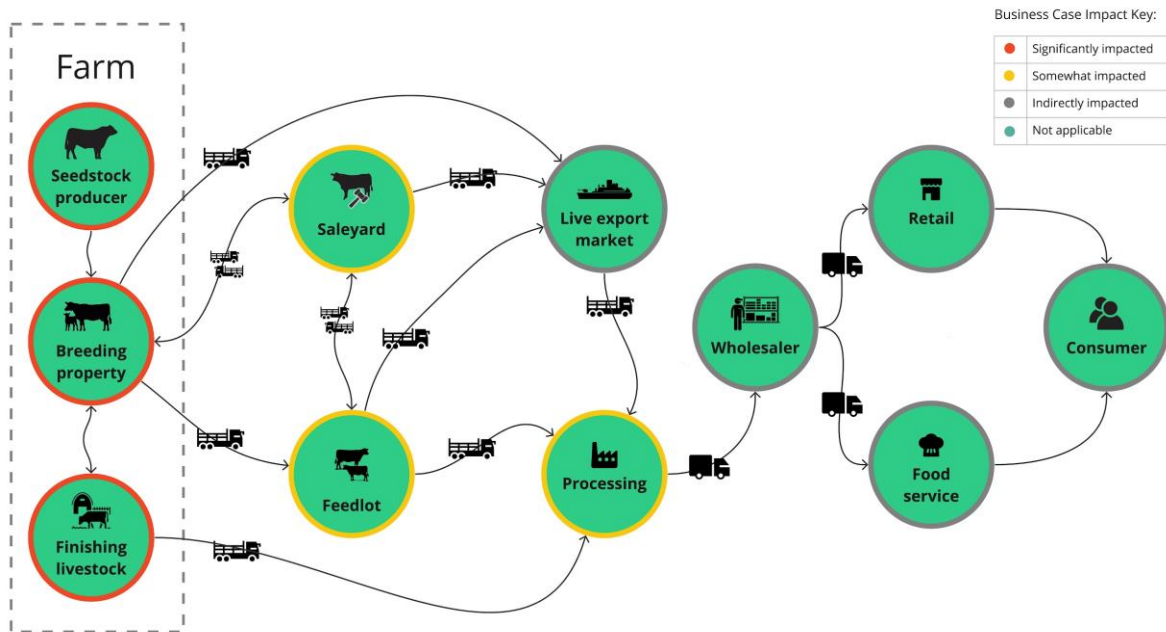
5.2.1.3 Objectives

The overarching industry outcome of this business case is to enable timely, strategic and targeted farm management and marketing decisions to increase returns for producers from having increased visibility over individual animal efficiency, performance and health data.

There are potentially multiple ways individual businesses could achieve this business case outcome. Some specific examples of business objectives for industry stakeholders are provided below in Table 7.

Table 7: Specific examples of business objectives

Data category	Specific examples of business objectives
Animal efficiency	Maximising kilograms weaned per retained breeder joined (e.g., high pregnancy and weaning rates, and culling all unproductive breeders on-farm)
	Breeding livestock that have higher feed conversion efficiency on a given feed type
	Breeding hardy animals with low input costs therefore low costs of production
Performance	Achieving a specific weight for age target for a particular market (e.g., at weaning, finished)
	Achieving a particular average daily gain (ADG) target on a given feed type
Health	Improving animal health from improved monitoring, recording and planning of treatments

	Optimising animal welfare by improving health, minimising mortalities and animal stress
	Improve parasite, pest and disease management to improve efficiency and animal welfare

5.2.2 Current state in the industry

5.2.2.1 Who's currently doing this today?

Based on consultations conducted throughout the project, the following industry stakeholders were identified as being current users of this business case in industry today, including:

- On-farm
    - Seedstock producers who rely heavily on data to make genetic improvements in livestock performance and efficiency, and want to be able to demonstrate this through individual animal breeding values (EBVs/ASBV's);
    - Commercial producers who also have their own studs;
    - Large corporate and family pastoral companies with rigorous reporting requirements who are already using technologies to collect and analyse data to some extent; and
    - Large producers that breed and finish their own cattle, or livestock traders operating on slim margins.
- Off-farm
    - Feedlots use individual animal management software systems to track and monitor performance, efficiency and livestock health; and
    - Processors collect individual carcase performance, quality and health data.

5.2.2.2 What data is relevant?

Examples of the types of data available today, including ways of sourcing the data, that are potentially relevant to this business case are provided in Table 8, below.

Table 8: Examples of potentially relevant data for this business case

Data category	Data source examples	Data examples
Animal efficiency	Pregnancy testing/scanning Ewe/cow production Calving/lambing ease Pasture/feed conversion Ewe/cow udder/milk assessment	Pregnancy rates Singles, twins, triplets Number of birthing difficulties and interventions Mortality rates Feed efficiency Lamb/calf weaned per kilogram of ewe/cow joined
Performance	Crushside weighing Walk-over weighing Condition scores	Birth weight Weaning weight 200 day growth 400 day weight

		600 day weight Mature cow weight Weight gains / average daily gains (ADG's) Estimated Breeding Values (EBVs)
Health	Crushside assessment Worm egg count Animal treatment records	Mortality rates Faecal worm egg counts Flystrike rates Number, timing and type of health treatment

5.2.2.3   What technology solutions are available to help?

Refer to Appendix 3 for examples of technologies available today that are potentially able to help with on-farm animal efficiency, performance and health data capturing and analysis.

5.2.3   Benefits and impact to industry

5.2.3.1   Industry impact of the data usage

The whole red meat industry will benefit if on-farm livestock production was to become more efficient and less wasteful through IAM, using data and technology to help. The purpose of IAM is to maximise production and returns on those better performing animals, while identifying the poorer performing animals or 'passengers' in the mob or flock who can be managed or marketed differently. This is because within a flock or herd there is a substantial variation in livestock performance, efficiency and health.

Collecting and using this individual animal data will therefore:

- Allow for performance, efficiency and health variations within a flock or herd to be identified, so that producers can then apply timely management and marketing decisions specific to that individual to improve its productivity, while reducing costs and labour, and ultimately maximising returns;
- Increase traceability and integrity at the individual animal level, potentially providing greater transparency for consumers in the future, which could therefore possibly increase demand for Australian red meat; and
- Build a foundation of data to allow for IAM data collected off-farm (e.g., at the feedlot/finisher or processor) to be linked back to the animals on-farm records to get a complete picture of its performance over its lifetime and help identify any areas for improvement.

The potential impact of data- and technology-driven decision making by farmers has been identified as being able to significantly benefit the Australian red meat industry.

The Precision to Decision[4] (P2D) report showed that the potential benefit to gross value of production (GVP) could increase by 16% for beef and 17% for lamb if the full value of data and technology was released on-farm.

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[4] The Precision to Decision (P2D) report " Accelerating precision agriculture to decision agriculture – analysis of the economic benefit and strategies for delivery of digital agriculture in" Australia

Specific areas by industry that could benefit from data and technology are shown below in Table 9.

Table 9: Industry areas that could benefit from increased individual animal data and technology use

Industry	Breeding decisions		Feed, landscape and water management		Animal health and disease monitoring		Labour saving	
	Impact %	GVP $mil	Impact %	GVP $mil	Impact %	GVP $mil	Impact %	GVP $mil
Beef	13%	$662	12%	$611	5%	$255	12%	$161
Lamb	13%	$177	12%	$163	10%	$136	12%	$40

5.2.3.2 Benefits to producers

Greater visibility over individual animal performance, efficiency and health on-farm would allow producers to make quicker decisions to change management practices, make more informed breeding and farm management decisions, and capitalise on timely marketing opportunities to maximise returns.

Examples of specific benefits for producers are included in Table 10. Where possible, a quantitative indication of the potential impact of the benefits is included.

Table 10: Benefits to producers from individual animal performance, production efficiency, and health data and technology use on-farm

Category	Description of benefits	Impact of benefits
Animal efficiency	● Knowing which females are the most efficient to be able to make informed culling and strategic breeding decisions accordingly. e.g., know which females get pregnant every year, which ones don't, which females have birthing difficulty, which females produce the highest lamb/calf weaned per kilogram of ewe/cow joined ● Which livestock are the most feed efficient because they gain more weight off the same amount of feed than others	● Increased kg's weaned per breeder per annum ● Increased kg of beef/lamb produced pe ha per annum ● Pen/paddock feed efficiency (kg's gained per amount of feed given)
Performance	● Knowing whether or not livestock are still putting on weight in the paddock to inform decisions around if they are ready to be sold or not, and/or if supplement feeding or a shift to a fresh paddock is required ● Monitoring individual female weights to ensure that they are a suitable weight to get pregnant again	● Increases in kg of beef/lamb produced pe ha per annum ● Cost of production per kg savings (% improvements)

https://www.crdc.com.au/sites/default/files/P2D%20Ecomomic%20impact%20of%20digital%20ag%20-%20AFI%20Final%20Report.pdf

Health	● Minimising drench resistance to optimise sheep worm control through strategic treatment planning ● Reducing mortalities and their associated cost from increased visibility over animal health and performance to be able to plan timely treatments where necessary	● Decreased cost of production due to improved animal health ● Decreased mortalities, improved survival rates

In addition to the livestock performance, efficiency and health benefits outlined above, there are a number of other benefits that a producer could unlock as a result of using data and technology to improve production efficiency, including:

- Potential labour savings from automation and reduced time spent to check and handle the livestock. eg., from having remote sensing / data collection technologies in operation;
- Streamline automatic digital data collection and reporting to meet internal reporting and compliance requirements;
- Help with forward planning and budgeting by having accurate and easily accessible information on exactly what you have out in the paddock. This information also provides on-farm communication efficiencies; and
- Being 'audit ready' by having immediate access to food safety, animal welfare and biosecurity data to be in the event of a Livestock Production Assurance (LPA) audit. Conversations with industry demonstrated that having access to all of your data in one place can reduce the time required to do an audit by as much as 90% for a producer.

5.2.3.3   Broader and indirect benefits to industry

The broader red meat industry does not benefit directly from on-farm individual animal performance, efficiency and health management, however, there are some indirect benefits, including:

- Production and supply of more efficiently produced and less wasteful livestock by producers will improve the industry's social licence to operate, and potentially increase demand for Australian red meat;
  - The red meat industry would be less wasteful and emit fewer emissions from livestock consuming fewer resources due to: lower mortality rates; and increased maternal and feed efficiency
- By building the foundation of IAM data at the on-farm level, this will potentially unlock greater benefits for the whole supply chain in the future. Having this IAM data collected on-farm, will allow for data collected off-farm (e.g., at the feedlot/finisher or processor) to be linked back to the animals on-farm records to get a complete picture of its performance over its lifetime. This will ultimately help industry identify any areas for improvement (refer to Business Case 1 for more details);
  - For example, there is some potential to link improved on-farm lifetime weight gain to better carcase and eating quality which would improve the quality of red meat products for the end consumers, therefore benefiting processors significantly from improved on-farm nutrition.

5.2.4   Adoption challenges, potential solutions and future prospects

5.2.4.1   Perceived barriers to successful implementation for producers

The following adoption barriers were identified from consultations with industry as potentially limiting the collection and use of on-farm individual animal performance, efficiency, and health data for producers:

- The perceived cost and time required to adopt relevant technologies particularly for commercial producers that don't face additional pressures (e.g., investor pressures, slim margins, the need for individual animal breeding statistics) as described earlier- for those that don't face these added pressures, the cost of IAM tools (software and/or hardware, plus ongoing labour costs) compared to the potential benefits do not always stack up;
- A gap in skills, capabilities and/or willingness to do things differently with the help of technology, for example due to a reliance on intuition to inform decision making in the past;
- Difficulty in making better decisions based on the collected data due to either a lack of skills or knowledge in how to interpret the data, or a lack of incentive to do the extra work;
- Some technologies in the past have not been able to assist producers to turn data into meaningful action, due to a lack of maturity, functionality and/or compatibility issues; and
- On-farm connectivity issues have been a significant barrier to adoption in the past.

"It's just too time consuming, difficult and costly to collect data on and individually manage my entire flock" - Sheep producer

5.2.4.2   Insights and potential solutions to help

Based on our consultations with industry, we gained a number of insights potentially able to help the Australian red meat industry overcome these adoption challenges.

There are several progressive businesses in the red meat industry who are already heavily using data and technology to drive IAM to maximise productivity and therefore profitability. These businesses (e.g., large corporates, finishers, seedstock producers) typically face additional pressures (e.g., investor pressures, slim margins, breeding statistics), and are often held tightly accountable to achieving their individual business objectives. Therefore, they see collecting and using data as a key solution. To help them improve and more easily achieve their goals, for these businesses, using data and technology was a no-brainer in most instances.

However, when some of these businesses initially looked at using data or new technologies, they found the prospect to be very daunting because it was so different to the way things always used to be done. To overcome this challenge, they started small and increased their data and technology usage slowly at first, and then more rapidly as they became more confident.

For producers who do not face the same pressures and drivers, there may be less to gain from this business case at present, or at least until technology becomes more affordable and IAM data easier to obtain and link to large numbers of individual animals (e.g., facial recognition technology). However, IAM may still have some utility in achieving individual business objectives and unlocking value today, as well as setting producers up for additional success and value in the future.

For example, some commercial producers are seeing value in moving from mob or flock-level data collection toward IAM in small steps. They may begin by just measuring some aspects of individual performance within a flock or herd (e.g., monitoring current and historical pregnancy status to improve maternal efficiency, animal treatments).

Further, there are strong indications that having a baseline of IAM data may underpin access to other benefits (e.g., traceability and premiums). Traceability and integrity at the individual animal level could ultimately provide greater transparency for consumers, which could therefore increase demand for Australian red meat.

5.2.4.3   Future prospects and other considerations

Future prospects for this type of data usage are rapidly evolving as technology matures and new technologies enter the market. Some specific prospects that may have an impact in the future include:

- Current technology solutions (e.g., individual animal management tools) are constantly getting smarter and adding more features so they are increasing in their ability help producers make better decisions, more easily/intuitively;
- Moreover, new technologies are entering the market all the time that are making the collection of data a lot easier and more affordable, including removing or reducing the need to bring livestock into the yards (e.g., walk-over weighing, facial recognition technology, sensors, cameras, etc.);
- The dynamics of the Australian red meat industry is changing rapidly and what consumers want is constantly evolving (e.g., transparency from birth to plate, life-cycle assessment, animal welfare concerns, etc.). Therefore, the need for rigorous individual animal data on-farm may become even more important in future- both to underpin social license claims, as well as to unlock possible new premiums or market access opportunities;
- IAM data collected off-farm (e.g., at the feedlot/finisher or processor) will be able to be linked back to the animals on-farm records to get a complete picture of its performance and any areas for improvement which will only increase the value proposition from such data usage; and
- Producers who operate their farming operations more efficiently, through on-farm IAM, may be able to unlock improved bank financing, insurance or additional premiums for their products in the future.

5.2.5 Case studies

Refer to Appendix 4 and Appendix 5 for two case studies showcasing real examples of data and technology usage, and the associated benefits, within the industry relevant to this business case.

5.3 Business Case 3: Grazing management, pasture availability and soil quality data to improve performance and sustainability

Type of data: Grazing management, pasture availability, and soil quality

Industry outcome: to improve on-farm performance and environmental sustainability, and unlock rewards for on-farm environmental stewardship. This will also improve consumer perceptions of animal production systems and increase demand for Australian red meat

5.3.1 Business case introduction, impact and objectives

5.3.1.1 Introduction

Grazing management, pasture availability and soil quality data can be used to improve on-farm profitability and environmental sustainability, while also capturing on-farm data to measure, improve and help unlock additional rewards for environmental stewardship (e.g., ecosystem service payments, premiums, market access).

The Australian red meat industry has set a target to be carbon neutral by 2030[5] (CN30). This means that by 2030, the industry aims to make no net release of greenhouse gas (GHG) emissions into the atmosphere. To help achieve this vision, and underpin claims, on-farm grazing management, pasture and soil quality data must be collected.

A number of red meat producers are already measuring and being rewarded for sustainably grazing their pastures, and making decisions based on data about pasture availability and quality; however, overgrazing does still occur, presenting a risk for individual producers and the industry as a whole.

Collecting and utilising grazing, pasture availability and soil quality data has the ability to unlock significant value for the red meat industry from increasing productivity, as well as unlocking alternative sources of revenue for producers from more sustainable grazing practices.

5.3.1.2 Industry supply chain and stakeholder impact

Figure 4 below highlights the degree to which individual stakeholders are impacted by this business case.

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[5] Carbon Neutral 2030 (CN30) https://www.mla.com.au/research-and-development/Environment-sustainability/carbon-neutral-2030-rd/cn30/

Figure 4: Business Case 3 Industry Supply Chain and Stakeholder Impact
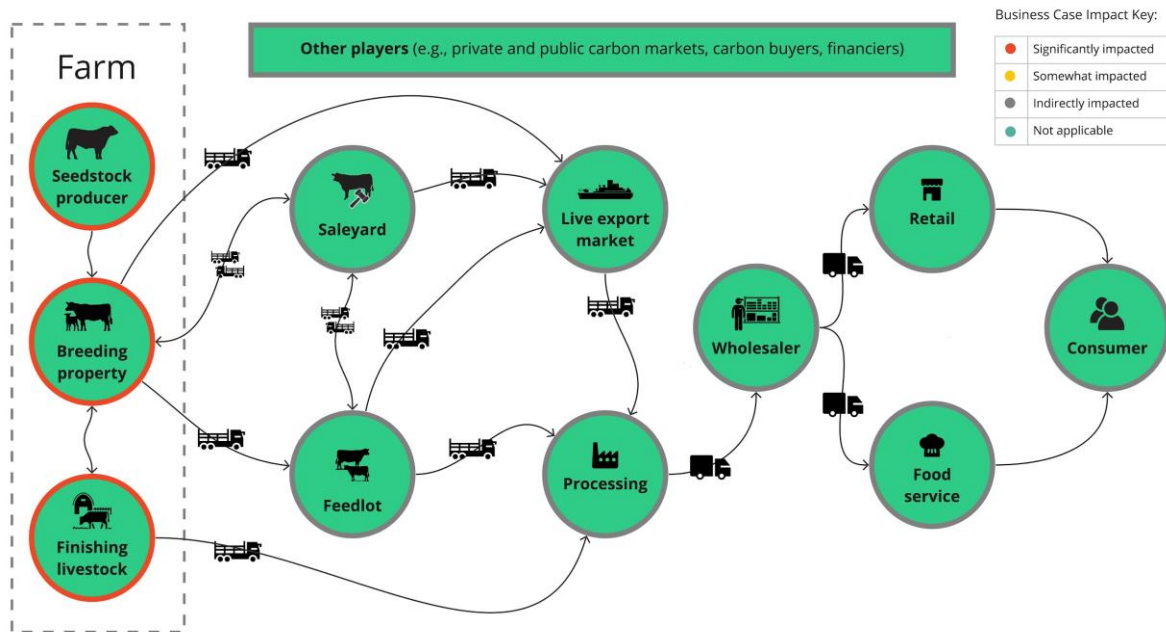
5.3.1.3   Objectives

The overarching industry outcome of this business case is to improve on-farm performance and environmental sustainability, and unlock rewards for on-farm environmental stewardship from improving grazing management and soil quality.

There are potentially multiple ways individual businesses could achieve this business case outcome. Some specific examples of business objectives for industry stakeholders are provided below in Table 11.

Table 11: Specific examples of business objectives

Data category	Specific examples of business objectives
Grazing management	Increase pasture yield and livestock performance by optimising stocking rates
	Increase carbon sequestration through improved grazing management
Pasture availability	Improve yield, quality and biodiversity of pastures to increase returns
	Optimise livestock movement and marketing decisions from more accurately knowing the quantity and quality of feed on offer (FOO)
Soil quality	Increase soil carbon levels
	Improve soil organic matter (OM); pH; nitrogen, phosphorus and potassium (NPK); and salinity

	Enhance soil moisture content and water holding capacity by increasing root depth, nodule formation, and the presence of earthworms

5.3.2 Current state in the industry

5.3.2.1 Who's currently doing this today with the help of technology?

Based on consultations conducted throughout the project, the following industry stakeholders were identified as being current users of this business case in industry today, including:

- On-farm
  - Large corporate and family pastoral companies with rigorous reporting requirements who are already using technologies to collect and analyse data to some extent;
  - Graziers targeting premium meat labels and markets who sell direct to customer (e.g., premium grass-fed, organic, carbon neutral); and
  - Producers who follow holistic, prescribed, cell or rotational grazing management practices.

5.3.2.2 What data is relevant?

Examples of the types of data available today, including ways of sourcing the data, that are potentially relevant to this business case are provided in Table 12.

Table 12: Examples of potentially relevant data for this business case

Data category	Data source examples	Data examples
Grazing management	Stocking rates Pasture utilisation assessments Feed budgeting	Animal production, i.e. total beef/lamb kg's produced. Grazing utilisation % (average removal per graze) Dry sheep equivalent (DSE) (DSE days/ha/100mm) Rainfall (mm) Grazing charts Ground cover %
Pasture availability	Measuring food on offer (FOO) using quadrats Remote sensing pasture availability and groundcover Visual assessment of pasture and ground cover Carrying capacity. Pasture assessment technologies such as hand-held yield devices	Pasture yield per paddock/ha Dry matter per hectare (kg DM/ha) or FOO Pasture species diversity % Ground cover %
Soil quality	Soil testing Soil moisture probes Remote sensing of soil quality	Soil carbon Soil OM; pH; NPK; Cation exchange capacity (CEC)

		electrical conductivity (EC) (salinity) Phosphorus buffering index (PBI)

5.3.2.3 What technology solutions are available to help?

Refer to Appendix 6 for examples of technologies available today that are potentially able to help with collecting and using grazing management, pasture availability, and soil quality data.

5.3.3 Benefits and impact to industry

5.3.3.1 Industry impact of the data usage

The entire red meat industry will benefit from improved use of grazing management, pasture availability and soil quality data. This is because such data usage will:

● Improve on-farm animal and pasture performance, soil quality, drought resilience, and environmental sustainability;
● Unlock new rewards and incentives for industry for on-farm environmental stewardship (e.g., carbon credits, product premiums);
● Reduce methane emissions per hectare because good quality pasture management makes livestock production systems more efficient;
● Reduce input costs from not overgrazing and degrading the pastures (e.g., reduced input costs such as fertilisers, supplement livestock feeding); and
● Enabling industry to provide evidence to underpin claims about improvements made in sustainable grazing management practices to consumers, thus improving consumer perceptions of animal production systems, and consequently increasing demand for Australian red meat.

Overgrazing has often been identified as a cause of environmental degradation, with livestock producers typically stocking pastures at rates higher than recommended. A grazier could risk forgoing production costs of $127/hectare by overgrazing a paddock and take up to 33 months to recover just two thirds of its original carrying capacity.[6]

5.3.3.2 Benefits to producers

Examples of specific benefits for producers from improved use of grazing management, pasture availability and soil quality data are included in Table 13. Where possible, a quantitative indication of the potential impact of the benefits is included.

Table 13: Benefits to producers from improved use of grazing management, pasture availability and soil quality data

Category	Description of benefits	Impact of benefits
Grazing management	● Optimised stocking rates and pasture utilisation will stimulate pasture growth and consequently increase pasture	● Improvements in kg's gained by livestock and revenue % increases being achieved as a result

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[6] MaiGrazing article "MaiaGrazing field day gives producers insight into cost of overgrazing" https://www.theland.com.au/story/5924236/true-cost-of-overgrazing-revealed/?cs=4941

	yield and subsequently livestock weight gain ● Providing livestock with higher quality and consistent nutrition throughout their lifetime has also been shown to potentially increase meat quality ● Increases in soil organic carbon content from improved pasture productivity	● Increases in livestock carrying capacity as a result ● Improved drought resilience from improved pasture management and optimised stocking rates ● Lower input costs from not having to rely so much on supplement feeding ● Increases in pasture biodiversity % ● Increases in soil organic carbon % ● Potentially improved quality of red meat products from better nutrition ● Reduce methane emissions per hectare from improved grazing efficiency
Pasture availability	● Increased pasture quality and yields will increase returns for producers through either increasing production of fodder to be sold, or increasing livestock weights ● Allow producers to make more timely management and marketing decisions from having greater visibility over the quantity and quality of pasture available. ● Forward planning of feed availability and feed budgeting based on pasture assessment data to make quicker decisions to supplement feed or to sell livestock if pasture availability is too low	● Improvements in production volume/kg's of grass produced per ha ● Improved farm drought resilience from increased volume of pasture and ground cover ● Reduce supplementary feeding costs from increasing the supply and quality of pasture grown ● Decrease overgrazing and land degradation, while ensure livestock performance isn't impacted, thus improving returns
Soil quality	● Ability to set a current soil quality baseline, and make improvements ● Increase carbon sequestration for which producers could seek alternative rewards or incentives from improving soil carbon levels	● Soil carbon level increases ● Soil water holding capacity improvements (moisture content) ● Sell carbon credits within regulated (e.g., Emission Reduction Fund) or private carbon markets ● Receive a premium for red meat products by targeting premium labels and markets (e.g., carbon neutral, sustainable labels) ○ Demonstrate compliance with industry and private sector certification schemes ● Improve farm drought resilience from increased soil moisture and soil quality

5.3.3.3   Broader and indirect benefits to industry

While the broader red meat industry does not benefit directly from more sustainable grazing management practices and improvements made to soil quality, there are strong indirect benefits including:

- Having access to grazing, pasture and soil quality data will allow industry to demonstrate more efficient production of red meat products thus improving the industries social licence to operate. e.g., increased carbon sequestration, reduced methane emissions etc;
  - Supply of more sustainably produced livestock will also increase public perceptions of red meat production and consequently demand for Australian red meat will increase
- Potentially higher quality meat will be produced from improved pasture availability and animal nutrition throughout an animal's lifetime;
- More reliable year-round supply of livestock from more consistent, and increased pasture production and improvements in drought and bushfire resilience; and
- Most importantly, widespread use of grazing management, pasture and soil quality data and technology will improve sustainable grazing and production efficiencies, and therefore fast track the Australian red meat industry to achieve its CN30 goal.

5.3.4 Adoption challenges, potential solutions and future prospects

5.3.4.1 Perceived barriers to successful implementation for producers

The following adoption barriers were identified from consultations with industry as potentially limiting the collection and use of grazing management, pasture availability and soil quality data for producers:

- The perceived cost and time required to collect and analyse grazing management, pasture availability and soil quality data, relative to the perceived benefits (e.g., some types of soil sampling and testing can cost a lot of money which can be hard to do when the benefit isn't clear or immediate);
- The amount of time it can take to make improvements. It can take a number of years to make significant improvements in pasture and soil quality which can be challenging when there is also the potential for some short term losses in productivity, and therefore returns for producers. For example, in some instances paddocks may need to be spelled to recover pasture ground cover, or not grazed as hard as they were previously, which could negatively impact profitability in the short term from having lower stocking rates;
- The level of effort required, and difficulty involved with, unlocking additional incentives such as ecosystem services market payments and meat label premiums. For example, Wilmot Cattle Company[7] recently made headlines because they were able to secure $500,000 worth of carbon credits in a private sale to Microsoft. This required a significant amount of time, resources and planning over a number of years to achieve;
- Validating the accuracy and building confidence in the technology used to collect the data. Given the relatively short period of time that these technologies have been available (e.g., remote sensing of pasture availability and groundcover) it is understandable that there is some hesitation about using these technologies, because they are relatively unproven still. Moreover, there are so many new technologies and these are constantly evolving, therefore there is a significant amount of confusion in selecting the best technologies to use; and

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[7] Wilmot Cattle Company article "Aus cattle company makes global carbon credit sale to Microsoft" https://www.beefcentral.com/news/aus-cattle-company-makes-global-carbon-credit-sale-to-microsoft/

- Making changes to traditional grazing strategies and management practices that have been around for a long time can be very hard. e.g., visual assessment of pasture availability and quality, and continuous grazing management.
  - A lot of farmers do pasture estimation by eye. Consultations have identified that this can often overestimate pasture supply and quality due to the difficulty in assessing variability across the paddock. A key challenge will be helping producers to see that using data from a technology solution to assess pasture availability and quality, will most likely provide more accurate information to be able to help improve grazing management, and consequently achieve greater yields and higher livestock weights.

"We've always continuously grazed at set stocking rates, and assessed feed availability by eye and its worked for us" - Beef producer

5.3.4.2 Insights and potential solutions to help

Based on our consultations with industry, we gained a number of insights potentially able to help the Australian red meat industry overcome these adoption challenges, including:

- Set out today to use grazing management, pasture availability and soil quality data to help you achieve your business objectives more easily. At the end of the day, we're in the business of growing more grass in the red meat industry, and as this business case demonstrates, there is value today in using this data to help. So to start:
  1. Pick your objectives, make a plan, and start slow
  2. Be patient and check on your progress using the data to help, and re-evaluate over time
  3. You don't have to go it alone either, seek advice. There are training groups (e.g., Profitable Grazing Systems[8] program), and even some vendors who provide support or courses, so reach out if you need help
- Make sure you set a baseline for where you currently are, so that you can see how you're tracking and measure improvement overtime. Having the data can help to achieve gains in the near term (page 32-33), and in the future it may unlock additional incentives (e.g., market access, premiums, ecosystem services payments). The landscape of options for participating in additional incentive programs is rapidly evolving, but it is not without its risks and challenges, and participating in the near term may not be possible or viable for everyone. However, having a baseline, and being able to demonstrate improvements over time, may make it easier and more rewarding to participate.

5.3.4.3 Future prospects and other considerations

This business case for data usage is fast increasing in its importance to industry as technology matures and the societal pressures to improve the efficiency and sustainability of livestock farming increases. Some specific prospects that may have an impact on grazing management, pasture availability and soil quality data use in future include:

- Natural capital accounting tools and frameworks, and ecosystem services markets, are rapidly evolving and hold the potential to unlock additional rewards for producers. Therefore, the value proposition to collect the data, and implement sustainable grazing

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[8] Profitable Grazing Systems program https://www.mla.com.au/extension-training-and-tools/profitable-grazing-systems/

management practices and make improvements in soil quality, will only increase in the future. Examples of this could include:

- ○ Rural property valuations based on pasture and soil quality, and biodiversity
- ○ Banks offering incentives (e.g., lower interest rates) for sustainable grazing management

- Regulated and private carbon markets will also become more affordable and easier to participate in over time as technology evolves and decreases in cost, and as industry standards mature;
- It will likely become easier to get premiums for more sustainably produced red meat products in future. e.g., the major supermarket chains may drive demand for carbon neutral products in future or similar; and
- Pressures on other supply chain participants, such as brands, processors, investors, and input companies, to shift toward more sustainable and climate resilient production are rapidly increasing. This pressure is driving new business models and incentive programs that may lower barriers to entry for producers to participate in ecosystem services markets, premium programs, etc. and unlock rewards.

5.3.5 Case study

Refer to Appendix 7 for a case study showcasing real examples of data and technology usage, and the associated benefits, within the industry relevant to this business case.

6. Appendix

6.1 Appendix 1 - Business Case 1: Technology Solution Examples

Business Case 1: Quality, performance and health data sharing to improve returns across the supply chain

The following table provides examples of technologies available today that are potentially able to help share, consolidate and analyse quality, performance and health data across the supply chain. (Note: this is not an exhaustive list).

Technology solution examples	Description	Performance	Quality	Health
MLA Livestock data link (LDL)	LDL is an online program that enables the timely sharing of carcase and animal disease information between processors and their producers with the aim of optimising supply chain performance.	✘	✔	✔
Black Box Co	Provides a platform that collects, refines and disseminates raw data, end to end, across the whole supply chain and feeds back to empower producers to make more informed genetic, productivity and ultimately more profitable decisions	✔	✔	✔
AgriWebb	AgriWebb creates easy to use farm management software covering all enterprises. Help farmers simplify their farm record keeping, solve their audit and accreditation needs and increase the productivity of their farm	✔	✔	✔
Lumachain	Delivers a comprehensive end-to-end solution for food supply chains. This incentivises farmers and processors to create high-quality, ethically-produced products from farm to fork, and enables enterprises to increase efficiency and safety while growing revenues and margins	?	✔	✔
AXIchain	An easy-to-use digital solution to move your livestock from farm to producer and/or processor.	?	✔	✔
Phoenix Livestock	If you are looking for a product that will give you detailed weight gain performance analysis across individual animals or mobs that is compatible with all electronic weighing and RFID devices - Phoenix Livestock has extensive record management and reporting systems.	✔	✔	?

Aglive	Aglive has a livestock traceability system that provides evidence-based tracking and authentication enabled technology, allowing food to be tracked along its journey through the food production supply chain. A	✔	✔	✔

6.2 Appendix 2 - Business Case 1: Case Study

Business Case 1: Quality, performance and health data sharing to improve returns across the supply chain

Case Study 1: MDH Pty Ltd

About:
MDH Pty Ltd
Cloncurry, QLD
Operation type: Cattle producers and feedlot
Area: 3.5 million hectares across 14 properties
Stock: 140,000 cattle
Rainfall: 350-1000 mm

MDH Pty Ltd[9] (MDH) is one of Australia's largest beef cattle operations, owned and operated by the McDonald family who represent 6 generations of beef producers and 190 years of experience in Australian agriculture.

MDH is a large vertically integrated beef cattle business, with operations spanning breeding, backgrounding, and feedlotting. With a wide geographical spread of country in Australia's vast Queensland outback, MDH runs 140,000 head of cattle across 14 properties, encompassing an irrigated farm and the company owned "Wallumba" feedlot on the Western Darling Downs.

Improving the bottom line through smart decision making

The key business driver for MDH is optimising livestock performance through strategic management and marketing decisions, to get the best possible returns for their cattle. In particular, MDH strives to produce productive and efficient cattle able to achieve a good weight for age and level of finish for their target market with the least inputs. MDH also aims to minimise carcase discounts by sending quality, healthy, and finished cattle to processors.

Being such a large, diverse and complex business with multiple properties, it is a major challenge for MDH to know which cattle are best suited to a particular market. For example, are cattle from a particular property better off being sent to the feedlot destined for the 100-day domestic market; or would they do better if they were background fed or grass-finished at another property? Other options include sending the cattle to the saleyards, selling through an agent to another property, or to the live export market.

Turning an abundance of data into good decisions

Like most Australian red meat businesses, MDH were struggling to derive full use from the data being collected from their backgrounding properties, feedlot operation, along with carcase feedback

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[9] MDH Pty Ltd https://www.mdh.net.au/

provided by processors. They knew that they needed to better interpret the data being collected in their decision making to help meet MDH's business objectives. This often meant that MDH weren't getting the best possible returns for their cattle, particularly given the high input costs and at times slim margins from breeding, backgrounding and feeding cattle. As a result, MDH were always on the lookout for a practical solution to help ingest all the raw data they had from their backgrounding properties, feedlot and processor, and quickly turn it into key insights they could use to make more informed decisions.

Julie McDonald, MDH CFO, was fortunate enough to meet the founders of the agtech startup company Black Box Co[10], Shannon Speight and Emma Black, through the Zanda McDonald Award[11] program. It was through this chance meeting, and a shared belief in what Black Box Co were working to achieve with their solution, that MDH became an early stage industry partner. At this point, Black Box Co were still in the early stages of developing a software product for the beef industry that would take raw individual animal data and turn it into decision making dashboards across the supply chain. To MDH's knowledge, no other tool was able to help them with their problem at the time, so they jumped at the opportunity to trial this technology.

Starting simple & slow, and getting it right over time

MDH began by trialling the software to assess how their cattle performed on the feedlot and at the processor, to help inform future breeding and management decisions. They did this by first using Black Box Co to link individual animal feedlot performance, with the carcase and health data collected by the processor, to identify top and bottom performing animals, including trends and differences in overall performance between properties, different regions and breeds. This was an easy place for MDH to start, given the feedlot was already a heavy user of individual animal data through the Feedlot 3000 software program, which tracks livestock weight gain, efficiency, and animal health from induction to when they are sent to the processor. This ultimately provided MDH with a comprehensive view of livestock performance, quality, and health from when cattle are first weighed and put on feed at the feedlot after they arrive from their property of origin, how they perform on the feedlot, and at the processor.

The implementation of Black Box Co was relatively straightforward, involving a simple drag and drop of digital data files from the Feedlot 3000 software program and abattoir carcase data kill sheets into the Black Box Co software. Other factors behind the successful roll-out of the new software included: MDH spending the time to onboard staff to align them with the vision; trialling the new software with only a few select farm managers initially; and providing staff with the support of a single person overseeing implementation.

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[10] Black Box Co https://www.blackboxco.com.au/

[11] Zanda McDonald Award https://www.pppgroup.org/

Early benefits with significant future upside

Even though the software has only been trialled for a relatively short time, and it is not yet fully implemented at the breeding and backgrounding property level, MDH have already started realising a number of benefits from improved data sharing and usage across the business. Using the Black Box Co Feedlot and Carcase dashboards, MDH have been able to identify trends resulting in carcase discounts, allowing them to look into why discounts were occurring, make changes, and ultimately receive fewer penalties. In some instances, it was an easy fix such as identifying bruising and pH discounts due to handling challenges or heat stress close to the trucking date; in other cases, the discounts may have been linked to genetics.

MDH have also been able to identify opportunities to send livestock to markets other than the feedlot based on livestock historical performance, quality, and health data. By asking the software a series of questions, MDH have been able to determine on a number of occasions if the feedlot is the best place for particular cattle given their stock type, sex, property of origin, or breed by looking at the historical performance, feed efficiency and health of those animals. Considering ration cost and $/kg of hot standard carcase weight (HSCW) on offer, MDH have been able to make objective decisions as to what is the best market for particular livestock. MDH have experienced a difference of up to $100/head in net profit between the options available at present, making a difference of over $13,000 in just one road train.

In the future, MDH also hopes to incorporate the Black Box Co software at the breeding and backgrounding property level, by leveraging individual animal data captured on-farm using Sapien Technology[12]. While this is still a little way off for a number of reasons, given the benefits they have already started getting so far, MDH are fully invested in continuing to improve data sharing and usage across the business to make more profitable decisions in the future.

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[12] Sapien Technology https://www.sapien.com.au/

6.3 Appendix 3 - Business Case 2: Technology Solution Examples

Business Case 2: On-farm animal performance and efficiency data to optimise returns

The following table provides examples of technologies available today that are potentially able to help with on-farm animal efficiency, performance and health data capturing and analysis. (Note: this is not an exhaustive list).

Technology solution examples	Description	Animal Efficiency	Performance	Health
Sapien Technology	Sapien Technology is a trusted technology partner providing individual animal management software and hardware solutions across the supply chain	✔	✔	✔
OptiWeigh	Optiweigh is a portable in-paddock weighing solution that takes advantage of the excellent relationship between front feet weight and whole body weight	?	✔	✘
AgriWebb	AgriWebb creates easy to use farm management software covering all enterprises. Help farmers simplify their farm record keeping, solve their audit and accreditation needs and increase the productivity of their farm	✔	✔	✔
Stockbook	Stockbook livestock management software offers improved profitability through livestock intelligence	?	✔	✔
AgriNet	AgriNet HerdApp, is a phone app that allows you to manage your compliance quickly and and improve livestock profitability	✔	✔	✔
Vytelle	Vytelle is a precision livestock company reshaping how cattle producers worldwide optimise their herds. Through Vytelle's integrated technology platform, generations of genetic gains can be made quickly	✔	✔	?
Tru-Test	Livestock Management Software. Make better decisions around feed, treatment and selling	✔	✔	✘
Ceres tag	Ceres Tag is a patent pending low cost, high retention, National Livestock Identification System compatible, smart ear tag for livestock that provides geo location, health management, performance measurement	✔	✔	✔

Gallagher	Weigh Scale and Data Collectors and includes a fully integrated EID reader. In addition, the TWR-5 supports the simultaneous recording of up to 9 traits and life data recording.	✔	✔	✘
Smart Shepherd	SmartShepherd is a system designed for sheep farming which tracks the maternal pedigree of lambs. This information is then used to generate breeding advice for farmers who can then start to make progress with traditionally difficult maternal issues.	✔	✔	✔
Genesmith	Applying the power of machine learning to the livestock industry. Matching lambs and ewes, in the paddock at a commercial scale.	✔	✔	✔
Techion	Intelligent digital microscope providing point of care in real time for animals, humans and the environment.	✘	?	✔
Agscent	Imagine if preg testing cows was non-invasive, efficient, accurate and affordable. Agscent's ground-breaking breath sensing technology is working to achieve just that.	✔	?	?
Smart Paddock	A small, lightweight, multi-sensor eartag designed to last the lifetime of the animal. Track heartrate, temperature, location, and movement	✔	?	✔
Agersens (eShepherd)	Agersens' "eShepherd" - the world's first virtual shepherd to enable farmers to fence, move and monitor their livestock using their smartphone	?	?	✔
Mobble	From animal records to paddock treatments, Mobble has all the features you need to manage your farm effortlessly.	✔	✘	✔

6.4 Appendix 4 - Business Case 2: Case Study

Business Case 2: On-farm animal performance and efficiency data to optimise returns

Case Study 2: Paraway Pastoral Company Limited

About:
Paraway Pastoral Company Limited (Paraway)
Operating: across Australia
Operation type: sheep, cattle, and a mix of dryland and irrigated cropping
Area: combined land holding of over 4.4 million hectares
Stock: capacity for 220,000 cattle and 250,000 sheep
Rainfall: varies by property

Paraway Pastoral Company Limited[13] (Paraway) is one of the largest agricultural property owners and operators in Australia, with land holdings of over 4.4 million hectares. Paraway owns and operates 35 properties which have been aggregated into 27 pastoral businesses with capacity for over 22,000 cattle and 250,000 sheep as well as dryland and irrigated cropping.

Livestock operations at Paraway include beef breeding, backgrounding, and finishing, the Pooginook Merino stud, and dual-purpose sheep breeding and growing enterprises, producing over 30 million kg of beef and 1.46 million kg of wool per year, and selling 170,000 sheep to processors and restockers.

Optimising returns through performance and efficiency

Paraway's primary business objective is to be a consistent, reliable supplier of quality produce produced under the highest animal welfare standards, while operating a sustainable business that targets long term returns, and effectively manages short term risks. The business is broken down into four regions, Northern, Central East, Central West, and Southern, each of which has a dedicated General Manager who sets their own business objectives, together with the Station Managers in line with Paraway's overall strategy, depending on the region and type of operation. Each year, Paraway's managers review the previous year's performance, consider seasonal and market forecasts, and map out their actions and objectives for the upcoming year. For example, breeding properties aim to maximise the number of kilograms weaned per retained breeder and other key metrics, while minimising the cost of production per kilogram produced, in order to optimise the operating return on assets for each property.

At Paraway's Barton station, an aggregation of 5 properties located in the southern Wimmera (region of Western Victoria, managed by Robert Cooper, a key objective with the 2,000 head Angus cattle breeding operation is to produce high performing cattle that achieve good weight for age and average daily gain (ADG), in order to achieve the best margins for the target market, typically the 100-day domestic market. Specific objectives with the cattle operation include breeding cattle with

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[13] Paraway Pastoral Company Limited https://www.paraway.com.au/

large eye muscle areas (EMA) and high marbling, while optimising maternal efficiency by only running breeders with high fertility and calving ease.

Using pragmatic tools to help with data collection and usage to improve results

To achieve these business objectives, Paraway station managers must find pragmatic ways to collect data on individual animals and at the herd or flock level, in real- and near-real-time, and use the data to make decisions that help maximise livestock performance and health, while minimising inputs, to ultimately achieve the best possible returns for the business. When it comes to achieving better business outcomes, station managers typically start by first identifying areas for improvement through the business performance review process, to determine the biggest costs or barriers to achieving their objectives.

Robert Cooper at Barton station identified that he was spending a lot of money on finishing cattle, without knowing how they were actually performing, which was negatively impacting his bottom line through feed and labour cost blow-outs. He was also noticing that the 14-kilometre round trip journey his cattle would have to take to get weighed at the yards to monitor their performance, was significantly impacting their weight gain for up to 10 days after completing that journey. The cattle should have been gaining 1 kilogram per head per day for those 10 days, instead, after completing that journey, weights would deteriorate or plateau at only 0.1-0.3 kilograms per head per day. For 1,700 head of cattle, this was costing Barton station approximately $110,000 in lost performance, which subsequently led to higher supplement feeding costs to get the cattle to the desired weight.

When Robert first heard about Optiweigh[14], a portable in-paddock weighing solution, he was very keen to try it, if it would give him real-time confidence in how the cattle were performing without having to take them all the way to the yards. During the initial trial, he soon found that the Optiweigh not only removed the need to take the cattle all the way to the yards, but it also helped him make immediate decisions to either feed the cattle more or change what they were being fed. It also helped him to know exactly when they were ready to be sold once they had achieved the desired target weight he had set. Based on how much the Optiweigh cost and the savings it unlocked, Robert says he has more than got his money back -- and quickly. He has since rolled out Optiweigh in other areas of the cattle operation, including to help him monitor heifer weights to be able to optimise their condition and get more in calf.

In addition to using the Optiweigh's, at Barton station they also use the Gallagher EID Reader and Tru-Test XR5000 Weigh Indicator crush-side to collect and monitor historical data on the maternal efficiency of all individual breeding cows. This allows the farmworkers at Barton station to see the historical pregnancy and production history of all cows, while they are being pregnancy tested, to help with making more informed management decisions for each individual cow. For example, cows can now be drafted into different management groups according to their month of pregnancy, or to

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[14] Optiweigh https://optiweigh.com.au/

a cull mob if empty. Older and younger cows can also be drafted separately. This helps with finding the most and least productive females, to ultimately increase maternal efficiency across the board. Having the cows drafted into these different management groups also allows for more tailored nutritional management through paddock selection and supplement feeding based on age and pregnancy status.

Starting slow and keeping options open

At Paraway properties, all cattle and sheep have individual EID tags, however, at this stage, not all animals are individually managed, or some data is collected individually with most still collected at the herd or flock level. At Barton station, they are aiming to roll out AgriWebb's[15] individual animal management platform in the near future because they see more potential gains in animal health, performance and production efficiencies from doing so, based on the benefits they have unlocked to date with individual animal management, particularly with their maternal breeding efficiencies. By starting slow with individual management to unlock maternal efficiency gains, Barton station has built confidence to implement individual animal management more widely. The station also currently already uses AgriWebb for their farm management, animal health record-keeping, and grazing management; therefore, they have already built confidence in using the platform, and are more willing to take it to the next step. Another key area that Paraway is currently exploring solutions to help with, is integrating and using data captured off-farm (e.g., feedlot performance data, carcase data collected at the processing plants) back on-farm. Black Box Co[16] is one solution Paraway are trialling to help with this.

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[15] AgriWebb https://www.agriwebb.com/au/

[16] Black Box Co https://www.blackboxco.com.au/

6.5 Appendix 5 - Business Case 2: Case Study

Business Case 2: On-farm animal performance and efficiency data to optimise returns

Case Study 3: Lambpro

About:
Lambpro
Holbrook, NSW
Operation type: Seedstock prime lamb producer
Area: 1,600 HA
Stock: 7,000 sheep
Rainfall: 680 mm

Lambpro[17] is one of the most influential seedstock enterprises in the Australian prime lamb industry, and is owned and operated by the Bull family. Lambpro is the largest supplier of prime lamb genetics to the Australian lamb industry, with Lambpro rams siring more than one million lambs annually. Based in Holbrook in southern NSW, General Manager Tom Bull runs 7,000 ewes spanning across Lambpro's Poll Dorset, Tradie and Primeline Maternal ram lines, and specialty high-end intramuscular fat (marbling) Hampshire Down breeding program. Lambpro was one of the first sheep producers in Australia to put EID tags on all of their sheep-- about 20 years ago.

Rather than producing a specific breed of sheep and trying to convince the world to eat that breed of lamb, Tom Bull's approach has been to work out what the market wants, and then breed sheep to fulfill that criteria by selecting for profitable traits. In other words, at Lambpro, it's about traits not breeds. For example, the Tradie and Primeline Maternal ram lines are composite breeds bred using a mixture of breeds including an infusion of White Suffolk, Poll Dorsets, and Southdown, among others to get the desired traits being targeted.

Maximum kilograms per hectare, maximum dollars per kilogram

Tom Bull's philosophy is to measure production traits in his seedstock while running them in a commercial environment with high stocking rates. This approach allows sheep with weak constitutions to be culled, and performance data to be collected in commercial conditions, so that Lambpro can focus its attention on selecting for traits that increase kilograms per hectare and dollars per kilogram of carcase value, and ultimately increase production efficiency and profitability.

Key traits that form the basis of selection at Lambpro to help achieve this objective are leg shape, eye muscle area (EMA), fat cover, growth rate, marbling, tenderness, and having hardy animals with strong constitutions that don't break-down easily in the paddock. The sheep are bred to a specification, balancing these traits towards low cost and high carcase-value animals. Lambpro's

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[17] Lambpro https://www.lambpro.com.au/

breeding programs are tailored towards producing lambs with 22-25kg carcasses, that are bred to create increased consumer satisfaction through improved marbling and tenderness.

The maternal breeding program aims to maximise the kilograms of lamb weaned per kilogram of ewe joined, and also breed and select for animals that have a lower cost of production. This is done by selecting hardy, moderate-sized ewes with high fertility rates, with an emphasis on selecting ewes that produce fast and early growing multiples (twins), while ensuring that mature size is moderate to achieve optimal production efficiency. Lambpro targets a weaning rate of above 155% and for all of their rams sold to be in the top 10% for industry LAMBPLAN maternal and performance indexes (ASBVs).

Accelerating genetic gain through data collection and analysis

Data is the most important driver behind how Lambpro operates. The industry performance-recording system, LAMBPLAN[18], has been the backbone of the business, with the breeding technology used to drive high rates of genetic gain and profitability in a commercial environment. Using this genetic evaluation system has helped Lambpro unlock premiums for their rams, because it enables their ram's genetic potential, across a range of traits, to be evaluated against the industry benchmark. Lambpro's breeding program also uses a combination of genomic testing and progeny testing to identify sires that will deliver consumers a better eating experience by ensuring they breed lambs with the right fat, retail yield and eating quality. They also leverage data collected by commercial ram clients to feed into selecting for and accelerating genetic gain. Lambpro even developed their own software, called Primeline plus, to help with the management, analysis and sharing of their data including the development of their own maternal and carcase quality indexes.

Tom Bull and his team, EID tag and weigh all individual lambs at birth which marks the beginning of a lamb's data collection journey at Lambpro. Lambs are then weighed again at weaning and post-weaning to closely monitor how they are performing and make management and breeding decisions accordingly. The team also ultrasound scans the lambs at about 6-8 months of age to measure EMA and fat cover. Mature ewe weights are monitored and tracked, along with their full pregnancy and lamb production history. Using the data obtained, Lambpro are able to manage their ewes to ensure that they have adequate fat cover to maximise the likelihood of getting in lamb, while providing them with sufficient reserves to assist in the event of a drought.

Taking advantage of evidence-based decision making

The philosophy at Lambpro is to breed rams that provide genetic gains for their commercial clients-they're not just in the business of selling rams. This drives the business to make improvements in sheep productivity through strategic breeding decisions using the data they collect to unlock benefits for their clients. For example, Lambpro have identified that their ram clients are weaning more lambs, achieving over 140% weaning rates to ewes joined, since using Lambpro genetics in their commercial breeding programs. Rams are also lasting clients for an extra season or two due to the improvements made in the breeding program, which has increased how hardy they are. Tom and his team have also noticed a significant (16%) improvement in the number of lambs weaned since 2010. Pregnancy scanning results have yielded a larger proportion of multiples over the years, now sitting at 77% multiples, 5% triplets 5% dry, off a 5 week joining period with 400 grams per day of lupins supplement feeding program. Recently Lambpro also achieved an impressive result with a 95% pregnancy rate in ewe lambs out of mature ewes with 60% of those being twin bearing

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[18] LAMBPLAN https://www.sheepgenetics.org.au/resources/lambplan/

multiples. Lambpro lambs are also hitting an all time high of 42-44kgs straight of their mums when they're weaned at 100 days. Tom and his team are also able to act quickly when they identify sick animals from regular weighing of lambs to identify poorer performers which ultimately improves animal welfare and production outcomes at the end of the day.

Thinking ahead and being prepared

Lambpro are constantly looking ahead and are already preparing through their data collection and breeding program for a world where lamb producers are rewarded for quality, and not just for carcase weight and achieving a minimum fat score. The recent announcement[19] by Gundagai Meat Processors about the launch of a lamb grid paying producers on lean meat yield, weight and intramuscular fat is certainly cause for optimism in this area, as DEXA and MEQ probe technology becomes more widely used.

While Tom fully recognises the benefits of individual animal data to Lambpro and subsequently to his clients, he recognises that it isn't always practical for large commercial sheep breeding operations to implement individual sheep management and monitoring to the same extent as they do at Lambpro, due to the costs and impracticalities of collecting individual sheep data on such a large scale. He does believe, however, that there is some cause for optimism that more gains through data usage will be made in commercial sheep breeding programs in the future, as existing technologies become more affordable, and new technologies such as facial recognition technology mature which will make individual sheep management more feasible to implement.

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[19] "Gundagai launches world-first meat yield and IMF lamb grid" https://www.sheepcentral.com/gundagai-launches-world-first-meat-yield-and-imf-lamb-grid/

6.6 Appendix 6 - Business Case 3: Technology Solution Examples

Business Case 3: Grazing management, pasture availability and soil quality data to improve performance and sustainability

The following table provides examples of technology currently available to potentially help with collecting and using grazing management, pasture availability and soil quality data: (Note: this is not an exhaustive list).

Technology solution examples	Description	Grazing management	Pasture availability	Soil quality
Cibolabs	Use world-leading science in remote sensing and machine learning combined with on-farm knowledge to bring new levels of understanding in pasture productivity and land condition to every farm, paddock or field in Australia	?	✓	✓
MaiaGrazing	MaiaGrazing is an easy to use online grazing management tool that helps farmers maximise their pastures and profits in the good times and reduce risks when it's tough	✓	?	?
FarmLab	FarmLab provides a streamlined service to help agronomists and farmers get the most out of their soil over the long term	✗	✗	✓
AgriWebb	AgriWebb creates easy to use farm management software covering all enterprises. Help farmers around the world to simplify their farm record keeping, solve audit and accreditation needs and increase productivity	✓	✓	?
DataFarming	DataFarming is an Australian agtech company which aims to break down the barriers to adoption of precision agriculture by providing low cost, simple to use, and easy to access platforms; taking it from boutique to mainstream	✗	✓	?
Farmdeck	Farmdeck is an Internet of Things (IoT) farm management solution that includes the sensors, the network connectivity and the Farmdeck application available online and on any devices	✓	✗	✗
Sentek	Sentek Technologies was founded in the early 1990's to meet the demand from	✗	✗	✓

	farmers for real insights into their irrigation decisions			
Wildeye	Make better irrigation and farm management decisions with live sensor information at your fingertips. Wildeye sensors are a reliable and affordable way to remotely monitor what's really happening in the field	✗	✗	✓
MAIT Industries	MAIT Industries provides innovative monitoring and irrigation-control solutions that help growers, horticulturists, farmers and other water users and providers to improve their water management practices.	✗	✗	✓
METOS	The Metos 3.3 is a durable and flexible data logger for all climatic conditions, powered by rechargeable batteries and solar panel.	✗	✗	✓
HoneAg	Hone is an Agtech company focused on delivering real-time, accurate chemical analysis for agriculture. Use light-based technology and machine learning to put the power of a chemistry lab in the palm of your hands	✗	✗	✓
Farmo	Farmo designs and develops sensors that address real life farm problems with technology that best suits the situation	✗	?	✓
Observant	Observant helps farmers optimise water consumption, reduce costs, improve productivity and gives them the ability to monitor and control farm operations from their mobile device(s)	✗	?	✓
Goanna Ag	With Goanna Ag, you can connect to your farm like never before. Using low cost sensors and connectivity, help growers to optimise water management across the farm and significantly improve on-farm efficiencies	✗	?	✓
Farmbot	Farmbot's innovative monitoring solutions deliver real-time reporting on water trends, consumption and alerts.	✗	?	✓
Mobble	From animal records to paddock treatments, Mobble has all the features you need to manage your farm effortlessly	✓	✗	✗

6.7 Appendix 7 - Business Case 3: Case Study

Business Case 3: Grazing management, pasture availability and soil quality data to improve performance and sustainability

Case Study 4: Danthonia Farm

About:
Danthonia Farm
Elsmore, NSW
Operation type: Cattle producer, breeder, and agister
Area: 2300 HA
Stock: 1,500 cattle
Rainfall: 750 mm

Located in the New England region of New South Wales, Danthonia is a 2300-hectare grazing property that was purchased by its current owners in 1999. Prior to new ownership, Danthonia was a conventionally farmed mixed cattle, sheep and cropping property. The property now exclusively runs livestock, with an operation that spans breeding, agistment, and backgrounding of beef cattle, specifically grass-fed angus.

Danthonia's current General Manager, Johannes Meier, first became involved with the business in 2004 in the middle of the Millennium Drought. At the time, Danthonia's landscape was severely impacted by the drought conditions, with productivity and profitability declining to unsustainable levels. With the farming operation's economic viability on the line, Johannes started searching for ways to restore pasture productivity while minimising input costs. In 2006, Johannes began experimenting with holistic, or rotational, grazing on a trial basis. Impressed by the results achieved, Johannes has now rolled out holistic grazing management across the entire property.

Improving pasture productivity and resilience to ensure economic viability

Danthonia's primary business objective is to optimise for pasture productivity and drought resilience to support grazing activity. As Johannes describes it, Danthonia "is really in the business of growing grass", with the ability to profitably raise cattle stemming from the land's capacity to support pasture growth. Another key management philosophy is focused on improving ecological outcomes including pasture biodiversity, soil microbiology, and soil carbon, to sustain the health and resilience of Danthonia's pastures. With an emphasis on grass-fed cattle, Danthonia also seeks to optimise animal performance by breeding for moderate and highly efficient animals.

Making well-informed and data-driven grazing decisions

Before fully committing to a switch away from conventional grazing at Danthonia, Johannes wanted to make sure he had proof of the results that holistic management could deliver for the business.

Paddocks across four sites on the property were split into trial sites, where rotational grazing was implemented, and control sites, where conventional grazing was continued.

In order to implement rotational grazing, Johannes and his team had to determine the optimum stocking rates for the trial sites according to the carrying capacity of those sites, and develop a grazing plan for where, when, and how long the cattle should graze at each location. In the early days, these decisions were made in a fairly manual manner--with the input of external consultants and informed by intuition and data that was captured on pen and paper, wall charts, or Excel spreadsheets.

The results from these trials were incredibly encouraging (Table 1, below), therefore holistic management was rolled out across the entire property. By 2012, the Danthonia team went from managing four trial sites to managing 250 subdivided paddocks where cattle graze for two to three days at a time. In order to manage complexity at this scale, the team were in search of a solution that could allow them to more easily develop grazing plans, track rotations across the property, and keep records of activity and outcomes in each paddock.

Johannes didn't have to search too far for his answer. Bart Davidson had already been providing consulting support to Danthonia when he and Peter Richardson co-founded MaiaGrazing[20], a data and analytics platform specifically designed to help streamline implementation of holistic management.

A pragmatic approach to using digital tools

Today, the Danthonia team uses MaiaGrazing to determine their optimal stocking rates and generate rotational grazing plans based on feed-on-offer (FOO) estimates and forecast data. Johannes and his team generate FOO estimates through visual paddock assessments or quadrat sampling. While Johannes sees the potential to use satellite imagery and remote sensing technologies to estimate FOO in the future, he hasn't gained enough confidence to make the switch yet. The Danthonia team also set a high ground cover threshold of 90% for their paddocks, which determines what proportion of pasture can be grazed out of any paddock.

The MaiaGrazing platform then combines this information provided by Danthonia's team with additional data, such as climate and weather forecasts, to determine how many head of cattle the property can sustain, and how the cattle should be rotated across the property. MaiaGrazing also allows the Danthonia team to view grazing plans across a variety of scenarios (e.g., average conditions, wet conditions, and dry conditions). Based on this information, Danthonia are now able to establish their grazing plans 6 to 12 months in advance and seamlessly manage rotation schedules across the property.

Reaping ecological and economic benefits

The switch to holistic management has helped Danthonia both restore and enhance the health and drought resilience of its land, as well as improve economic performance. The table below

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[20] MaiaGrazing https://www.maiagrazing.com/

summarises aggregate improvements across the original 4 trial sites where rotational grazing was implemented from 2011 to 2016.

Table 1: Average Improvements from Holistic Management at Danthonia, 2011-2016[21]

Measure	Percentage Improvement
Pasture Productivity (dry stock equivalent days per HA / 100mm rain)	26%
Plant Biodiversity	60%
Soil Moisture Content	1%

Danthonia has also noticed improvements in livestock carrying capacity and weight gain by livestock over the years, with the average weight gain per head per day now at 0.75 kg just off grass, which has been driven by the improved pasture productivity. This ultimately is benefiting Danthonia's bottom line.

Implementation of holistic management has also helped Danthonia remain economically resilient in the face of more recent droughts. For example, while neighbouring properties either destocked or purchased hay for $300-400 per ton to get through the 2017-2019 drought, Danthonia was able to continue carrying cattle and only bought in hay for the final four months of the drought. The use of MaiaGrazing to forward-plan not only enabled Danthonia to save significant sums on hay, but it also allowed them to retain their grass-fed genetics herd and could continue to produce bulls for that market.

New revenue opportunities on the horizon

While Johannes and his team have already started to reap the benefits of their transition to holistic grazing management, they see further opportunities to maximise the return on their investment in the future. Danthonia have been conducting periodic soil sampling across paddocks and are starting to see improvements from both implementation of rotational grazing, as well as application of biological amendments to improve soil microbiology and health. Nominally, Danthonia saw, on average, a 12% improvement in soil carbon levels between 2014 and 2021.[22] Johannes sees potential for Danthonia to monetise these outcomes through both carbon markets and participation in supply chains offering a premium for outcomes related to carbon and the environment, in the future. Before jumping on these opportunities, however, Danthonia wants to ensure that the markets are mature and the costs and burden of participation on producers isn't too high. In the meantime, given the benefits they have already realised, Johannes and his team believe they have plenty of reasons to continue their commitment to holistic grazing management.

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[21] Data provided by the Danthonia team, as reported in a Evaluating the Effects of Grazing Management, Investigation paper written using farm-data.

[22] Calculated as the average percentage change between soil carbon levels in paddocks that were sampled in both 2014 and 2021 (n= 9). Improvements in soil carbon levels were most pronounced in paddocks where biological amendment application and plant diversity improvements were made in addition to implementation of holistic management.