Final report

Digitalisation Pilot of Operational & Supply chain Data Management

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Abstract

The *Digitalisation Pilot of Operation and Supply Chain Data Management* project aimed to establish the potential in facilitating the aggregated consumption of data on farm, and to enable data sharing for collaboration along the supply chain, into a distributed ledger or blockchain, to then be transacted with external third parties. To achieve this, **AxisTech** partnered with **Stone Axe Pastoral Company**, an Australian ultra-premium quality Wagyu producer, where their operational data was digitalised, ingested, standardised to a uniform data model into the AxisStream data platform. In addition to this, three scoping studies were completed to establish the requirements for Stone Axe's data to be shared with: meat processors, blockchain and other agricultural producers.

AxisTech successfully demonstrated the capabilities of AxisStream to standardise, ingest and aggregate whole-of-business data to produce valuable reports and visualisations for Stone Axe's enterprise. These outcomes can benefit Australia's agricultural production supply chains which currently encounters significant gaps and fragmentation relating to data collection and management. Consolidation of this data would provide production insights for producers and supply chain participants, while enabling improvements in transparency, traceability, and provenance of consumer end-products within local and global markets.

This project has provided Stone Axe Pastoral with valuable knowledge regarding the digitisation and streamlining their whole-of-business data. It has established the interoperability and reuse of their data, which can be used towards future developments such as, implementing a distributed ledger, participation within data communities, and provides the opportunity to connect directly with their meat processors data using APIs.

Executive summary

Background

The agricultural industry involves production supply chains which spans across a vast network of on-farm and off-farm activities that involve multiple parties and organisations. When it comes to the collection and management of agricultural production data, significant gaps are common, however when data does exist, it is often fragmented and disparate. Without ways to address these data management gaps, producers and downstream food and beverage processors resort to intuition when managing their own production activities and associated data sets. Consolidating data and bridging these gaps has the dual effect of providing producers and supply chain participants with a complete and comprehensive knowledgebase to achieve detailed operational insights, and secondly it facilities with improved transparency, traceability, and provenance of end-products for customers within local and global markets.

AxisTech together with the participation of Stone Axe Pastoral Company aimed to unlock their data and identify opportunities for analysis using a complete and unbroken set of data records from product code right back to cattle genetics and lifecycle.

Objectives

Our key objective was to demonstrate the AxisStream data management platform that integrates data from a range of installed devices and software at Stone Axe's properties. This data was consolidated into the platform where data is completely owned and controlled by Stone Axe with the aim to achieve unimpaired and comprehensive operational insights for the producer and supply chain participants into their operations using this data.

This project included several key activities listed below which formed the project deliverables:

- Ingestion of off-farm data
- Ingestion of on-farm data
- Scoping study: industrial blockchain – Ripe
- Scoping study: meat processors
- Scoping study: data sharing

Methodology

- Data planning and mapping activities and establishing a deployment plan
- Off-farm and on-farm data was provided to AxisTech which was digitised, transformed, standardised, and aggregated
- Data was then successfully ingested into AxisStream by AxisTech's data engineering team
- AxisTech's software team created a range of production reports using this data. Images from these reports are included in the pages to follow
- Stone Axe was provided with their AxisStream login details to commence exploring and reviewing their available reports, visualisations, and data
- Outcomes for each scoping study were achieved through several meetings with key stakeholders.

Results/key findings

Collaboration between all parties along the supply chain is challenging, especially when it comes to technology and innovation. The willingness to participate, establishing trust and communicating clear benefits for participation are all crucial factors for projects such as this to be successful.

Digitisation process and management: this is the building block for data transformation, standardisation and making it accessible for sending streamlined data along the supply chain. This also enables and supports data flows and feedback loops with other external systems thus, establishing the interoperability and reuse of data

On-farm and off-farm data synchronisation: having a synced database into *Stockbook* would be highly beneficial for Stone Axe's business processes and streamlining data flows

Blockchain implementation: an extensive data discovery session is required prior to implementation, which can be costly. Undertaking the data mapping work and incorporating their data into AxisStream for this project will significantly reduce the data discovery cost for Stone Axe

Blockchain development: will require additional work to develop web interface and tools to establish an integration between Ripe.io and AxisStream along with associated costs

Meat processors: Elevated levels of concern regarding privacy around technological solutions for operational and production management and a reluctance to engage with AgTech providers

Data sharing:

- **Trust**: It is essential to establish trust between supply chain parties to procure complete participation in digitisation and supply chain projects;
    - Benefit should outweigh any perceived risks
    - Important that key attributes have a granular level of control with the ability to suspend, exit or stop sharing certain data (data ownership and control)
    - De-identification of data shared
    - Vested interest in the protection of data (e.g., commercial risk for project owner if it is not protected)
- **Time:** Onboarding of participants takes time thus, this time must be available in order to commit with engagement in projects;
    - Time of year and commitments need to be considered (e.g. business requirements, harvest, Christmas, school holidays, bushfire season etc)

Benefits to industry

The below benefits were identified during the project:

- **Time savings:** by reducing the time required for document/data collection, standardisation, and aggregation and collation of data sets for ongoing reporting requirements
- **Cost savings:** decreased labour costs related to time savings above, in addition to reducing and improving production input costs. For example, by analysing historical and current operational data (e.g., fertiliser, treatments, and livestock feed; cost, intake, wastage etc.) combined with, weather forecasts and trends, producers can improve their feed budgets, inventories, treatments, and application rates to reduce production input costs and wastage

- **Genetic improvements:** the evaluation of breeding performance and meat processor data, would lead to improved genetic selection and breeding plans resulting in superior consumer end-products, expanded market access and increase their overall profitability
- **Increased productivity:** from genetic improvements and time savings above. Time saved can then be allocated towards enterprise expansion, development and refining on-farm processes
- **Industry benchmarking:** through AxisStream's data communities which enables the sharing and exchange of individual data sets
- **Authenticity verification**: by utilising AxisStream's data sharing capability, specific datasets relating to an animal/(s) can be shared into a blockchain distributed ledger for independent data verification on producer claims relating to animal welfare, provenance, and genetic blood stock
- **Streamlining compliance and biosecurity processes:** by improving document control and data flows through the supply chain, and increasing visibility and accessibility for compliance and regulations
- **Sustainability, GHG, ESG, Natural Capital reporting**: Value can be derived from increased efficiency, traceability, the ability to analyse product safety, quality, and sustainability with verifiable data
- **Supply chain interconnectivity:** by facilitating collaborative supply chain activities from multiple participants and organisations to create individual, auditable and immutable (unchangeable) records using a distributed ledger

Future research and recommendations

Future research opportunities from this project include:

- Sync *Stockbook* data flow from their server
- Develop a widget tool for *Stockbook* within the *AxisStream* platform
- Further investigate *Harvey Beef* portal API
- Blockchain:
    - Data discovery session and deployment plan
    - Develop web interface and tools for integrating *Ripe.io* and *AxisStream*
- Investigate the reluctance of supply chain participants to engage in collaborative and integrated supply chain solution studies.

Data planning and collection can be a large undertaking for any business, especially when having to access data from disparate sources and for a range of locations. It is essential that adequate resources and hours allocated to achieve this task is committed to by businesses completing any data project such as this.

Table of contents

1. Background

1.1 Digitisation

The agricultural industry involves production supply chains which spans across on-farm and off-farm activities involving multiple parties and organisations. When it comes to the collection and management of agricultural production data, significant gaps are common, however when data does exist, it is often fragmented and disparate. Without ways to address these data management gaps, producers and downstream food and beverage processors resort to intuition in order to manage their own production activities and associated data sets. Overcoming these data gaps and consolidating data from all sources, facilitates with creating detailed operational insights, improved transparency, traceability, and provenance of consumer end-products.

According to the 2017 report commissioned by the Australian Government (Leonard, et al., 2017), this ad-hoc way of working with production data is estimated to cost the Australian Agriculture sector $20.3B per year. A lack of data-driven operational capability means growers and processors alike are exposed to risks associated with managing production.

For these reasons, the consensus between participants at all levels of the agricultural production supply chain is clear - the future of agriculture is 'digital'. The race is now on to connect growers and processors with an effective means of managing and leveraging their production data.

Data is the key to increasing the maturity of the agricultural industry at both the farm operational level and in improving the way growers can participate and collaborate with others downstream along supply-chains.

AxisTech's project partner, Stone Axe Pastoral Company are an Australian ultra-premium quality cross-bred and full blood Wagyu producer who have a range of device data inputs from across their operations which was ingested into the AxisStream data platform and then utilised to demonstrate and achieve valuable outcomes and unlock value from their existing data. They currently manage 42,000 head of beef in their vertically integrated supply chain including circa 45,000 hectares of properties positioned in 16 locations across WA, NSW, QLD, and VIC, five large scale integrated feedlots (custom feeding and company owned), working with multiple meat processors and cold chain storage providers. They currently export to around 15 countries including China, Korea, Southeast Asia, Middle East and Europe.

AxisTech together with the participation of Stone Axe Pastoral Company aimed to unlock data and identify opportunities for analysis using a complete and unbroken set of data records from product code right back to animal genetics and lifecycle.

1.1.1 About AxisStream

AxisStream is a powerful data management system that enables whole-of-business data to be digitalised, ingested, standardised to a uniform high-integrity data model (industry or global standard), and stored in a grower/processor owned data store. Stone Axe has a range of data inputs from across its operations that were ingested into the AxisStream data platform and then utilised to demonstrate valuable outcomes including time savings for management reporting.

This well organised and structured data has become the building block for Stone Axe to enable digital operations and realise a range of valuable business outcomes including the ability to generate reports and analysis using a range of data to assist with business and operational decision making.

2. Objectives

Off-farm and on-farm data ingestion: The main objective of the *Digitalisation Pilot of Operational & Supply chain data management* project was to utilise a single data platform (AxisStream) which integrates data from a range of devices already installed at Stone Axe Pastoral and consolidate this data together in one form to achieve a more comprehensive overview of their enterprise and more detailed operational insights for their production systems.

Off-farm data from various sources and in multiple forms was successfully ingested into AxisStream during the course of this project in 2021/22. All off-farm data is now standardised and stored in the one place, which enables Stone Axe to analyse, create reports, conduct research and better manage their off-farm operations. Additionally, they identified that this could assist them in addressing critical questions along the supply chain such as animal welfare status and other quantitative and qualitative supply chain insights.

On-farm operational data was also successfully ingested into AxisStream. This provides Stone Axe with the opportunity to generate insights into on-farm operational activities and create significant gains to the business in terms of decision making. Additionally, by combining data sets from both on-farm and off-farm, it provides a wealth of qualitative and quantitative data that supports the provenance of products delivered to their customers.

AxisStream: Stone Axe was to provide feedback and input into the usability, functionality, and overall experience of the AxisStream data management platform so that AxisTech can continue to improve and evolve the solution for industry users.

Stone Axe provided the feedback requested throughout the completion of this project, which AxisTech has considered when making improvements to the overall design, layout, interface, and functionality of AxisStream.

Case studies: Stone Axe was to be trained so that they could conduct their own research and analysis using AxisStream, with the results and learnings to be documented in a collection of case studies.

While AxisTech and Stone Axe successfully conducted demonstrations and tutorials remotely, formal training sessions and materials were not accomplished due in part, to the COVID pandemic, scheduling conflicts and Stone Axe's time poor situation while expanding their operations. In addition to this, AxisStream is continually undergoing upgrades, improvements, and developments which led to changes in the user interface and user experience throughout the project.

These compounding factors resulted in Stone Axe having limited availability to undertake their own research and analysis using AxisStream. This part of the project outcomes was supported by Beanstalk AgTech who provided data visualisations and data-oriented process change to demonstrate 'people and process' elements of the project.

Scoping study blockchain: This study aimed to establish pragmatic, and where possible programmatic, extraction of snippets or hashes of operational data from AxisStream and delivering it into the blockchain at key points in the animal lifecycle and supply chain.

This scoping study was successfully completed, and this potential future integration would establish independent data verification of producer claims such as quality, animal welfare, provenance, and genetic blood stock for customers and supply chain assurance.

Scoping study meat processors: This scoping study aimed to establish pragmatic, and where possible programmatic, retrieval of data from the processor's operational software to be ingested into AxisStream.

AxisTech successfully completed this scoping study, however encountered issues when trying to engage with some meat processing facilities. An opportunity to integrate Harvey Beef processing data using API's available in the future was identified as a potential solution to retrieving processor data and ingesting into AxisStream

Scoping study data sharing: Our aim was to identify a pragmatic methodology and rationale around data sharing capabilities for producers and other supply chain participants.

This study was completed and describes further development work required to progress with a wider producer roll out and adoption, along with the potential key use cases and applications that were identified while undertaking the study.

MLA Workshops: This project was to include virtual workshops with MLA's Adoption Team to discuss potential adoption pathways.

The first workshop was held at the beginning of the project and successfully identified and discussed potential adoption pathways which are described in section 5.1.4. An additional adoption planning workshop was held in February 2022 to check in on the progress of the project.

3. Methodology

3.1 Data ingestion

AxisTech and Stone Axe Pastoral held regular meetings to discuss the ongoing progress of the *Digitalisation Pilot of Operational & Supply Chain* project. These discussions were aimed to develop an understanding of the data and outputs for the project and how to best structure the project and associated data. The following key activities were required in order to complete the data ingestion project deliverable:

Data Planning: The data ingestion activities began with Stone Axe Pastoral providing AxisTech with a list of their off-farm and on-farm data sets that would be provided for the project including the type, source (e.g., Stockbook, excel, csv etc), format, and time periods of these data records.

As part of the data planning activity AxisTech conducted thorough data mapping activities for end-to-end data flow within Stone Axe's wagyu supply chain in addition to creating a deployment map.

Data Handout: Stone Axe Pastoral provided AxisTech with all their on-farm and off-farm data in various file formats into a file sharing service.

Data Implementation: This step involved multiple the completion of multiple activities some of which are listed below;

- Confirmation that all datasets expected were received
- Examining options that were available to link the various documents/files and file types to each other
- Determining common links for all documents/files and types
- Assessment of which dataset would be the 'source of truth' for animal identification

- Standardisation of attributes, units of measurement, references (locations, identification etc) used throughout data files, types, and formats
- Editing and aligning data structures
- Identifying and categorising datasets/types/strings
- Extraction and addition of attributes to the AxisStream system that weren't already available
- Grouping of documents based on datasets and types
- Clarification of data units, references, and requirements
- Identifying the 'primary key' for data streams
- Verifying and/or removing blank data

After all data was transformed into the required format and final analysis and quality checks were complete, all data was ingested into the AxisStream data store ready for visualisation and analysis, which is explored in the results section of this report.

3.2 Scoping studies

3.2.1 Blockchain

Data is the key to increasing the maturity of the agricultural industry at both the farm operational level and in improving the way growers can participate and collaborate with others downstream along supply-chains. This would result in more detailed operational insights for producers and supply chain participants while improving the overall, traceability, provenance, and traceability of consumer end-products for both local and global markets.

This scoping study aimed to establish a pragmatic, and where possible programmatic, extraction of 'snippets' or 'hashes' of operational data from AxisStream and deliver it into the blockchain at key points of the animal lifecycle and important events throughout the supply chain. Another focus will include the methodology, development requirements and potential costs on both sides.

Stone Axe, AxisTech and Ripe.io held several meetings during the project to complete the scoping study on incorporating blockchain within the Stone Axe wagyu supply chain. Central to these discussions was to determine what activities (scope) would be required to facilitate this outcome as a project. The discussions were aimed to provide outcomes to the key points outlined further in Table 1.

Table 1 – Blockchain Scoping Outline

Category	Detail
Data Mapping	**Mapping Exercises:** ▪ Conceptual schematic using blockchain
Business Position	**Identify:** ▪ Current pain points for data flow and events ▪ Internal/external demands STX have regarding the supply chain ▪ Level of visibility/traceability STX wish to achieve ▪ Identify elements of data STX would and wouldn't like in blockchain: ▫ Determine which datasets/events relate to these elements ▫ Identify who hosts the datasets/events

	▫ Engage with hosts of datasets/events to establish possibility of implementing blockchain with STX
Requirements for implementation / deployment	**Identify:** ▪ Processes required for STX and associated costs ▪ API – Processor Scope: ▫ Identify value proposition and associated costs ▫ Resulting utilisation of this data ▫ Processor requirements for raw data API ▫ What data would be available ▫ Other uses/reuse opportunities for this readily accessible data ▪ Any immutability challenges ▪ Genetics data – direct source ▪ Cold chain monitoring/management ▪ Export supply
Potential Benefits	**Identify:** Possible gains/benefits of blockchain for STX ▪ Automation of data/document flow ▪ Reducing personnel time ▪ Repurposing personnel time for higher level work tasks

3.2.2 Meat processors

This scoping study aims to establish pragmatic, and where possible programmatic, retrieval of data from the processor's operational software to be ingested into AxisStream. It will also focus on the methodology, development requirements and describe the required costs on both sides (processor and AxisTech). Opportunities for discovery include which data elements collected on farm that are of interest to the processors and how they may be reused. Inversely, quantitative and qualitative data being collected by the meat processors may be unlocked to provide value for Stone Axe operations (grower).

In parallel to its operational capability, AxisStream has developed a unique data sharing capability. Data is shared within groups or supply chain participants while data owners always maintain possession and control over the data.

As part of this scoping study, AxisTech held several meetings with some of the meat processors that Stone Axe Pastoral utilise in their wagyu production system. To date we have engaged with Harvey Beef (WA) to scope the requirements for data transfer of relevant datasets.

This scoping study aims to deliver outcomes on the items listed in the below table relating to sharing data from meat processors (Table 2).

Table 2 - Meat Processors Scoping Outline

Items	Detail
Data Mapping	• Determine current data collection and flow at processors used by Stone Axe o Data collection points o Software used o Future technology upgrades planned/in progress

	○ Potential to share valuable key data sets with producers • Identify the potential data sets provided by producers
Business Position	• Identify value proposition and associated costs
Requirements for implementation / deployment	• Processor requirements for raw data API ○ What key data elements will be available ○ How data will be utilised ○ Other uses/reuse opportunities for this data
Potential Benefits and uses	• Possible gains and benefits sharing processor data to producers • Potential gains and benefits sharing producer/feedlot animal data to processors

3.2.3 Data sharing

Building on existing developments and capabilities of the AxisStream data management platform, this scoping study centred on data sharing within the red meat industry and supply chain. Inherent within AxisStream's design is a unique capability to share data between data owners (individual businesses within the supply chain), to create data communities, a type of virtual multi-party data aggregation frameworks, and conduct data exchange between parties.

This scoping study aimed to develop a rationale and identify a pragmatic methodology and for producers and other supply chain participants to share data. In addition, we aim to identify any further development work required and what key use cases and applications exist to warrant the investment and development.

Stone Axe and AxisTech have held several meetings during the project in order to deliver outcomes on the items outlined in the below table relating to data sharing within the red meat industry and supply chain (Table 3).

Table 3 - Data Sharing Scoping Study - Outline

Items	Detail
Data Mapping	**Mapping Exercises:** ▪ Conceptual Data Sharing Framework
Business Position	**Identify:** ▪ Desirable key data sets currently not available, that could be accessible through data sharing ▪ Internal/external demands STX have regarding data sharing ▪ Determine what data STX business areas would like to visualise on dashboards/reports ▪ Barriers to accessing or sharing data
Requirements for implementation	**Identify:** ▪ STX Requirements to share data ▪ Identify circumstances and use cases for sharing data

Potential Benefits	**Identify:** ▪ Possible gains and benefits of sharing data

3.3 Case studies

AxisTech's project team worked closely through a number of workshops with Stone Axe leadership to identify key decision points and co-design a series of proof-of-concept dashboards within PowerBI. These dashboards connect directly to Axis Stream via API's and therefore provide a live data-stream for Stone Axe. This work was conducted by Beanstalk AgTech who have deep experience in the data visualisation and data-led-decision-making field.

4. Results

4.1 Data ingestion

As part of the data ingestion process AxisTech conducted a thorough data mapping exercise for Stone Axe's end to end data flow (Fig. 1) which resulted in the creation of a deployment map as seen in Fig. 2.

This exercise demonstrated that their on-farm data is sourced from their existing software Stockbook. This data spans the whole life to date for each animal involving multiple attributes and records, of which many have multiple entries such as weights. These attributes were then divided into; animal, genetics, pregnancy, weight and livestock categories.

The main challenge identified was how to retrieve Stockbook data into AxisStream without using Sybase data dumps which relate to specific periods of time. This current process using data dumps takes a significant amount of time due to each animal (RFID) containing multiples entries for weights and locations. It has also limited the amount of data accessible for the project to a maximum of 10 per entry type e.g., weights and locations. In order to extract all data for each animal from Stockbook, AxisTech has been exploring ways in which we can connect to its database directly rather than extracting data through Stone Axe's account. The methodology to do this would require selective queries to run after Stockbook's database syncs, which allows all new and updated data to be sent into the AxisStream platform.

The data ingestion activity resulted in the following outcomes:

- Off-farm and on-farm data was successfully ingested into AxisStream
- The software team at AxisTech have created a range of reports using this data. Images from some of these reports have been included in the pages that follow (Fig. 3 – 8)
- AxisTech provided Stone Axe with their AxisStream login details to commence exploring and reviewing their data and available reports and visualisations. The reports, including those developed by Beanstalk have been included within AxisStream for Stone Axe to access and review. Future work required would be to have the data from Stockbook automated into the system so that reports are easily and readily up to date for operational use.

Figure 1 - Stone Axe - Current Process Data Map

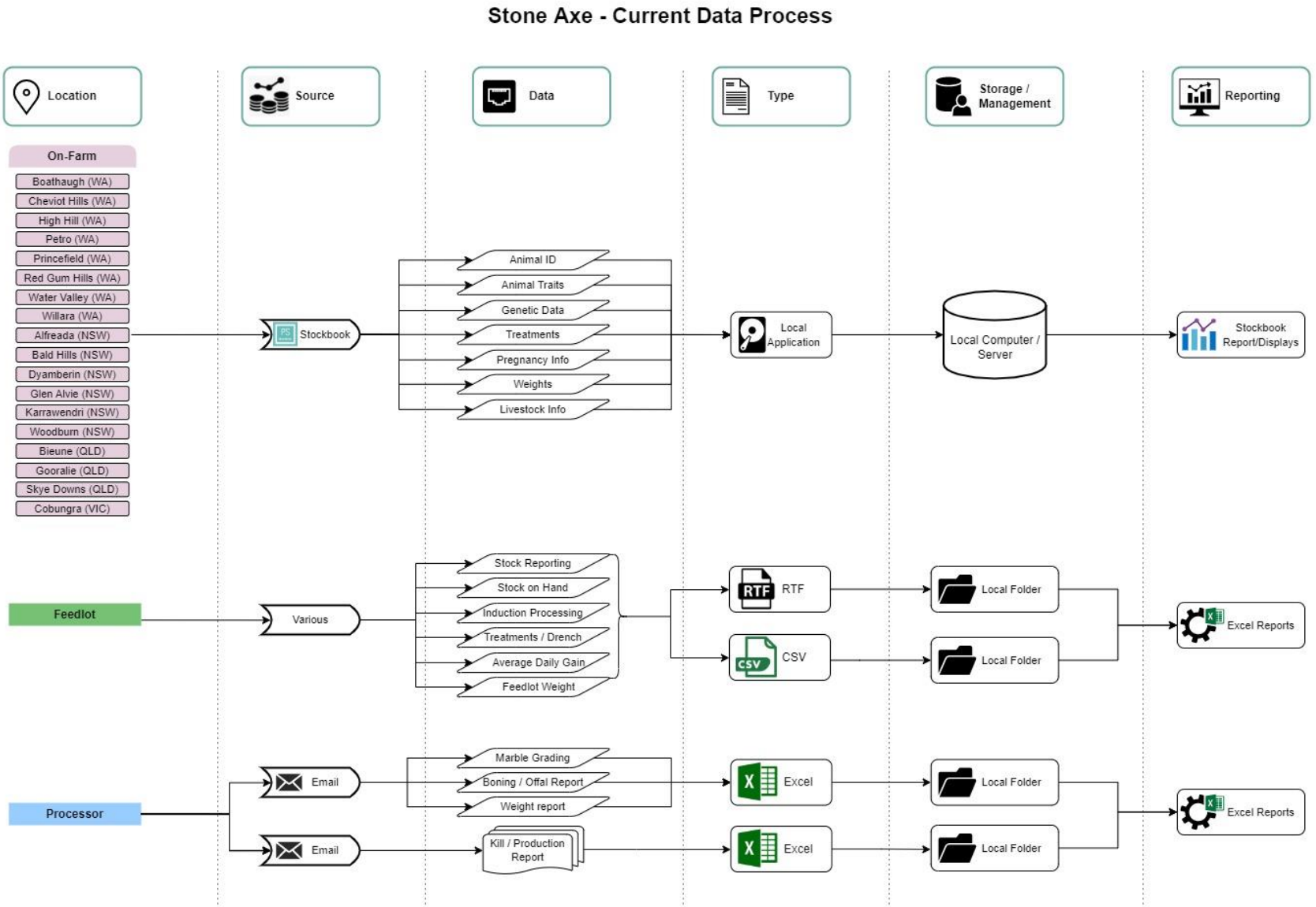


Figure 2 - Stone Axe AxisStream Deployment Phase 1

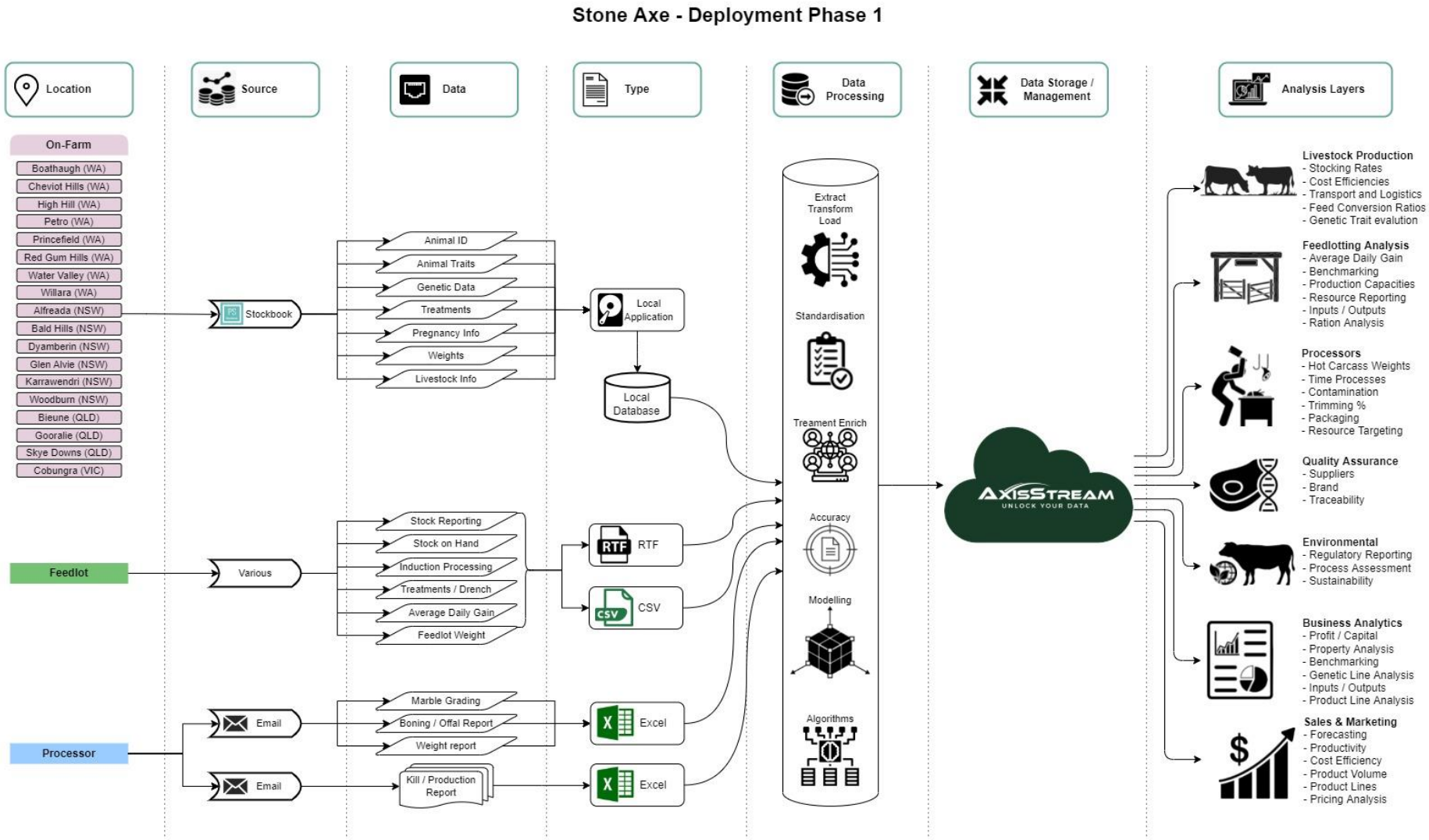


Figure 3 - Weight Report

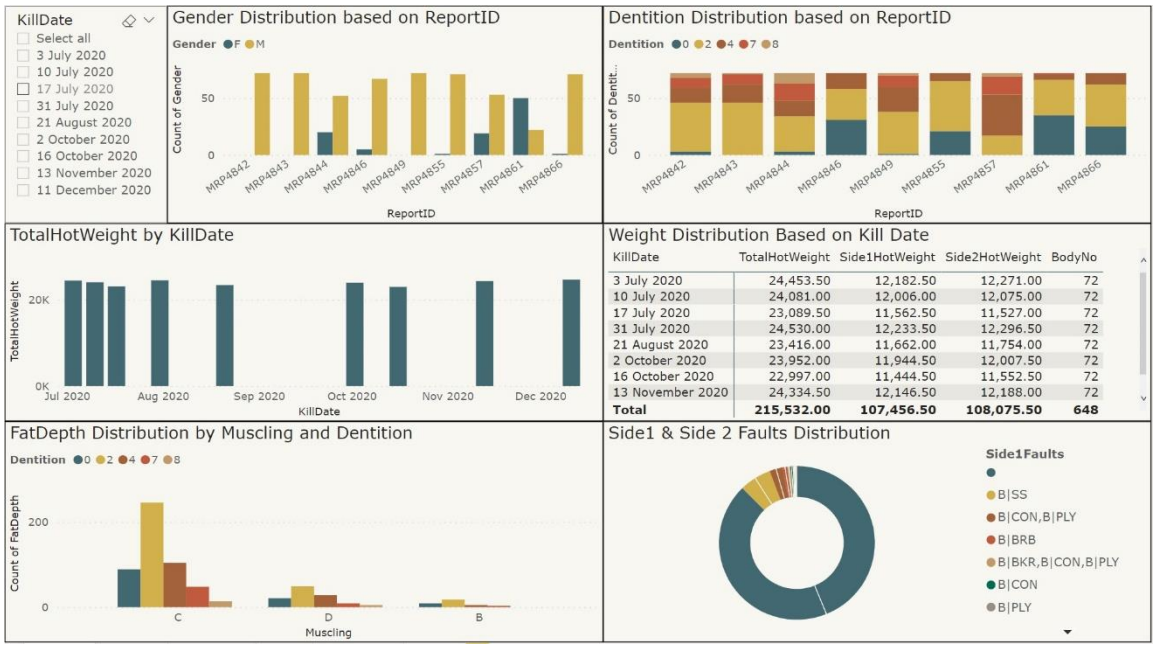


Figure 4 - Net and Hot Weight Report

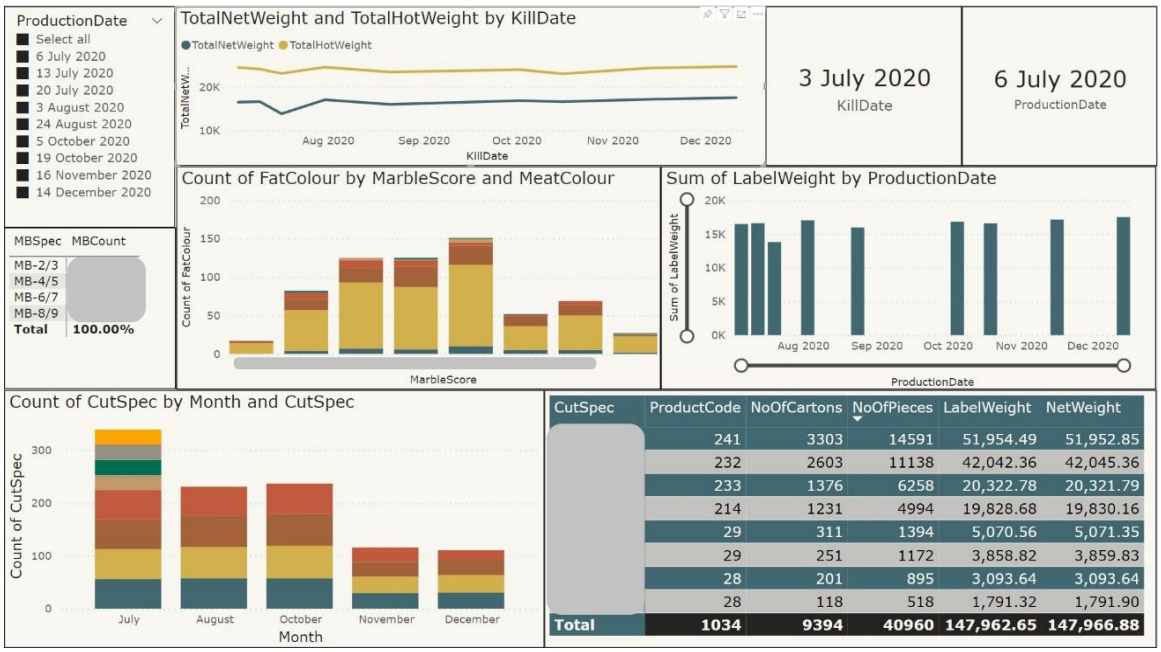


Figure 5 - Production and Cut Specification

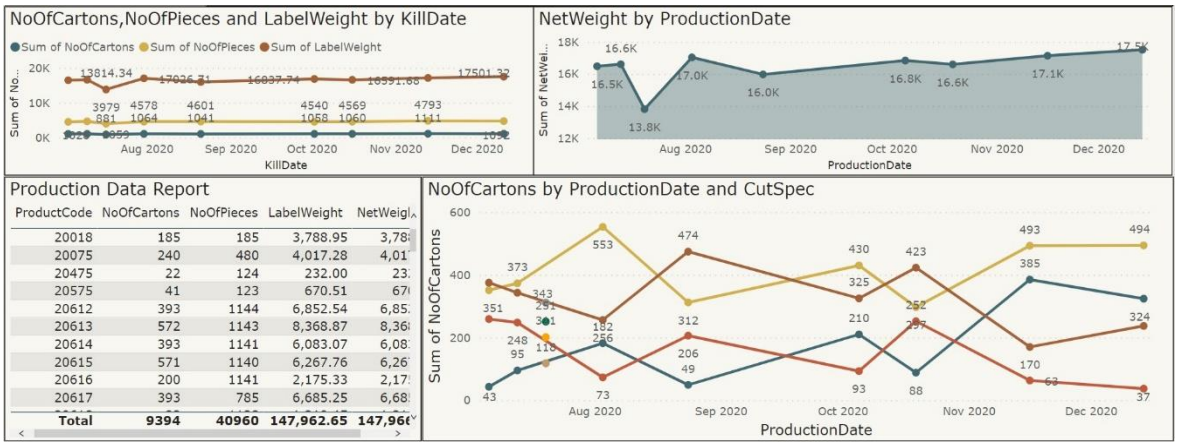


Figure 6 - Marble Grading

Figure 7 - Marble Score Specification

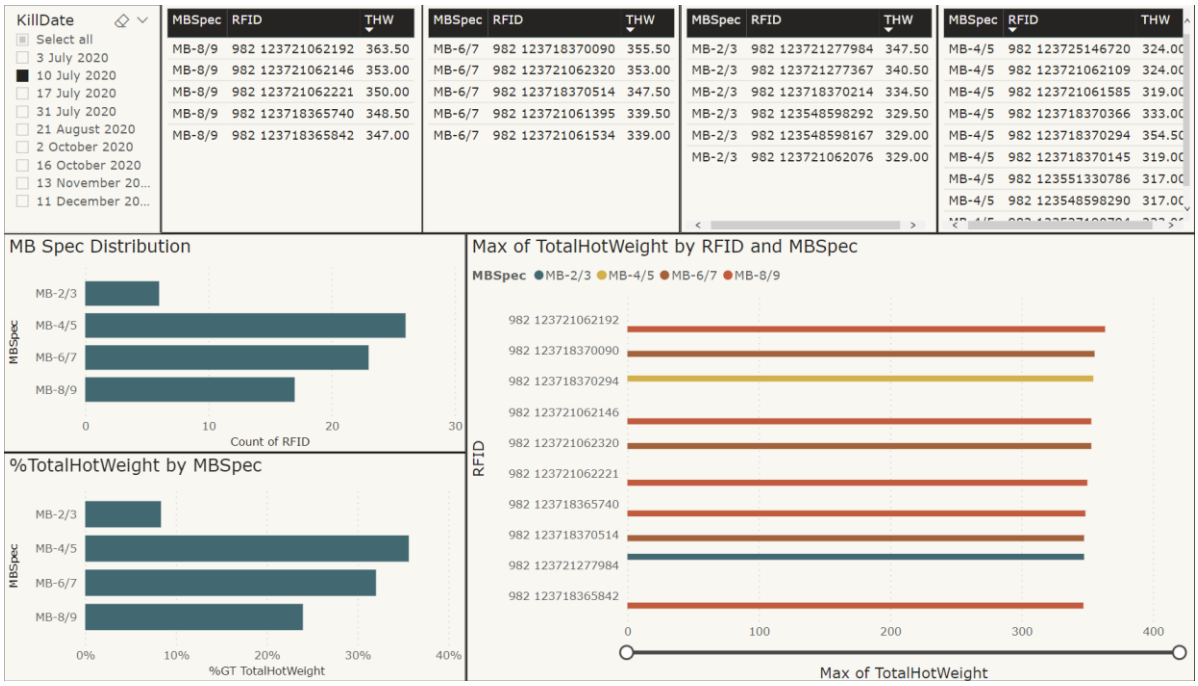
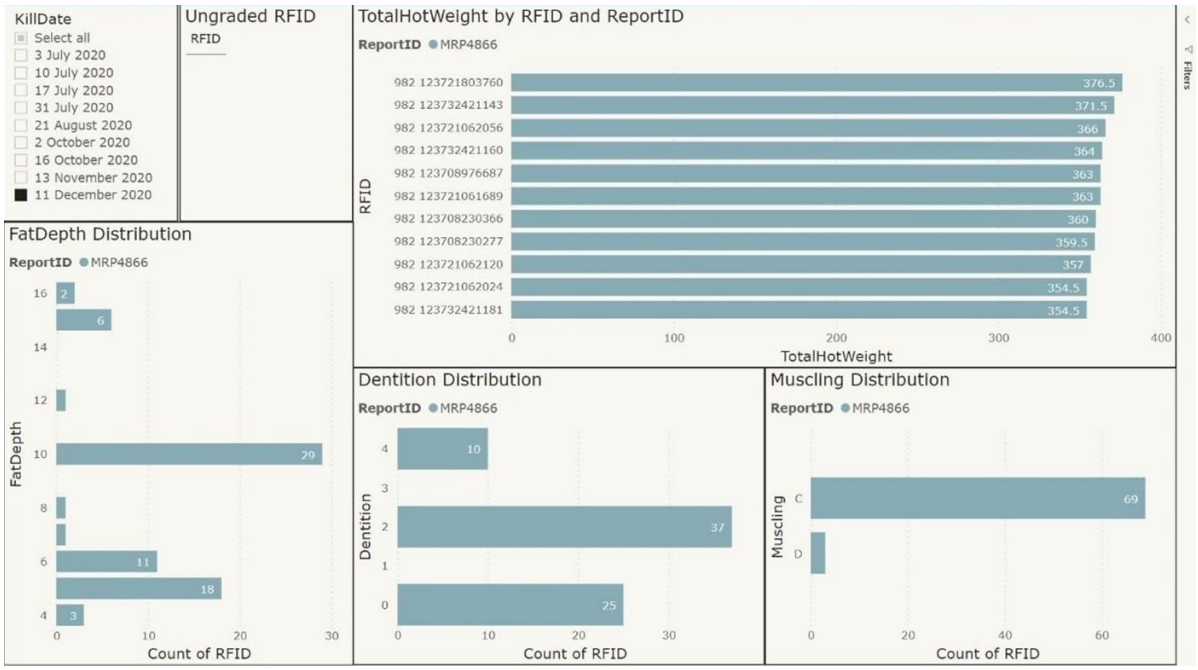


Figure 8 - RFID Animal Data



4.2 Scoping studies

4.2.1 Blockchain

For the purposes of this scoping study on industrial blockchain for data verification, AxisTech held discussions with Ripe a provider of blockchain solutions within agri-food supply chains. Together with industry participants such as Paraway Pastoral, Jack's Creek and the Northern Co-Operative Meat Company Ltd. (NCMC) Ripe have previously partnered with MLA around generating insights into the red meat supply chain data flows.

Blockchain has the potential to offer added functionality in augmenting AxisStream's capability by enabling external third parties to transact data with growers and processors, using a distributed ledger.

Developing an integration between Ripe and the AxisStream platform, producer data can be reused and shared for independent verification on producer claims regarding quality, animal welfare, provenance, and genetic blood stock which would result in improved customer and supply chain assurance.

The below table lists the potential stakeholders identified during this blockchain scoping study.

Table 4 – Stakeholder Parties

Stakeholders	Detail
Producers	Stone Axe Pastoral
Data Management	AxisTech – AxisStream Data Management Platform
Blockchain	Ripe.io (Mitch Grosky)
Feedlots	WA, QLD
Processors	WA, NSW, QLD
Cold Storage	Americold
Exporters	Export documentation Bill of Lading Export Slaughter Interval (ESI)

Collaborative Immutable Verified Data

Blockchain can facilitate collaborative supply chain activities from multiple participants and organisations to create individual, auditable and immutable (unchangeable) records. It does so by enabling two or more parties to interact and contribute along the supply chain as peers, without one person or party having control over the other. Value can be derived from increased efficiency, traceability, the ability to analyse product safety, quality, and sustainability with verifiable data.

Each party would have a node developed in the blockchain platform, with individual user accounts and ledger. The user accounts would also be given private and separate encryption keys to ensure they're secure. Participants' data is therefore secure and only available to others if it has been purposefully shared.

Ripe.io noted in their publicly available final report on MLA project P.PSH.1193 – supply chain for the 21st Century in Australia, 2020 that their pilot used only 448 animals due to some issues they faced such as:

- Laborious manual process for participants to create the data extracts
- Variations in tabular format between individual data files

The above challenges in Stone Axe's case are mitigated through its use of AxisStream for its data management. AxisStream standardises, digitises, and stores all of Stone Axe's production data making it easily accessible and interoperable for use in a blockchain methodology.

Sustainability and Environment

Sustainability in the red meat industry requires the production of red meat in a socially, environmentally, and economically responsible way. To achieve this, producers must continually improve their usage of natural resources, foster health and welfare of animals all while listening and responding to community sentiment about meat production.

MLA's target to reduce greenhouse gas emissions in the Carbon Neutral by 2030 (CN30) initiative, means that the red meat supply chain will require suitable technologies to capture, store, analyse and report on operational data in relation to environment and economic targets. In addition, carbon neutral certifications are now available (Climate Active) and organisations who wish to be certified must meet the Climate Active Carbon Neutral Standards which necessitates calculating greenhouse gas emissions and natural capital accounting.

Some of the benefits to setting the carbon neutral target include reaching established markets for low and zero carbon red meat products and livestock selection to increase production and reduce methane emissions. Stone Axe's initiative in digitising their business using AxisStream has resulted in their data being standardised, accessible, re-usable and interoperable. Should Stone Axe wish to demonstrate or report on their sustainability practices or claims, a blockchain solution linked to the AxisStream platform can be used to provide verifiable, secure, and immutable evidence.

The potential applications and uses of blockchain within Stone Axe Pastoral's operations were explored during the study and are listed in the below table (Table 5).

Table 5 – Blockchain Uses and Applications

Uses and Applications	
Automation of data flows	• Data from Stone Axe to meat processors • Data from processors to Stone Axe • Data from Stone Axe to retail consumers, wholesale and export • Export data and documents easily viewable and accessible to Stone Axe
Document uploads	• Easily accessible web interface • Customisable visibility and accessibility for each document based on type requirements
Cold Storage	• Cold chain management data
NLIS (National Livestock Identification Scheme) Database	• Livestock movement data for all animals
ICS Integrity Systems	• Livestock Production Assurance (LPA) • National Vendor Declarations (NVD)
National Feedlot Accreditation Scheme (NFAS)	• NFAS accreditation for feedlots

Meat and Livestock Australia (MLA)	• Aggregated data for analysis – national and state levels

The potential benefits from implementing and deploying blockchain within the Stone Axe business are detailed in the below table (Table 6).

Table 6 – Blockchain Potential Gains and Benefits

	Gains and Benefits
Stone Axe Brand	• Increased transparency and customer messages • Improved brand trust • Supports traceability • Improving sustainability
Exports and Docks Team	• Improved document control • Improved data and information flow • Increased visibility and accessibility regarding compliance and regulations
Internal Processes	• Evaluation of performance, efficiency and value derived across all properties and genetic lines • Lifecycle traceability • Better efficiency generating and management data, documents and digital records • Improving recall processes – no longer reliant on chasing up records internally or externally
Food Safety	• Visibility of chemical use • Monitoring use of animal treatments (i.e., vaccinations and treatments)

A conceptual framework for a blockchain web interface is illustrated in Fig. 9 and the data sets identified along the supply chain are detailed in Fig. 10.

Figure 9: Block Chain Web Interface View & Flow for Supply Chain Participants

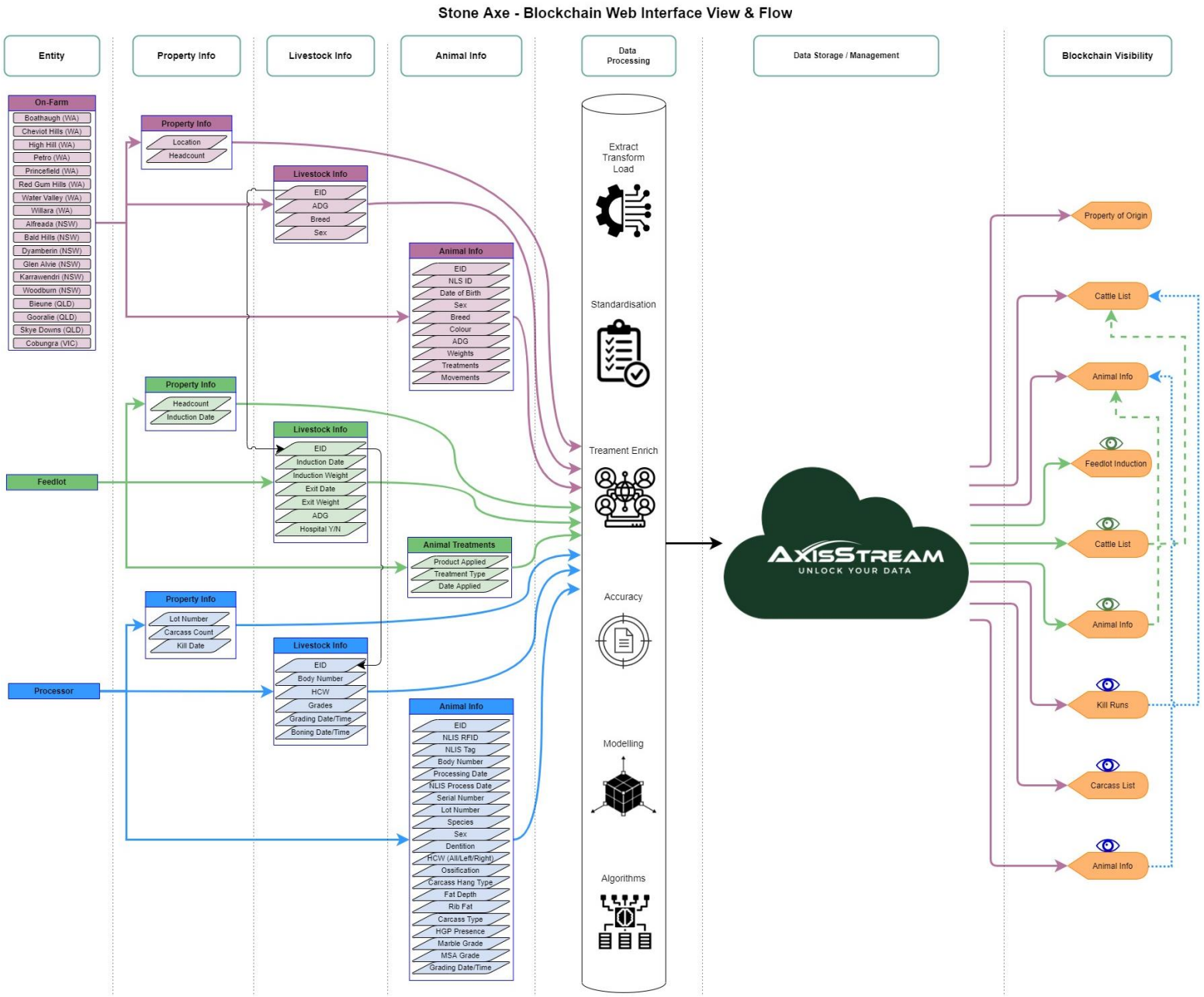
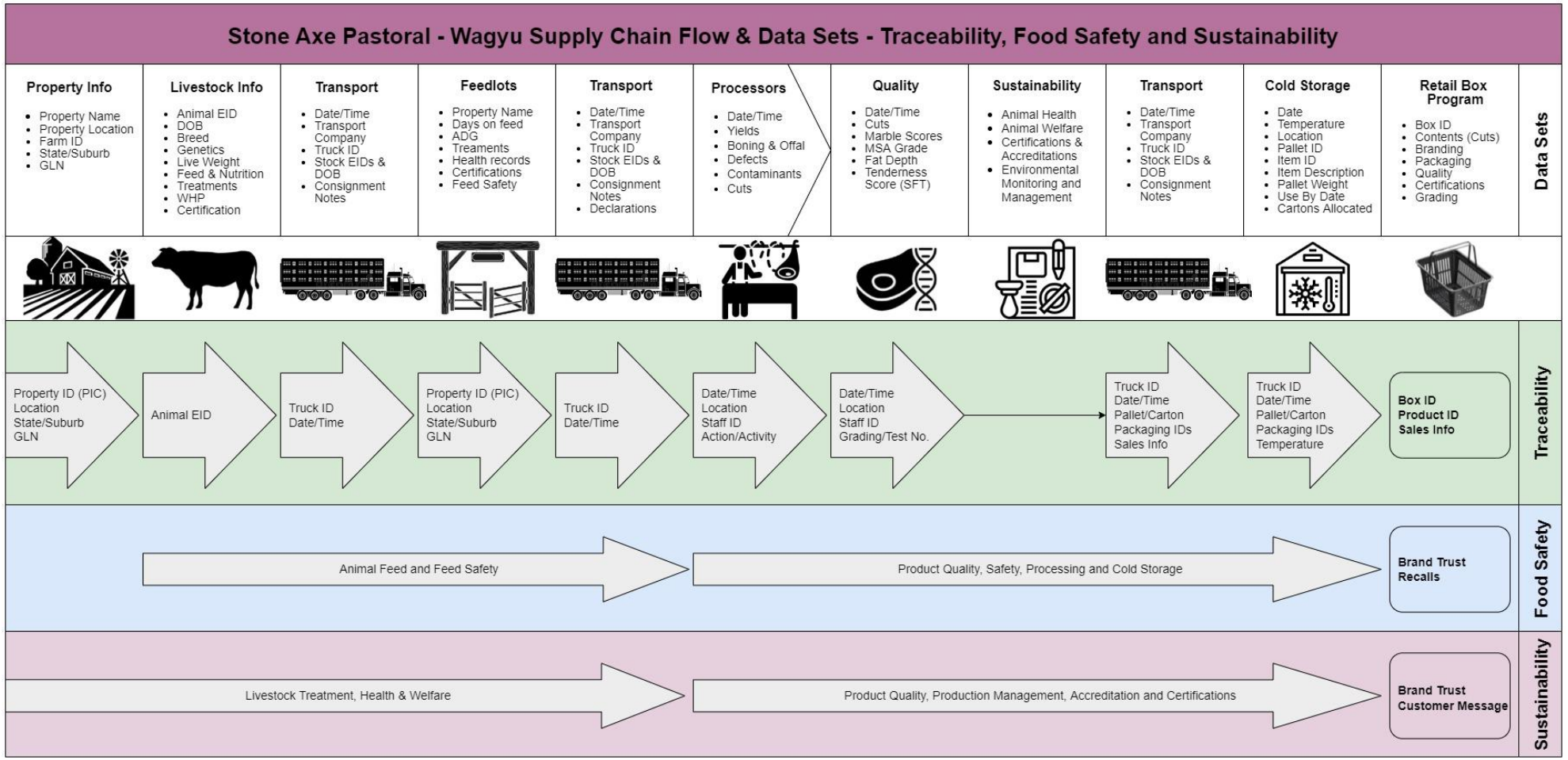


Figure 10 - Supply Chain Flow and Data Sets



4.2.2 Meat processors

As part of this scoping study, AxisTech aimed to have discussions with some of the meat processors that Stone Axe Pastoral utilise in their wagyu production system. AxisTech were successful in engaging with Harvey Beef (WA) to scope the requirements for data transfer of relevant datasets.

The below table outlines the key stakeholders identified during the meat processor data sharing scoping study.

Table 7 - Meat Processors Stakeholders

Stakeholders	Detail
Producers	Stone Axe Pastoral (Prime Wagyu Producer)
Processors	Harvey Beef (WA)
Data Management	AxisTech – AxisStream data management platform
Exporters	Traceability and verification of product information
Retailers	Product assurance and brand confidence
Consumers	Traceability and verification of product quality and safety
Feedlots	Carcass grading feedback valuable for ration/feed budgeting analysis and overall operational performance
Breeders	Valuable feedback on meat processing data on genetic lines
Grower Groups	Potential benchmarking opportunities

AxisTech undertook a supply chain data mapping exercise which provides an overview of Stone Axe's supply chain from breeding to meat processing which is outlined in Fig. 11.

Harvey Beef do not currently provide feedback on feeder cattle. They aim to do this in the future through a feedback portal which they've previously trialled. This will allow customers to access the meat processing data (kill sheets) for their livestock online rather than using the current method of email attachments.

Ideally this feedback portal will have an API function to transfer data to and from other sources. While an API could be a possibility, they envisage that an export and/or reporting function would be available once the portal is ready to deploy. Stone Axe and AxisTech are both interested in providing feedback on the portal such as pilot testing or co-design and feedback.

The advanced uses and applications such as this, is illustrated in the diagram below (Fig. 12).

Figure 11 - Stone Axe - Supply Chain Overview

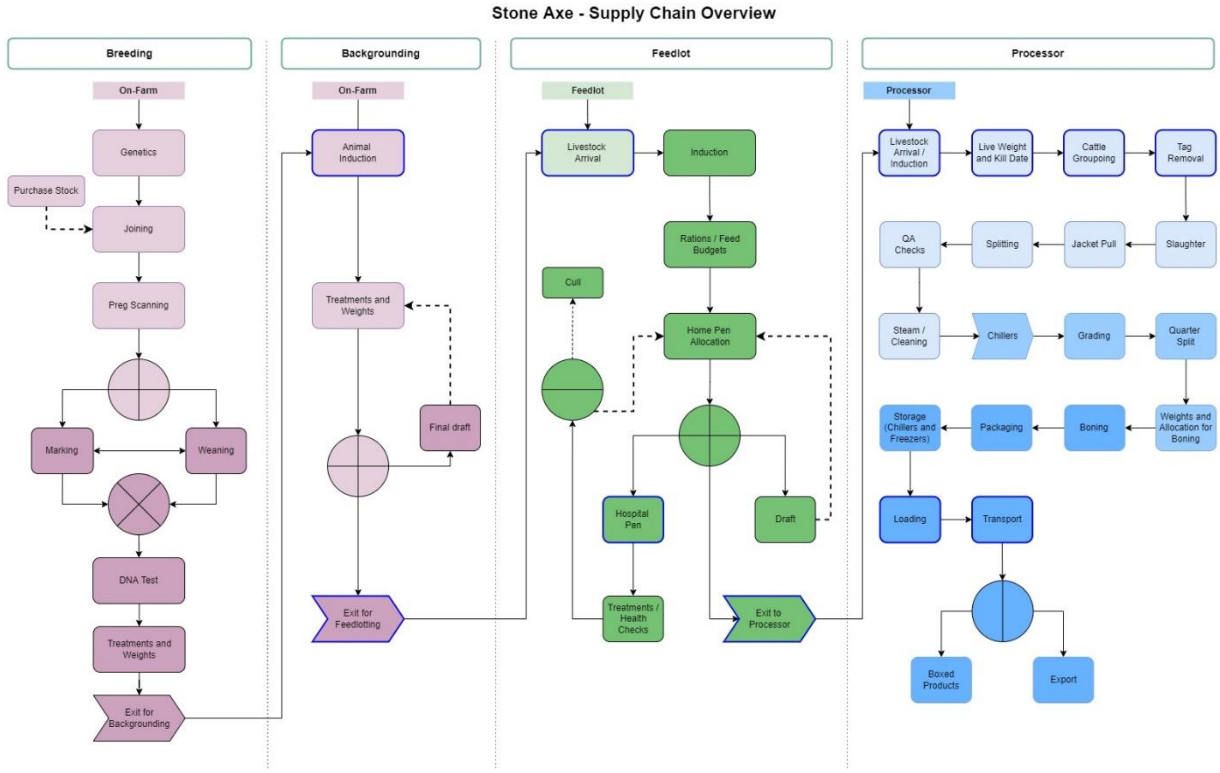
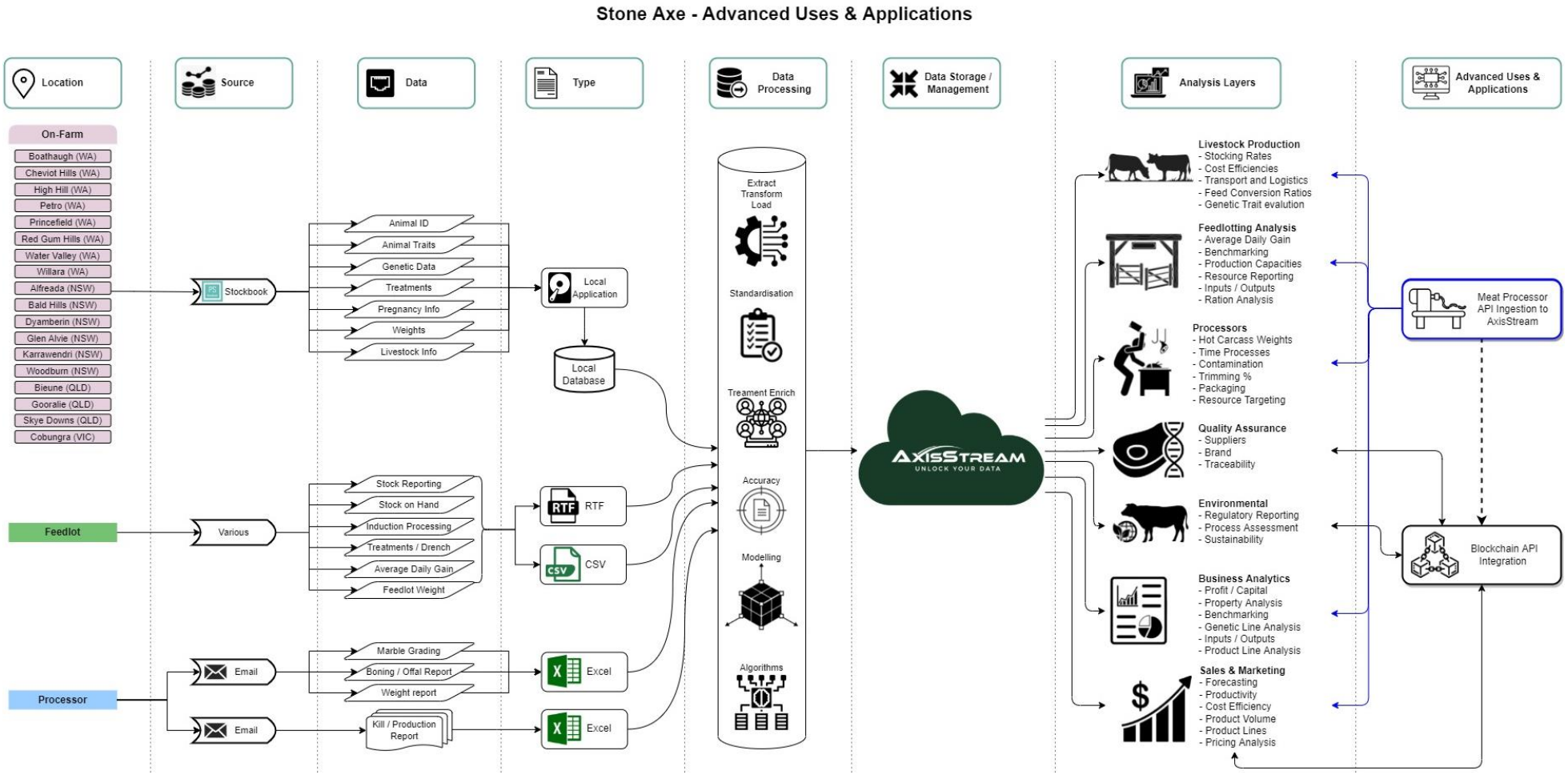


Figure 12 - AxisStream Advanced Uses & Applications



4.2.3 Data sharing

The below table lists the potential stakeholders identified during the data sharing scoping study.

Table 8 – Data Sharing Scoping Study - Stakeholders

Stakeholders	Detail
Producers & Breeders	Stone Axe Pastoral: • Business Managers • Sales and Marketing Managers • Livestock Production Managers • Operations Managers • Regional Farm Managers • Production and Sales Co-Ordinators • Commercial Managers
Data Management	AxisTech – AxisStream data management platform
Meat Processors	• Stone Axe Meat Processers WA, NSW, QLD • State Processors Benchmarking (de-identified data streams)
Cold Storage	• Americold
Feedlots	• Stone Axe Feedlots • Regional Feedlots Benchmarking (de-identified data streams) • State Feedlots Benchmarking (de-identified data streams)
Producer/Grower Groups	• Regional Benchmarking (de-identified data streams) • State Benchmarking (de-identified data streams)

For each grower and business operation within the supply chain, benefits can include the ability for farm records, production data and device data to be centralised into one data management platform. Data is ingested and standardised into a uniform data model (industry or global standard) with data ownership, possession and control maintained at an individual farm or business level.

Visualisation of dashboards and reports enables the analysis of data across all business data sets. Users can conduct their own research and analysis to highlight gaps in their data, gain insights at farm or operational levels which leads to more informed decisions and improvements in business outcomes and operational performance.

Potential uses and applications that were explored are summarised in the below table (Table 9).

Table 9 - Potential Uses and Applications of Data Sharing

Uses and Applications	
Ease of access and flow of data	• Data to and from Producers/Feedlots/Processors
Benchmarking (de-identified)	• Regional and State Levels • Sales and Market Pricing • Average Liveweights (LW) • Growth Rates

	• Weaning Rate Average • Hot Carcass Weights (HCW) • Weather Data • Cold Chain Management • Biosecurity • Sustainability
Collaboration Projects	• Growers and producers • Producer and grower groups • Group and regional research and trials • Natural Resource Management • Research Institutions • Government
NLIS Database	• Livestock movement data for animals • Scheduled exports or possible integration of data
ICS Integrity Systems	• Livestock Production Assurance (LPA) • National Vendor Declarations (NVD)
Meat and Livestock Australia (MLA) Database	• Aggregated data for analysis – national and state levels • Access to shared relevant data sets in future projects/research

The AxisStream solution also provides the opportunity to utilise its unique data sharing and data communities' capability. Discussions with Stone Axe's management team validated the opportunity, requirements and applications of this functionality within the Stone Axe business. Several use cases for data include:

Sales and market pricing
Stone Axe consistently review their pricing according to supply and demand affects along with other mitigating factors, there is little understanding about the broader market in order to make informed changes to pricing. There is no current way to see how their prices compare with the rest of the wagyu market to determine if they're on the high, middle or lower end of market prices.

Therefore, the possibility of benchmarking their business against other wagyu producers' sales and pricing would be beneficial to internal processes and decision makings in relation to future market considerations. However, it is understood that much of the wagyu beef industries trade and business is confidential and essentially 'behind closed doors', having this information in a de-identified at a national level and without cut specifics, could potentially ease the reluctancy in providing such data.

Production data
Valuable on-farm data from other producers that Stone Axe believe would benefit their business include:

- Growth rates
- Weaning rates
- Feed lotting data
- Weather (rain, temperature etc.)
- Soil data

Stone Axe have previously considered if there is a correlation between decreases and increases in ADG relating to changes in weather conditions, and access to additional producer data could assist them in assessing such interactions further. In addition to this, feed ration information is currently sent out in invoice form. This results in a laborious and manual process to utilise this information, thus the potential to have such data consistently sent into AxisStream would be highly beneficial.

Access to this type of data would also provide additional benchmarking opportunities during each production cycle/season to see how they are progressing compared to other growers through visualisations and dashboards displaying de-identified data.

For example, Stone Axe discussed the abnormally cold wet winter WA experienced with other companies in which little to no growth occurred within their feedlots. Such discussions tend to occur at the conclusion of seasons and/or at grower group meet ups rather than in situ. Thus, having access to this type of shared data streams, organisations could have an efficient and easy way to compare their current progress against other producers in their region.

Regional growers/producers
Stone Axe are members of a number of grower and producer groups. The farming industries these groups cover differ by each region of operation and there are few that are Wagyu specific. However, Stone Axe acknowledges they could take more advantage of these groups by engaging in the common farming factors such as weather and land management, with the primary value to them coming from data and analysis.

In addition to the on-farm production data as noted above additional information perceived to be beneficial include:

- Fire events or risks on neighbouring farms
- Water assets available in the event of fire
- Pests and diseases (de-identified)

Access to this information can assist in mitigating the spread of fires and increasing farmers preparedness in the event of fires. AxisStream's communities and data sharing technology would be of high value in assessing outcomes and reaching goals/targets within these groups.

Animal transfer and processing data
When cattle have been processed the 5th quarter is kept by meat processing facilities, however this differs from state-to-state and by processor. Stone Axe would be interested in receiving data for the entire lifecycle of their animals and to understand the percentage that is retained for their in-house box food products.

Cold chain
Beneficial cold chain management data could include:

- Shelf life
- Calculators
- Measurements (i.e., length of time in cold storage)

Again, this information could be used to assess their products performance against others in the industry and enable more informed decisions within their cold chain management.

Buyers and end point customers
There is currently a big push for traceability in the red meat industry, however to-date, Stone Axe has not invested in such capability. This is due to the perceived lack of market demand. Stone Axe has developed a certain level of trust between themselves and the limited number of wholesalers they use, along with their direct relationships with end point customers.

Stone Axe do not currently provide animal data to their customers but believe it would be beneficial to do so and have considered the possibility of providing product authenticity information such as:

- Geographical regions
- Age of animal/(s)
- Nutritional information (grain, grass fed etc.)

While Stone Axe would like to provide the age of animals to their customers, they acknowledge that there is a gap in traceability when animals are processed resulting in more than one animal in packaged boxes. This break in traceability would need to be addressed in order to provide such animal data to their customers.

Stone Axe understands that for them to branch out to more customers and potential markets, having this traceability in place would be highly beneficial.

Meat processing data
The main challenge is that data is delayed, lacking consistency or provided with poor accessibility by meat processors, and it would be beneficial to have this data provided automatically.

If meat processors provided information on yields and marble scoring, this would be valuable information for benchmarking. Given the small number of Wagyu producers in WA, to de-identify information, a wider pool (possibly nationwide) would be required to ensure producers could not be identified.

Sustainability
Sustainability data is key to participating in carbon neutrality programs and demonstrating traction against specific targets such as MLA CN30.

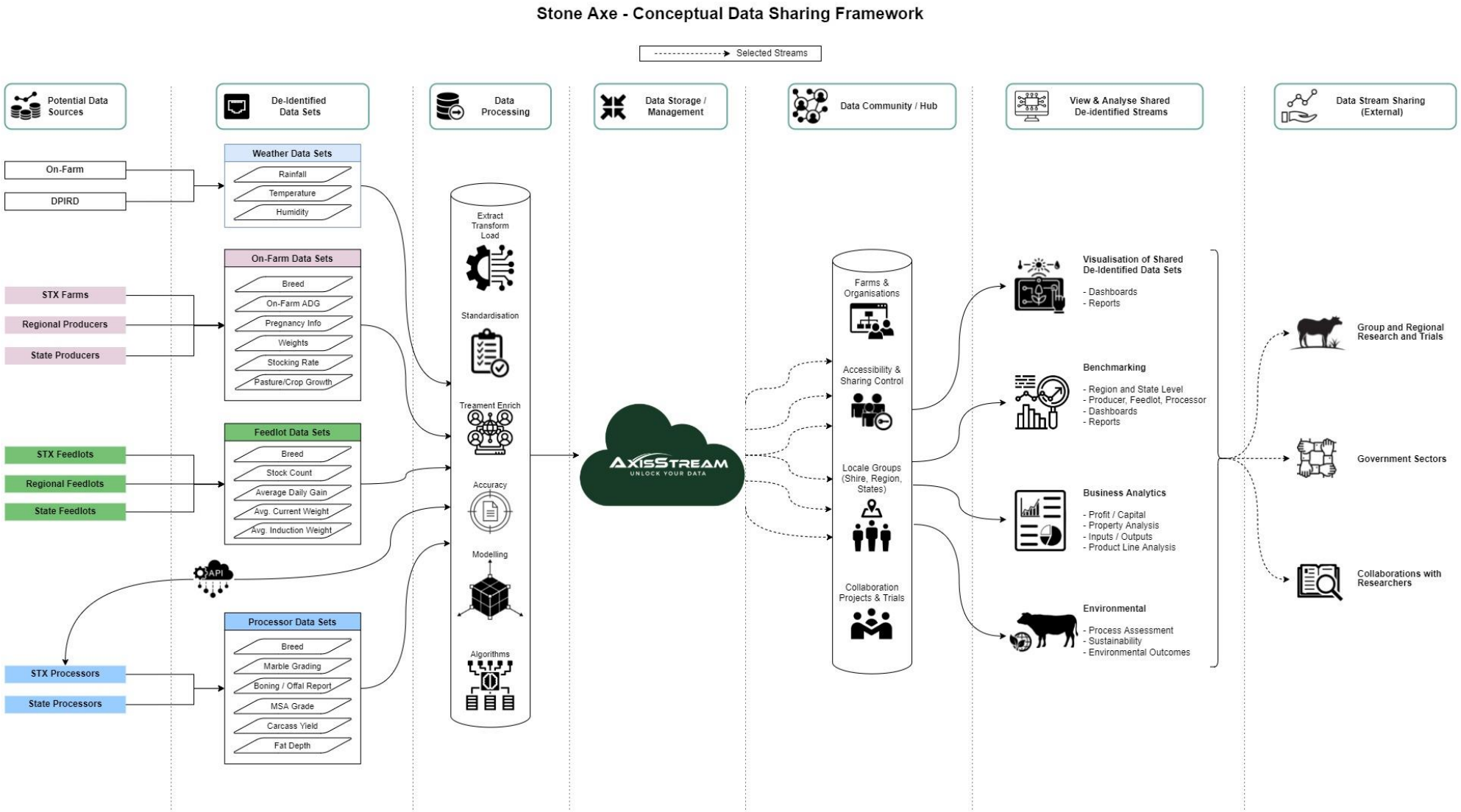
Stone Axe is aware of upcoming sustainability challenges and its potential impact as future drivers in the red meat industry, however there is no clear indication as to what this may entail or what producers will be required to undertake. With this in mind Stone Axe are currently participating in sustainability projects and continue have discussions regarding sustainability strategies as part of their business management and development.

Biosecurity
Biosecurity data is valuable to growers and producers in a number of circumstances. Use cases include:

- When purchasing a business or property the historical information would form part of their decision-making process.
- Disease incidence and management at either regional or shire levels would assist in the management and prevention of diseases and pests.

A conceptual data sharing framework was explored and illustrated in Fig. 13.

Figure 13 - Conceptual Data Sharing Framework



4.3 Case studies

Towards the completion of this project Stone Axe provided AxisTech with additional feedlot data, which enabled the exploration of certain use cases. This data was transformed and ingested into AxisStream which was then utilised by Beanstalk AgTech for the outcomes delivered in the below case studies.

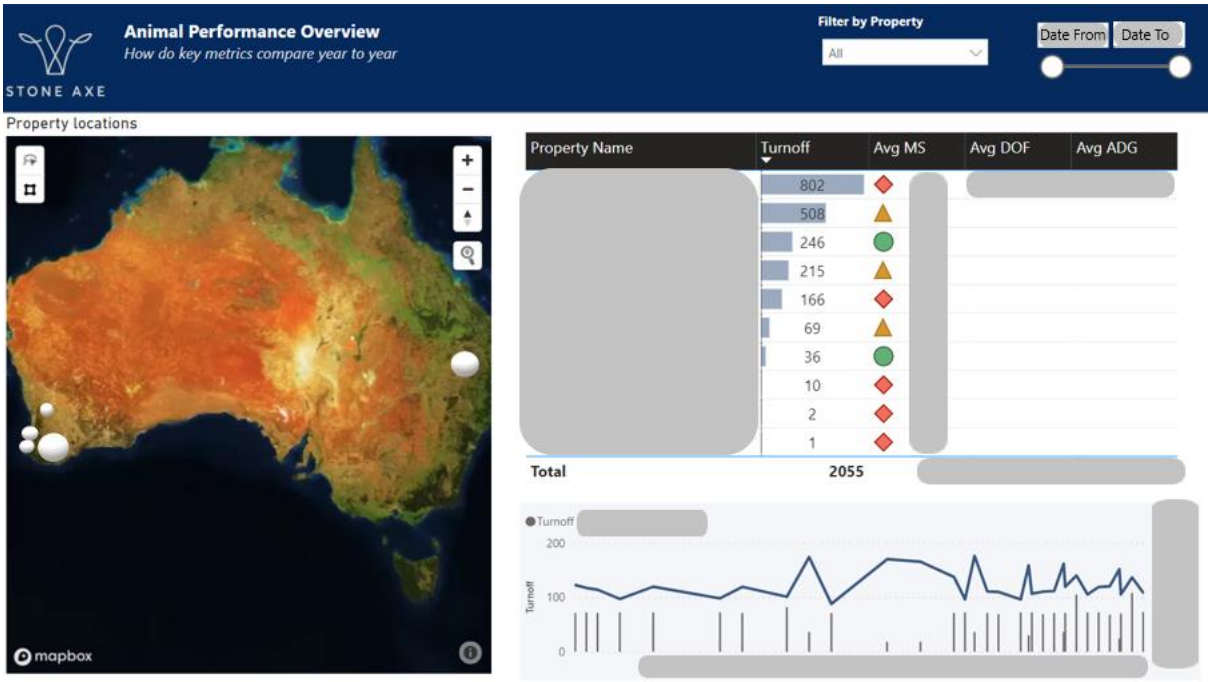
4.3.1 Management overview dashboard

The Animal Performance Overview dashboard (Fig. 14) shows a summary of key metrics across different Stone Axe properties over time. This landing page allows the Stone Axe management team to quickly compare animal performance between different properties, and to analyse how these have changed over time. This provides management with a starting point to quickly compare historic performance with actuals and simplifies the reporting process back to key stakeholders.

The left-hand side of the dashboard shows a view of all the locations around Australia that are included in the dashboards, with the right-hand side showing a summary table including turnoff, average marble score, average days on feed and average daily gain for each of the ten properties included. The line graph below the summary table shows how average marble score has changed over time and the columns in the chart shows the date and size of each kill. The dashboard can be filtered by property and date to highlight the data for one property over a given period of time.

The data for this dashboard comes from a summary of both kill sheet/boning ("performance") and feedlot data, using cattle EID to link each animal from the performance data back to feedlot data. This requires years' worth of data to link specific EIDs as most animals spend ~350-400 days on feed, and the induction weight and date for each needs to be captured. This can currently be achieved for one feedlot however with the ingestion of extra data could be accomplished for all properties.

Figure 14 - Management Overview Dashboard



4.3.2 Marbling score dashboard

The Marbling Score Dashboard gives the Stone Axe management team an in-depth view of how marbling score varies over time and across properties. This allows for analysis of how the distribution of marble score varies for each kill and for each property and forms the basis for both historic investigation on discrepancies as well as accurate and reliable forecasting on expected revenue generation per property and indeed, across the Stone Axe portfolio.

The left-hand side shows a table of year, count of animals and average marble score, and a bar chart showing the overall distribution of marbling score along with the count of animals for each score. The large, stacked column chart shows how marble score distribution varies per month, with each block of colour representing a different score from 2 to 9. The red line shows how average marble score changes over time. The score cards along the bottom show the average marble score for each of the ten properties. This dashboard can be filtered by to show a deep dive on marble score for each property, as well as show the percentage distribution of marble score over time. The data for this dashboard comes from the performance dataset and uses PIC number to link each animal back to each property.

Key decisions that can be made from this dashboard are around identifying any properties or kill dates that have significantly lower marble score and taking steps to investigate why this occurred. It also allows Stone Axe to predict/forecast likely performance at each location and forms the foundation of more accurate sales decisions.

Figure 15 - Marbling Score Dashboard 1

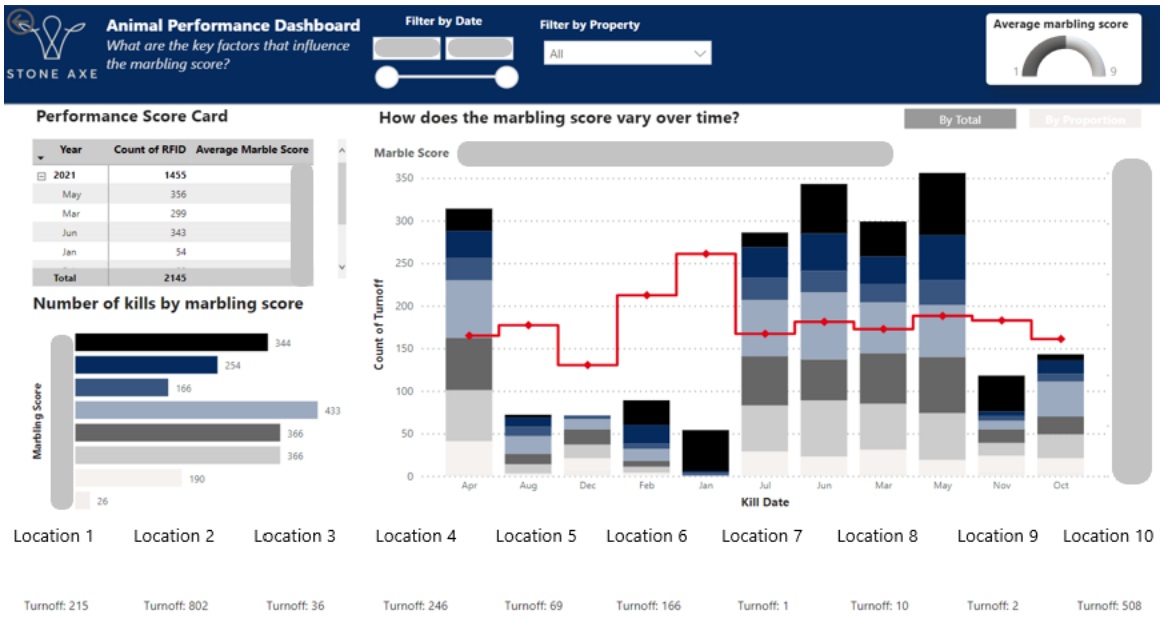
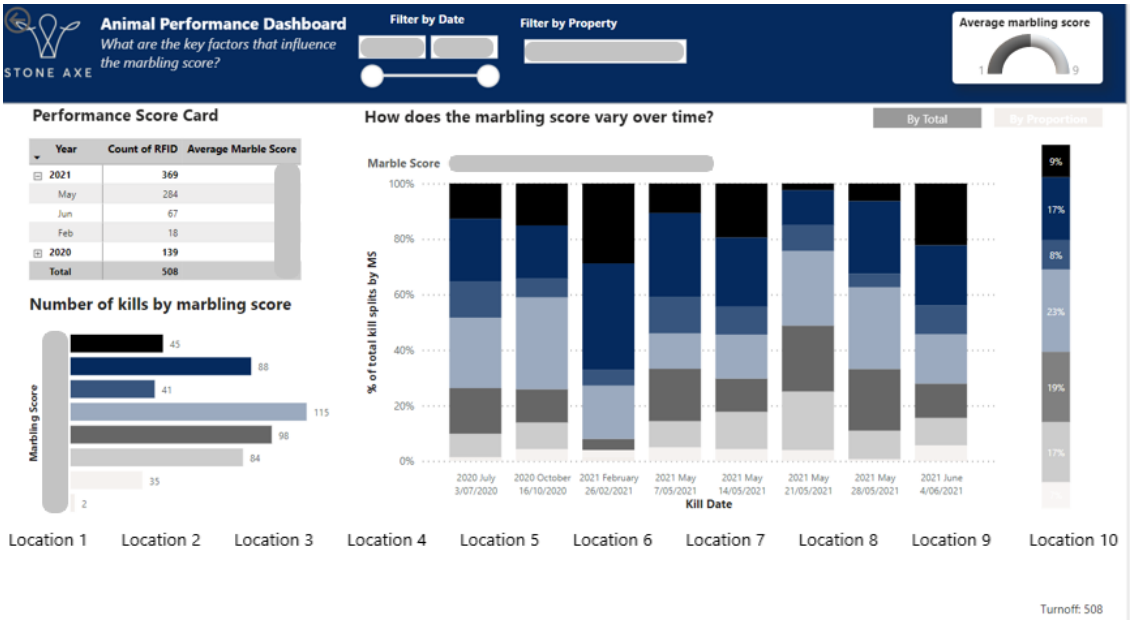


Figure 16 - Marbling Score Dashboard 2



4.3.3 Weight gain dashboard

The Weight Gain Dashboard shows the feedlot induction weight distribution and hot standing carcase weight (which has been used as a proxy for feedlot exit weight) distribution in combination with marble score to analyse how weight and marble score vary. The purpose of this dashboard is to uncover insight into the relationship between marble score and weight gain in the feedlot.

The two column charts show weights bucketed into ten-kilogram categories with the colour banding representing marble score. This view makes is easy for trends to be identified in marbles score amongst different weight groups. For example, there is a general trend of higher marble score in the higher weight categories. Key decisions that can be made from this dashboard are around what is the ideal entry weight for an animal to achieve a high marble score as well as what is the best exit weight.

Figure 17 - Weight Gain Dashboard

4.3.4 Genetic performance dashboard

The Genetic Performance Dashboard is a critical dashboard that forms the basis of herd improvement. It can be used by Stone Axe's genetics and breeding managers to identify top performing animals across key performance metrics. The dashboard shows the relationship between average daily gain and days on feed, hot weight, and entry weight, with colouring to indicate the marble score of that animal. The table on the dashboard makes it possible to rank the RFIDs of animals and identify the top performing genetics in the herd.

By analysing the three scatterplots, trends in performance can be identified, such as those animals that had a high average daily gain and low entry weight tend to have a higher marble score. By understanding these trends, better decisions can be made around target average daily gain, days on feed, entry weight and hot weight. Most importantly this allows the Stone Axe management team to identity animals that performed well (highest revenue) for the lowest days on feed (lowest cost). Stone Axe can then identify the genetic lines it wishes to extend. On the flip side it also allows Stone Axe to identify the worst performing, highest cost genetic lines to remove.

The data for this dashboard comes from linking feedlot data with performance data to relate how feedlot variables affect marble score. This dashboard would become even more useful by ingesting further data over a longer time period and increasing the animal sample size.

Figure 18 - Genetic Performance Dashboard

4.4 AxisStream

AxisTech has further developed the AxisStream platform to provide users with the capability to upload their own data and documents into their respective projects. AxisTech is currently in the process of developing an automatic client onboarding process, including an automatic processing of uploaded data and documents.

Stone Axe provided valuable feedback about their experience with the AxisStream data management platform. They see the value that the platform brings to their business with the ability to unlock data and enable reusability of data. Being such a large and separated business, the collection of data has been quite difficult and AxisStream has solved this challenge and enabled the consolidation of data into one database owned and controlled by the business. This provides the ability to perform analysis and reporting throughout the business and help with improvements to business operations and performance. To further enhance the benefits of AxisStream to the business, Stone Axe have provided the following suggestions:

- Pre-scheduled training session prior to deployment within the business
- Getting started guide with step-by-step instructions on where to find tools and features and functionality
- On-going follow up meetings pre-scheduled after initial sending of log in details (i.e., remote meetings using screen share to provide additional training and support.
- Sequenced emails and notifications to assist in customers journey (i.e., "Did you know you can upload your data directly from your account?", "How are you finding AxisStream? We'd love to hear your feedback" etc)
- Further development of AxisStream to become more user orientated so that it can be easily implemented into the business.

Stone Axe has indicated that they are happy to provide ongoing feedback regarding AxisStream's user interface and functionality.

Any future ongoing projects, it is essential for the AxisStream platform to be developed in a more user orientated way so that it can be implemented as a business

5. Conclusion

AxisStream is a powerful data management system that enables whole-of-business data to be digitalised, ingested, standardised to a uniform high-integrity data model (industry or global standard) and stored in a grower/processor owned data store. For the project *Digitalisation Pilot of Operation and Supply Chain Data Management*, AxisTech partnered with Stone Axe Pastoral Company an Australian ultra-premium quality, cross-bred and full blood Wagyu producer. Stone Axe has a range of data inputs from across its operations that were ingested into the AxisStream data platform and then utilised to demonstrate valuable outcomes.

This well organised and structured data has become the building block for Stone Axe to enable digital operations and realise a range of valuable business outcomes.

Now that Stone Axe's digital foundation has been established, their operational data can be utilised in multiple ways. They can now leverage this data for visualisations, insights, and analysis to support decision-making, collaborating with partners, demonstrating compliance, value-add uses such as processing through third party algorithms and machine learning tools and much more. This digital building block facilitates the reuse of data where data can be selected by the user for data sharing purposes. By using this data sharing functionality within AxisStream, collaboration can occur with industry groups, supply chain participants and researchers, or to enable commercial transactions with external third parties.

AxisTech is continually improving and developing the AxisStream platform, a recent example of this relates to its data sharing capabilities. As part of *The Australian Agrifood Data Exchange Project*, AxisTech completed a "Grains Benchmarking Experiment" which was facilitated using the AxisStream platform. Part of AxisTech's project included an experiment for "Voluntary benchmarking for

comparisons and decisions, the outcomes of which verified its applicability as a data sharing solution across industries and throughout the supply chain.

The experiment provided farmers with personalised contextualised recommendations to improve their outcomes around yield and profitability. A granular rainfall to soil-type correlation model was also developed to provide a baseline range, along with inputs and considerations for improvement.

This work validated the data exchange platform to allow growers to measure the impact of inputs and weather conditions on yield in real time through the captured rainfall and soil data as a time series set (as opposed to an average taken for the season).

AxisTech successfully demonstrated the capabilities of AxisStream and how the methodologies for conducting permissioned transactions by growers could be executed for benchmarking using its data sharing features. AxisTech is both eager and capable to progress with data sharing projects to enable agricultural enterprises to better understand their own operational and production processes and performance within their industry.

5.1 Key findings

5.1.1 On-farm and off-farm data

Stone Axe Pastoral have been considering possible synchronisation technologies within their business for some time. During their onboarding into AxisStream we identified that a synced database into Stockbook would be highly beneficial for their business process and streamlining their data flows.

This could lead to the development of a widget tool for Stockbook within the AxisStream platform in order to send information back into their Stockbook account.

5.1.2 Scoping studies

5.1.2.1 Blockchain

Digitisation process and management is the building block to getting data transformed, standardised and accessible to implement into blockchain (Ripe.io®). Having the datasets ready in this way within AxisStream allows the sending of relevant streamlined data into the supply chain and beyond the current limits of Stone Axe's organisation.

It also enables and supports the data flows into other areas with feedback loops into Stone Axe's current data management system therefore establishing interoperability and reuse of their data.

In order to determine how blockchain can be implemented within the business, an extensive data discovery session with Ripe.io® could potentially be undertaken. However, this is likely to 'be an expensive exercise'. As AxisTech and Stone Axe have already completed a thorough data mapping processes during this project, the overhead cost would be significantly reduced.

Future steps required to incorporate blockchain and digital distribution ledger into the Stone Axe Pastoral business include:

- Engagement of cold chain company Americold to scope the requirements to integrate Stone Axe's cold chain management data with AxisStream and blockchain/supply chain distribution ledger tools.

- Engagement with NLIS to scope feasibility of a potential integration with blockchain. Alternatively, gain access to NLIS export for Stone Axe livestock data.
- Establish implementation and deployment plan with Ripe.io to develop a web interface and tools needed to integrate blockchain platform with AxisStream; and determine associated costs
- Further software development within AxisStream to enable the sending and receiving of required and relevant data into blockchain.

5.1.2.2 Meat processors

The endeavour to establish traceability and data flow along the red meat supply chain is multifaceted and will require the collaboration of all key parties. AxisTech encountered two distinct and contrasting sentiments while undertaking the engagement process of meat processors to participate in this study. The first standpoint was enthusiastic, transparent, and willing to participate in a collaborative effort to achieve mutually beneficial learnings and outcomes. The other was not only unwilling to take part, but also rejected the opportunity to contemplate the potential talking points, prior to making the decision to participate. Therefore, it is apparent that there are high levels of concern around privacy when dealing with technological solutions relating to operational and production management.

AxisTech plans to continue discussions with Harvey Beef regarding their feedback portal and hope to establish a connection between the portal and AxisStream via API. Further development work will be required both at Harvey Beef and within the AxisStream data management platform.

5.1.2.3 Data sharing

This scoping study provides context to the opportunities and challenges facing the red meat industry in sharing data.

Stone Axe provided AxisTech with some valuable feedback on this data sharing study including insights regarding the potential next steps.

Producer Participation

The results and benefits from data sharing can only be as good as the information that is collected, which requires both good quality and quantities of data which can only be achieved from high levels of producer participation:

- **Trust**: It is essential to establish trust for growers and producers to participate in projects and to share their data;
    - Benefit should outweigh any perceived risks
    - It is important that key attributes have a granular level of control with the ability to suspend, exit or stop sharing certain data = data ownership and control
    - Stone Axe believe AxisTech has a vested interest in the protection of their data due the commercial risks involved if it is not protected. It is key to communicate this and establish trust for producers to participate in data sharing
- **Producer Time:** Onboarding of producers takes time and requires producers to have time that is available in order to commit with engagement in projects such as this
    - Time of year and grower commitments need to be considered (e.g., harvest, Christmas, school holidays, bushfire season etc)

Value

Producers are motivated to keep their business processes, activities, and data safe within their own knowledgebase. While it would be great to gain industry specific information from their peers, no business will want to lose their commercial edge:

- **Contextualised Data:** Sharing data for benchmarking should be categorised correctly to ensure that it provides the right context e.g., producers using growth hormones would be excluded in Stone Axe's data analysis and visualisations
- **Observation and Perspective:** There is definitely value in understanding their production performance in relation to other producers, in a particular feedlot, region, state etc to support new views and insights rather than going with their "gut feel".
- **Forecasting:** Currently producers tend to communicate face to face when a season has concluded which does not provide opportunities to assess current practices or support decision making during the season. There would be great value in having access to a synchronous and collaborative platform which allows for in season analysis and trends
- **Incentives:** However, producers may require incentives and/or proof of its value. For example, assurance they have control of their own data, evidence-based returns on time and financial investment with documented use cases or case studies

5.1.3 Case studies

The biggest factor to increase the reliability and useability of all these dashboards is more data both across a longer period and across a larger number of properties. The current data set covers 12 months of data from June 2020 to June 2021, with detailed feedlot data only available for one feedlot. By ingesting data over a longer period and across more properties, it would be possible to link more performance data to feedlot data to gain a detailed understanding of how feedlot variables affect key performance metrics.

In addition, it would be imperative to work a broader range of the Stone Axe management team to understand critical pain-points in the decision process (e.g. trust in data, availability of data, reporting formats etc) to ensure each dashboard is fit-for-purpose.

5.1.4 MLA workshops

This project was to include three virtual workshops with MLA, however due to the COVID pandemic and restrictions two of these workshops were cancelled.

The workshop held at the beginning of the project with the MLA Adoption Team, AxisTech and Stone Axe identified potential adoption pathways:

- Producer presentation to MeatUp and BeefUp as a case study discussing the integration of data systems across the entire on- and off-farm system. Signposting interested producers to further training.
- Producer virtual farm tour, video showcasing project outcomes learnings for other producers.
- One-day training workshop or Data EDGE workshop where all the data/tech systems are covered and how then can be integrated and analysed to direct management decisions.
- The EDGE workshop could then lead to the development of a PGS package which would be a facilitated training package of assisting producers to develop these systems on their property(s).

- Development cost for the EDGE, who will deliver it in terms of knowledge and competency. Training would be required for a couple of deliverers to provide the capacity for delivering the workshops.

5.2 Benefits to industry

The undertaking of the *Digitalisation Pilot of Operation and Supply Chain Data Management* project, required the onboarding of Stone Axe into the AxisStream platform. This included thorough data mapping, sourcing, standardisation, and quality checks in order to complete the digitisation and ingestion of their operational data into the platform.

Stone Axe identified a number of data driven benefits such as potential productivity gains, time savings and financial benefits from analysing feedlot and genetic performance.

The benefits identified throughout this project are summarised below:

- Time savings
- Cost savings (production inputs and staff time)
- Genetic evaluation and improved breeding performance
- Increased productivity
- Industry benchmarking
- Authenticity verification
- Streamlining compliance and biosecurity processes
- Sustainability, GHG reporting, ESG, Natural Capital
- Interconnectivity along the supply chain

6. Future research and recommendations

Throughout this project the following learnings and recommendations have been identified:

Producer Participation Strategy

- Should be incremental in order to establish trust which will result in increased producer participation at each step;
    - Begin with weather and/or soil related data to establish trust in data sharing; de-identification of data, ownership, and control etc. which will allow for further development and improve its useability
    - Move forward to biosecurity, weaning rates etc. with the final steps progressing towards meat processing data and market pricing
- Establish a timeline for the participation process taking the time of year and grower commitments into consideration

AxisTech and AxisStream Development

- Establishing data sharing agreements with detailed Terms and Conditions aligned with the *National Farmers Federation Farm Data Code*
- **Technology enablement**
    - Data de-identification
    - Creation of categories for contextualised benchmarking
- **Onboarding process and automation**

  - The current onboarding and ingestion of data into AxisStream has manual and time-consuming elements for the AxisTech team. AxisTech are developing the AxisStream platform further to continue simplifying and automating the process for onboarding clients and also enable clients to upload their own data where possible.
  - Establish protocol and communication sequencing, i.e. after customer has received log in details
  - Formalise onboarding process and support resources, i.e. quick start guide with log in details and booking link for remote training sessions.
- **User interface improvement**
  - Improvements to interface that are more user orientated
  - Increase the ease of use and intuitiveness for users

Data mapping

It is highly recommended that businesses within the food supply chain have an established data flow map in place, or to go through this process in order to streamline future data scoping studies relating to traceability and quality assurance. We have found that most businesses appear to be reactive to changes in their business system processes and tend to not prioritise such activities due to the day-to-day requirements of operations.

Future projects will require a more thorough and systematic process for those undertaking any data mapping activities, to ensure that all data sets and their sources are captured in their entirety including identifying any data gaps at the commencement of such projects.

Time and resourcing

Data planning and collection can be a very large undertaking for any business especially when having to access data from disparate sources and for a range of locations. It is essential that adequate resources and hours allocated to achieve this task is committed to by businesses completing a data project like this one. Stone Axe allocated a resource to this project to assist with identifying data sets, organising and making them available to AxisTech, however, it was perhaps underestimated how much time this would actually take in the initial project planning phase. A thorough data mapping exercise as outlined above will help to reduce the time required for this process in future.

7. References

Leonard, E., Rainbow, R., Trindall, J., Baker, L., Barry, S., Darragh, L., . . . Zhang, A. (2017). *Accelerating precision agriculture to decision agriculture: Enabling digital agriculture in Australia.* Cotton Research and Development Corporation, Australia. Retrieved from https://www.crdc.com.au/sites/default/files/CRD18001-001%20CRDC%20P2D%20Report%20low%20res.pdf