Final report

Understanding the requirements and enabling the integration of Livestock Data Link (LDL) into lifetime performance systems

Abstract

Traceability systems have the potential to deliver enhanced data usage across red meat supply chains and businesses. Understanding alternative uses for this data to deliver valuable insights, reporting and/or alternative value creation has not yet been demonstrated and is not well understood. It is proposed that through the optimisation of traceability data, linked to on-farm management records, greater value to red meat supply chains can be provided through improved management of red meat brands and supply chains, including maximising inventory.

This project undertook research, development, and trial work to understand how a complete lifetime performance data set can provide value to a supply chain beyond existing use cases.

The key results of the project successfully integrated a Farm Management Solution (FMS) and a traceability platform, which uncovered that the Australian red meat industry can benefit from sharing data sets for enhanced business decision making through complete lifetime traceability. It also validated improved inventory/asset management through the data connection.

The outcomes have provided direction to future investment and development work by MLA, highlighting that future development between Livestock Data Link, the MLA Data Platform and the traceability platform provides opportunities across multiple stages of the supply chain from farm through to the cold chain for the red meat industry.

Executive summary

Background

The purpose of this research was to understand how a complete lifetime performance data set could provide value to a supply chain, beyond existing use cases and aimed to provide outcomes which could provide direction to future investment and development work by MLA and the red meat industry in this space.

The results of the research will provide Argyle with a data standard and implemented technical infrastructure, which provides the connections to collate, permission and share data from across the Argyle value chain. These results will also contribute to the KPMG Origins future roadmap design, to continue to connect additional data sets that enable producers and supply chain participants to gain access to new value generation streams such as the monetisation of carbon and access to trade finance.

Objectives

The key objectives of this project included:

- Develop a link between a commercial on FMS with a commercial traceability platform, to support enhanced business decision making through complete lifetime traceability and demonstrate improved inventory/asset management for greater decision making. This was successfully achieved.
- Develop visualisation of lifetime traceability data to provide valuable insights and demonstrate how these insights may or may not apply to different red meat businesses (user test with a range of supply chains). This was successfully achieved with ongoing refinement.
- Investigate the opportunities to integrate traceability data from third-party platforms into the ISC data platform and develop an API to enable data sharing. This was successfully achieved with future scope items to be considered.

Methodology

The projects methodology centred around the integrate the KPMG Origins traceability platform with the FMS to share Argyle Food Groups (Argyle) data to analyse the benefits of shared data to Argyles end customers.

The approach required significant collaboration between the Argyle, MLA and KPMG teams to explore the value generation from having additional data sets available within the MLA and KPMG Origins Platforms.

Results/key findings

The project successfully integrated and exchanged data from the FMS to the KPMG Origins traceability platform and then to the MLA Data Platform. This integration and the project milestone generated a range of considerations, outcomes, and opportunities because of the data exchange between the systems.

The key findings included how livestock lifetime performance metrics can be enhanced within industry solutions like Livestock Data Link, the benefits of MLA making certain data sets accessible to traceability platforms and the key future opportunities that are enabled by traceability platform connectivity such as carbon monetisation and access to finance.

Benefits to industry

The project identified a range of benefits to industry resulting from the connectivity of commercial on-farm management systems with a commercial traceability platform. This project validated improved inventory/asset management through the data connection between FMS's and Livestock Data Link/MSA Data Platform data via the KPMG Origins traceability platform. The opportunities observed exist across multiple stages of the supply chain from farm through to the cold chain.

Future research and recommendations

The project concluded with several recommendations that require further research to enable the value to be realised by Argyle and other red meat producers. The recommended research areas including monetisation of carbon, access to working capital finance, and enabling animal benchmarking. All the recommendations require the continuance of the connectivity between the key participants and software solutions including the FMS, traceability platform and MLA Data Platform developed as part of this project.

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1. Background

Integrity Systems Company (ISC), a subsidiary company of Meat & Livestock Australia (MLA) has developed and operates Livestock Data Link (LDL), 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.

The current LDL business case supports a network effects model with the target of enabling the greatest use of feedback for decision making by industry. FMS's provide solutions to producers to capture on-farm data. Currently the carcase compliance and animal disease data in LDL is not able to be automatically ingested by on-farm management systems to enable the linking of a complete lifetime feedback record for enhanced decision making. Due to planned changes within the LDL product and the MLA data platform, now ensuring all data will be ingested into the data platform, the linking of data sets from carcase to live animal records is now feasible. This project aimed to further understand the requirements for such linking to be made possible and will inform future feedback system development.

In addition, traceability platforms have the potential to deliver enhanced data usage across red meat supply chains and businesses. Understanding alternative uses for this data to deliver valuable insights, reporting and/or alternative value creation has not yet been demonstrated and is not well understood. It is proposed that through the optimisation of traceability data, linked to on-farm management records, greater value to red meat supply chains can be provided through improved management of red meat brands and supply chains, including maximising inventory.

1.1 Traceability platform

Argyle have implemented the KPMG Origins traceability platform into their cattle and beef supply chain. The decision to implement KPMG Origins was documented in the 'Argyle Case Study for the Development and China Launch of Chilled Retail Ready Australian Meat (Stage 2)' (MLA project code: P.PSH.1214).

1.1.1   KPMG Origins introduction

KPMG Origins is a blockchain based traceability platform, that has enabled Argyle to provide international retailers comprehensive supply chain information on the paddock to plate story of individual packs of beef.

KPMG Origins achieves this via sophisticated data permissioning and sharing capabilities that enables the sharing of data from farm, processing, value adding, transport, through to domestic and international retailers.

As the KPMG Origins platform does not originate data (it's the mechanism under which data is permissioned and shared) there is the requirement to integrate with the data source solutions. As an example, an existing integrated data source for KPMG Origins is the National Livestock Identification Scheme (NLIS). The NLIS provides unique animal identification and location of animal's data to enable the creation of identifiable cattle Products in KPMG Origins.

FMS are an essential data source for livestock supply chains that can enrich and compliment the traceability journey from paddock to plate. This requires the data to be integrated from the FMS into the traceability platform to unlock the potential benefits. As KPMG Origins focuses on end-to-end

supply chain traceability, only critical traceability events that have a value proposition and recipient to be shared with, are captured from FMS data sources.

In addition, standardised traceability solutions like KPMG Origins create an industry wide scalable channel for solutions, like Livestock Data Link, to receive standardised data from a broad variety of sources without the complexities of having to integrate with multiple data sources and multiple FMS platforms.

1.1.2   KPMG Origins traceability data model

KPMG Origins uses a GS1-aligned traceability Event data model to capture information about Products, in this case, cattle. The way Products are created, updated, transformed and deactivated is controlled by Events. The sequence of these traceability Events is used to form an immutable history of the life and associated data of a Product.

Traceability data is commonly represented as a combination of:

1.1.2.1   Master Data

Master Data refers to common data points that relate to Organisations and Locations, that do not frequently change and are common across Products and Events.

- **Organisations** represents a participating business, company or other entity type within the traceability platform. Organisations can manage Master Data and create Event Data where relevant to them.
- **Locations** represent geographical sites operated by Organisations in the supply chain where Events may occur. Example Locations in cattle supply chains include a farm, a feedlot and a processor.

1.1.2.2   Event data

Events are key supply chain activities that enable the traceability of physical products in the supply chain. Events create, update and change data elements for each Products Instance.

There are five types of Events relating to cattle Products that are required to achieve the desired on-farm data capture for the traceability platform as follows:

- **Commission Event** creates a new active Product(s) based on a Products Template and with its own unique identifier. For example, when a calf is born and tagged, an active cattle Product is created based on the relevant cattle Products Template.
- **Object Event** enables new data to be associated with a product. For example, adding a new weight record to an animal.
- **Aggregation Event** converts specified child products into an aggregated specified parent product. For example, if 40 head of cattle are loaded onto a truck, an aggregation event is used to now identify those animals as single transport unit.
- **Dispatched Event** when a transport unit leaves a location. For example, a cattle truck leaving the farm.

- **Decommission Events** deactivates a Product(s) to represent the end of tracking. This Event is used to indicate a Product(s) has reached an end buyer or needs to be removed from active circulation for another reason such as animal mortality.

There are a further four Event types that are required at other post-farm gate stages of the livestock supply chain as follows:

- **Disaggregation Event** is the reverse event to undo an aggregation from a single parent back to many children products. For example, a truck is unloaded and instead of identifying a single truck, we now identify the 40 individual cattle that we're unloaded.
- **Received Event** when a transport unit arrives at a location. For example, a cattle truck arriving at a processor.
- **Ownership Change Event** when the ownership of a product(s) changes from one organisation to another. For example, the cattle have been sold from the farmer to the processor.
- **Transformation Event** represents processing activities, which change the characteristics of a Product(s). A Transformation Event can create one or several new active Products as an output based on a new Products Template. The input Products Status will be updated to Inactive, and the output Products Status will be Active. For example, when an animal is processed, a cattle Product is transformed into a carcase Product.

1.1.2.3   Product data

Products refers to the smallest, uniquely identifiable Product unit in the traceability platform. In this case Products relate to specific animals, and further along the supply chain, a carcase identified by a body number, and a barcoded retail-ready packaged cut of meat. Products are linked to Product Templates and utilise Events to form a traceability journey as the Products travels through the supply chain.

A Product Template represents a fixed set of core parameters that make up a generic Product. Examples of Product Templates in livestock supply chains include cattle, sheep, carcases, and primal cuts. These Product Templates are then linked to many specific instances of that Product (for example, a specific animal is linked to a cattle Product Template).

All Products are created via Commission Events. The data associated with each Product(s) is then changed and added through traceability Events. The traceability platform maintains a permanent record of all changes to data points related to a Product(s), therefore it's possible to view a complete history of a Product's life.

1.2 Livestock & Farm Management Solutions (FMS)

1.2.1   FMS introduction

FMS assist farmers to record and keep track of their livestock from birth all the way to sale, capturing pasture and location management, feed management, individual or herd level livestock records and key events such as purchase/sale, breeding, deaths, treatments and feeding.

1.2.2   FMS data model

FMS have custom data hierarchies, as there are no widely adopted FMS data structure protocols in existence (unlike GS1 for traceability platforms as an example). This results in each FMS solution having different data models and naming conventions and as such, no two FMS integrations will be the same.

The benefits of integrating FMS with KPMG Origins are to simplify these multiple FMS formats into a standardised data format that enables stakeholders (like the MLA Data Platform, financiers and retailers etc) to integrate without the complexity of understanding each FMS.

As an example, the FMS Individual Livestock Management solutions data model publishes the following hierarchical data elements and definitions within their integration documentation:

- **Enterprises** are used to define your farm businesses and the livestock running in them. Enterprises contain management groups, which define the different animals and how they're managed.
    - **Farms** are an area of land and its buildings, used for managing livestock and growing crops
        - **Fields** are an area of open land mapped for grazing or cropping
    - **Management Group** is a group of individual animals
        - **Animal** is a specific uniquely identified animal
    - **Session** is a data recording activity
        - **Record** is a specific weight or score data point recorded

1.2.3   FMS and KPMG Origins data model alignment

Despite the obvious differences in the data models between the FMS, illustrated above, the data model can be aligned relatively closely to KPMG Origins data model as per Table 1 below.

Table 1 – System data model alignment

FMS Element		KPMG Origins Element
Enterprises	▶	Organisations
Farms	▶	Locations
Management Group	▶	Product Template
Animal	▶	Product
Session	▶	Event

1.3 Livestock Data Link & MLA Data Platform

Throughout this project, ISC staff completed in-depth analytics on the data which was made available through the integration of the KPMG Origins and FMS alongside the information provisioned through ISC-owned systems (NLIS & LDL). Additional business data was provided by Argyle. The proof-of-concept aimed to determine the ability to generate complete lifetime performance across a business through combining multiple data sources. The outputs aimed to understand current road-blocks to achieving this, and also informed future feedback initiative, such as the Livestock Data Link product roadmap.

The proof-of-concept demonstrated that there is a valuable opportunity to work with traceability systems (such as Origins) to connect post-slaughter data with NLIS movements. For instance, the analyst was able to use NLIS RFID numbers to link livestock movements between properties, MSA body number to obtain carcase attributes from slaughter and then, using a combination of the product barcode, carton number and the sales ID, track the movement of the meat through to the export destination port. Key on-farm performance metrics were then able to be interrogated to determine areas of improvement, patterns of performance and overall inform optimisation strategies across the business, including on-farm production.

The proof-of-concept demonstrated that the availability of near-real time data will enhance the capabilities of the MLA Data platform from KPMG Origins. An example of this is today LDL has access to an animal's breed and sex information as part of the carcase compliance data, this data however could now be sourced and utilised far earlier in the animal's life, if supplied from the FMS via KPMG Origins.

Due to privacy considerations not all areas of the analysis completed to date can be published. For further information on the analysis, please contact ISC.

1.4 Integration points, Events and data

It's essential that there is clear, customer led, objectives as to what data should be integrated between the Systems and at what points in time that data should be made available to the traceability platform. The objectives to share on-farm data with a traceability platform generally centre around there being a downstream organisation requesting that information be provided. These objectives ultimately form the requirements for the system integration points.

In Argyle's case, these objectives have a strong alignment to the product claims being made on the end meat-products. An example to illustrate this point is, an end meat-product that has an antibiotic free claim, which can be substantiated from the animal's treatment history. Treatment history would therefore be an integration point for the systems. Other examples of integration objectives include carbon neutral meat, animal welfare certificates and Best Management Practice (BMP) certificates. This is important as it affects the model under which integration data mapping will occur between the two systems (see section 4.4 Integration and Data Considerations for more details on this).

The scope of this project's integration was:

a) implement a one-way flow of data from the FMS to the KPMG Origins traceability platform, and
b) implement a one-way flow of data from the KPMG Origins traceability platform to LDL, and
c) explore a one-way flow of data from the MLA Data Platform to the KPMG Origins traceability platform.

1.4.1 FMS to KPMG Origins

Figure 1 below illustrates the key integration points which would instigate the transfer of data between the FMS and KPMG Origins traceability platform prior to livestock processing.

Each of the specific Events explanations, data fields and JSON examples are included in the Appendix.

Figure 1 – Visualisation of on-farm traceability events including the data source, event type and data ID
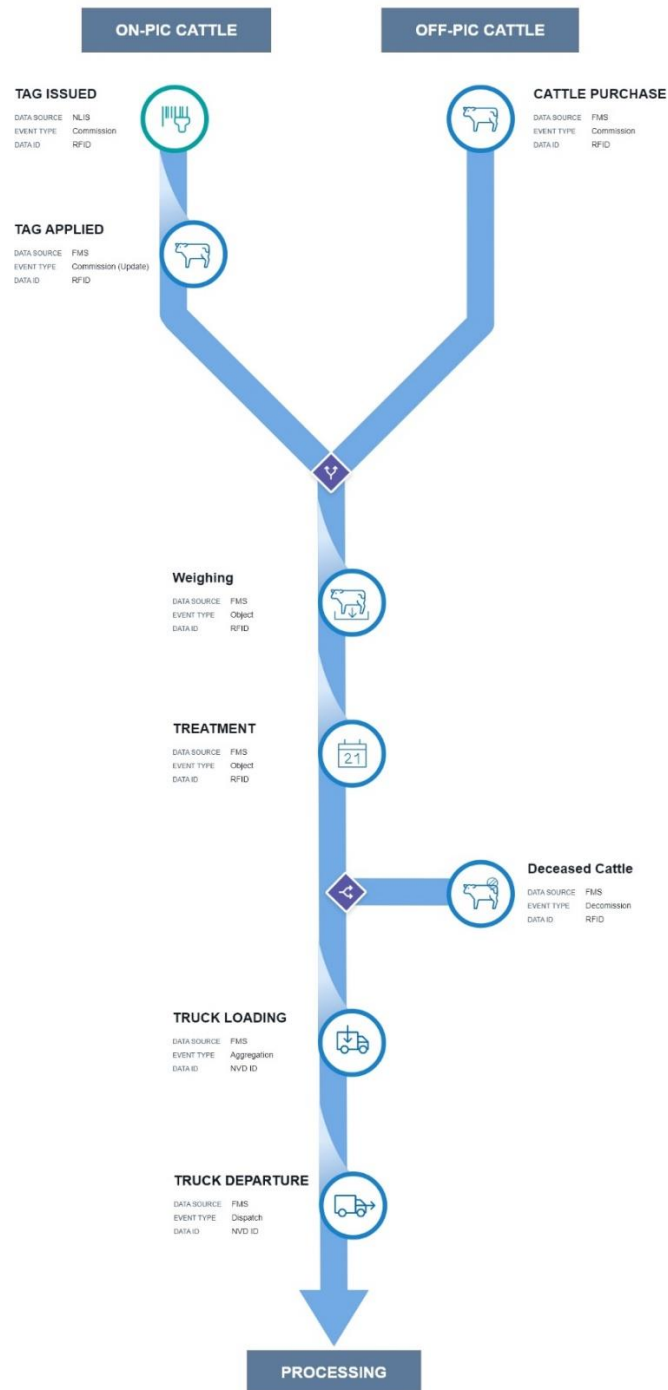
Table 2 displays the types of animal related records that can be provided in near real-time.

Table 2 – Lifetime Performance FMS Animal Data Fields

KPMG Origins		FMS	
Event Type	Data Field	Data Field	Record Type
Commission	Metadata: Breed	Breed	Animal record
	Metadata: Sex	Sex	
	Commission event date	Date of Birth	
Object	Product weight	Weight	Weight record

	Product weight UOM	Weight name	
	Product weight timestamp	Weight datetime	

Argyle believes that the availability of valuation data within LDL would add significant value, as it will enable the direct analysis and correlation of financial outcomes vs carcase compliance and disease information. Table 3 displays the available valuation data from the FMS that could be automatically transferred to the MLA Data Platform, via KPMG Origins, for analysis within LDL. This data would again be provided in near-real time, before processing and could enable LDL to analyse things like required sale prices or carcase yields to break even, for example. Once the processing data is then available, this analysis could be updated to display the actual outcomes.

Table 3 – Lifetime Performance FMS Valuation Data Fields

KPMG Origins		FMS	
Event Type	**Data Field**	**Data Field**	**Record Type**
Ownership change	Product value	Purchase price per head	Purchase record
		Sale price per head	Sale record
Location change		Value per head	Transfer on farm record
			Transfer off farm record
Ownership change	Product value per UOM	Purchase price per individual (weight)	Purchase record
		Sale price per individual (weight)	Sale record
Location change		Value per individual (weight)	Transfer on farm record
			Transfer off farm record
Received	Transport unit Expense	Transport cost	Purchase record
			Transfer on farm record
Dispatched			Sale record
			Transfer off farm record
Ownership change	Event expense	Additional costs	Purchase record
			Sale record
Location change			Transfer on farm record
			Transfer off farm record

Whist NLIS tracks the movement of animals between PICS, it doesn't currently provide any further insights or analysis capability around the impact livestock movements might have on an animal and its meat quality. A combination of FMS, MLA Data Platform and integrated services information could be used to provide further in-depth analysis.

Some examples of information available to analyse would be:

- The distance an animal has travelled across its life by calculating the road distance between an origin PIC address and a destination PIC address.
- Using the above distance to then estimate the transport duration, based on average drive times, with an industry standard overlay of driver fatigue and animal welfare break time durations.
- The number of animals on a specified vehicle type.
- The above metrics could then be compared to carcase quality and compliance feedback to assess correlations.

Importantly, enabling access to the data brings these elements, which are typically explored in research settings, into the forefront or day-to-day business decision making. And therefore, turning theoretical research outcomes into tangible outcomes for individual businesses based on the unique variables present.

Table 4 – Lifetime Performance FMS Livestock Movement Data Fields

KPMG Origins		FMS	
Event Type	Data Field	Data Field	Record Type
Dispatch Event	Event id	Record id	Transfer off farm record
	Event timestamp	Departure date	
	Product ids	Animal ids	
	Certificate id	Declaration id	
	Certification template	Declaration type	
	Location Origin	Source aw farm id	
	Location Destination	Destination aw farm id	
	Custodian Organisation	Transport operator	
	Metadata: Transport method	Transport method	
	Metadata: Waybill	Waybill	
	Metadata: Vehicle id	Vehicle id	
	Metadata: Estimated transit time	Transit time	
Received Event	Event id	Record id	Transfer on farm record
	Event timestamp	Departure date	
	Product ids	Animal ids	
	Certificate id	Declaration id	
	Certification template	Declaration type	
	Location Origin	Source aw farm id	
	Location Destination	Destination aw farm id	
	Custodian Organisation	Transport operator	
	Metadata: Transport method	Transport method	
	Metadata: Waybill	Waybill	
	Metadata: Vehicle id	Vehicle id	
	Metadata: Estimated transit time	Transit time	

2. Objectives

The primary objectives of this project included:

1. Case studies on the value provided to red meat business, by linking supply chain traceability data to on-farm management data, for enhanced business decision making through complete lifetime traceability. i.e., Understand and quantify the secondary benefits of traceability platforms to red meat producers through the creation of a two-way feedback loop of data.
   - This objective was successfully met through the integration of the KPMG Origins traceability platform to the FMS with the key findings documented in section 5 of this report. Future recommendations have been documented in Section 6 of this report that documents the resulting analysis and benefits to the red meat industry through the creation of a two-way feedback loop of data between KPMG Origins traceability platform and the MLA platform.

2. Demonstration of improved inventory/asset management, through data connection, for greater decision making across brands to deliver optimal margins.
   - The KPMG Origins platform was able to successfully connect Argyles FMS, to enable Argyle to set sharing permissions that provided the MLA access to Argyles data. This data was then used to assess the additional service offering that could be developed, into the Livestock Data Link solution, to demonstrate the improvement of inventory/asset management, through data connection, for greater decision

making across brands to deliver optimal margins that are detailed in section 5 of this report.

3. Develop visualisation of lifetime traceability data to provide valuable insights and demonstrate how these insights may or may not apply to different red meat businesses (user test with a range of supply chains).

4. Explore opportunities to integrate traceability data from third-party platforms into the MLA data platform and develop an API to enable data sharing.
   - The opportunities for this objective were explored and a trial was undertaken to provide API access from the KPMG Origins traceability platform to the ISC Livestock Data Link/MLA Data Platform. The data provided was used to analyse the benefits to the industry, the outcomes of which are detailed in Section 4 of this report. The opportunity for the MLA Data Platform to provide the traceability platform data was also explored and deemed that further analysis was required. The further analysis areas are detailed in Section 4.3 of this report. As a result, the decision was made to not proceed with the API connectivity between the platforms within the current project scope.

5. Support the development required to link a commercial on-farm management systems with a commercial traceability platform. Provide the key requirements for other platforms to achieve the same.
   - This objective was met with the successful integration between the FMS to the KPMG Origins traceability platform, that now automatically shares key data in near-real time. The data contributes to the lifetime performance of an animal e.g. animal weight capture, treatment records etc. KPMG Origins can integrate to multiple third-party platforms and/or can provide third parties API access to extract this data, based on client sharing permissions.

3. Methodology

The project was undertaken by Argyle with regular project team meetings between themselves, KPMG and MLA. The project was broken down into 6 milestones that covered both analyses, reporting and system integrations to align with the project objectives. The methodology used successfully uncovered both immediate benefits, roadblocks and future recommendations to support the red meat industry.

Milestone 1 saw Argyle facilitate the collaboration of the KPMG Origins and FMS teams to workshop and explore how a FMS could be successfully integrated with a traceability platform, detailing the connection points and data to be shared between them. The motivation for the on-farm data to be shared was driven by Argyle's end customers (e.g. international retailers) who requested this information accompany Argyle's beef products. This milestone also saw the installation and on-farm implementation of the FMS to ensure adequate data was available to generate supply chain insights.

Milestone 2 had KPMG facilitate the collaboration of the Argyle, MLA and KPMG SME and Technical teams to workshop and explore:

1. The livestock producer and MLA value generation from having additional data sets available within the MLA Data Platform, and
2. A technical exploration around the current state and integration requirements to determine the consideration areas to be included within the project plan.

All participants agreed that the following four areas would become the focus of the Milestone 2 report and set the path for future integration plans.
- Lifetime performance
- Processing Results (Carcase feedback)
- Livestock Movement (In transit)
- Ownership vs Location Master Data

KPMG proposed the way forward was to begin an initial trial phase, to validate the integration and to agree a roadmap into Production.

Milestone 3 involved KPMG providing MLA trial access to the KPMG Origins platform (including API's), and Argyle permissioned MLA to receive access to their product, event and certificate data housed within KPMG Origins. This provided access to the required data to demonstrate any improved inventory/asset management and to analyse enhanced decision making across brands to deliver optimal margins.

Access to the Argyle data enabled MLA to undertake data analysis to assess how the data could be used by producers within the Livestock Data Link platform. This was then verbally discussed with Argyle to enable them to submit a case study demonstrating any additional value to product from connecting KPMG Origins back to the farm gate.

Milestone 4 covered the creation of lifetime traceability data visualisation to provide valuable insights and demonstrate how these insights may or may not apply to different red meat businesses.

Throughout this project, ISC staff completed in-depth analytics on the data which was made available through the integration of the KPMG Origins and FMS alongside the information provisioned through ISC-owned systems (NLIS & LDL). Additional business data was provided by Argyle. The proof-of-concept aimed to determine the ability to generate completed lifetime performance across a business through combining multiple data sources.

Milestone 5 was superseded by a Go/No Go decision to develop a two-way API to enable KPMG Origins and MLA data platform to share data. The decision was made to not proceed as a part of this project. Key areas of focus have been highlighted in this report that demonstrates the benefits for a future integration.

Milestone 6 was to report publicly, as per this publication, the detailed findings from the project, highlighting the business opportunities that the data sets and case studies could use to benefit Industry and individual supply chains.

4. Results

4.1 FMS data to KPMG Origins integration results

The project successfully integrated and exchanged data from the FMS to the KPMG Origins traceability platform. This integration and the project milestone generated a range of considerations, outcomes, and opportunities because of the data exchange between the systems.

To demonstrate the integration pattern, KPMG Origins initially showcased the ability to connect data being supplied by both NLIS and FMS within the traceability platform. Validating the traceability platforms ability to connect data from various sources to a single Product, in this case cattle. This demonstration illustrated that the on-farm data can be made available, via the traceability platform, providing greater value to red meat supply chains through the improved management of red meat brands and supply chains.

The initial integration demonstration focused on two sequential integrated Events including:

1) Tag Issued Event from NLIS

This Event utilised an established NLIS integration with KPMG Origins, which resulted in a Commission Event creating a new Product. The Product used the NLIS ID as it's unique identifier, was created at a specific Location based on the PIC, and it was linked to a specific Product Template using the Species Type.

Figure 2 – Showing the created NLIS Commission Event in KPMG Origins user interface
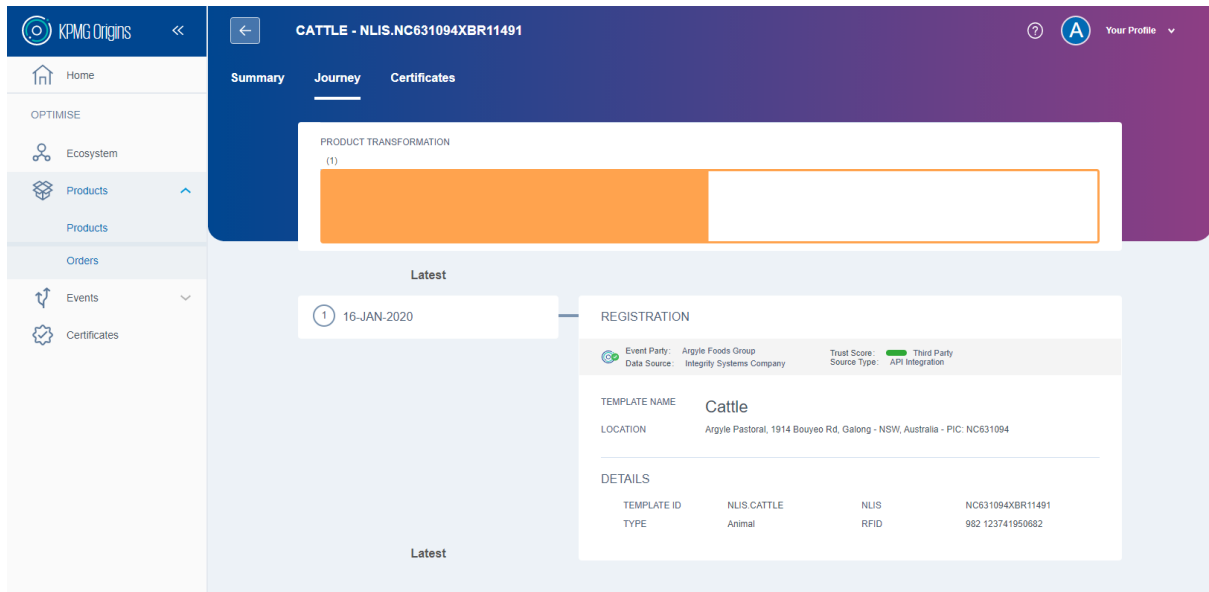
Image supplied by KPMG

2) Tag Applied Event from FMS

This Products data was then appended by the FMS, via a Commission Update Event, that added additional data to the Product record from the FMS. This data included the breed, sex, age class, date of birth and weight of the animal.

Figure 3 – Showing the animal record within the AgriWebb user interface
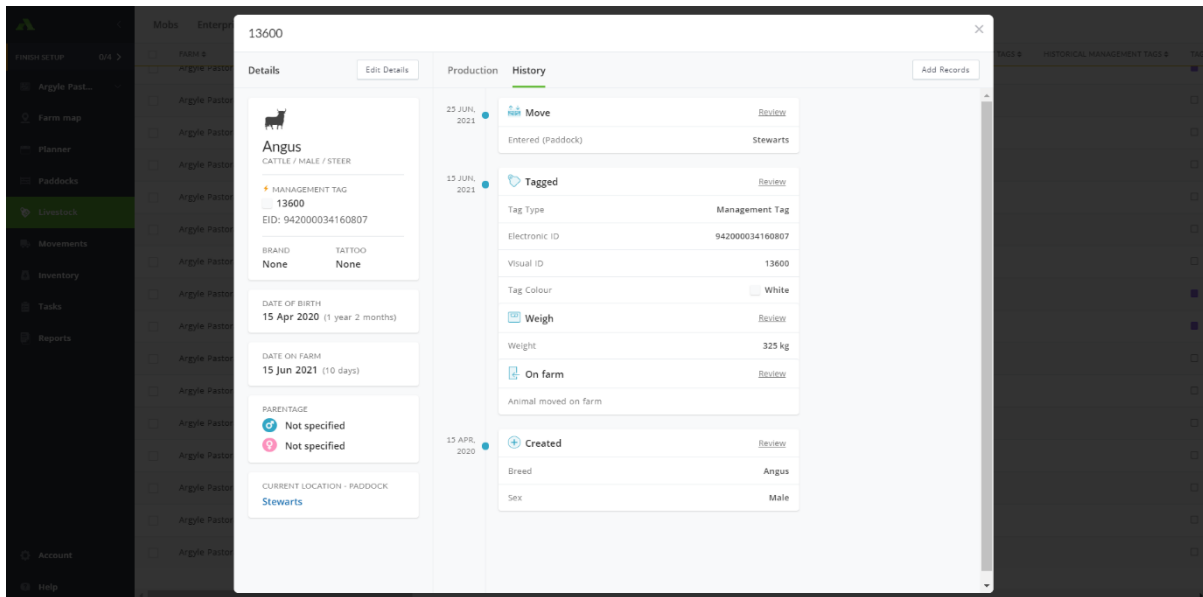
Figure 4 – Showing the appended FMS Event in KPMG Origins user interface
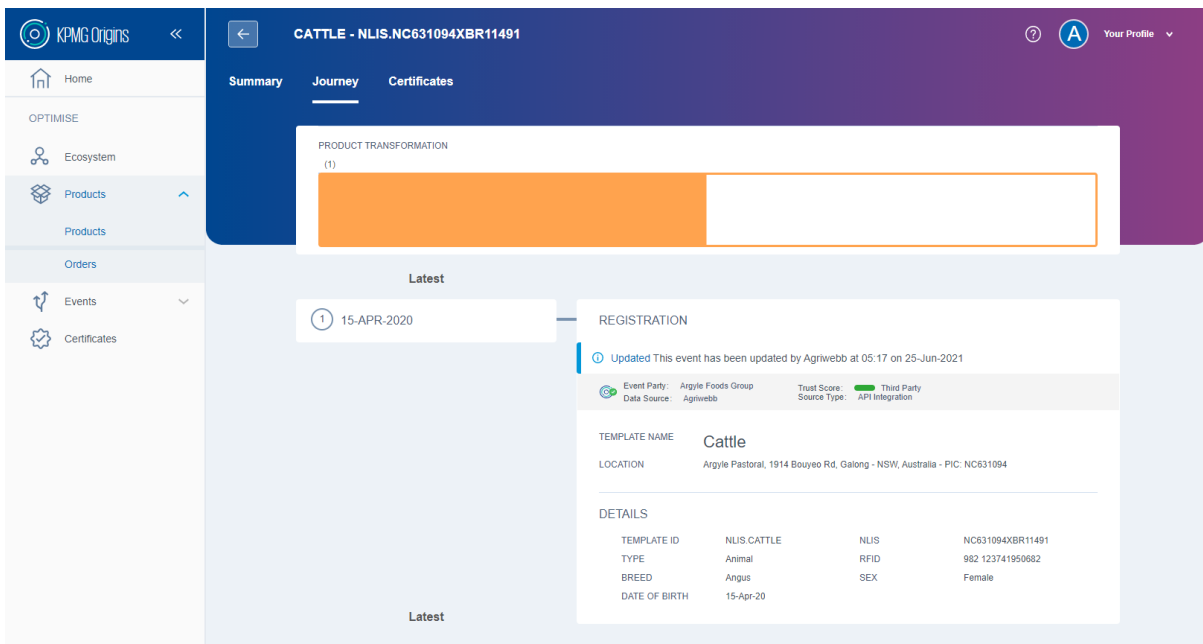
Image supplied by KPMG

As a result of the successful initial showcase integration, the project went on to complete the integration points as described in Figure 1 and detailed in the appendix of this report. The integration has now successfully synced the following data from the FMS to KPMG Origins:

- 1,568 cattle records with associated data
- 1,814 cattle weight records
- 33 cattle transport events (NVDs)

4.2 MLA Data Platform to KPMG Origins integration results

In addition to passing on-farm data through to LDL, the project assessed the sharing of data from MLA Data Platform to KPMG Origins. There were six data sets that were identified and assessed as being of value for traceability platform customers to integrate into KPMG Origins including:

1. LPA:
    *   *Assessment*: Does the MLA Data Platform have sufficient data and integration capabilities to enable KPMG Origins to automatically create and update LPA certificates?
    *   *Outcome*: The LPA Platform has sufficient data to create certificates for certain programs. However, there is no integration (API) support available at present. Mechanisms to allow accredited users to better manage their LPA requirements via the MLA systems requires further research.
    *   *Value*: Having LPA credentials automation available in traceability platforms provides red meat suppliers with the ability to share their credentials with supply chain stakeholders whilst maintaining access control.
2. Lifetime Traceability:
    *   *Assessment*: Does the MLA platform have sufficient data and visibility for KPMG Origins to create the previous PIC locations where an animal has been located including the location change events, at a point in time?
    *   *Outcome*: The MLA database has the full history of NLIS Animal movements but only admin or regulatory account types have visibility over all movements associated with a device. KPMG Origins currently only has access to see Argyle's movements through an authorised Third-Party role which restricts the ability to gather full data sets for animal lifetime traceability.
    *   *Value:* Access to the lifetime traceability enables supply chain stakeholders to access information from the full life of the animal via the traceability platform, not just the most recent PIC the animal was associated with. Analysis undertaken through this project has demonstrated that the association between livestock movements and productivity metrics have a strong correlation and would provide powerful insights for business decision making (ie. livestock procurement strategies) if access was made available.
3. MSA Grading Results:
    *   *Assessment*: Does the MLA platform have equivalent MSA Grading data to the processor to create the MSA Grading Event and Product transformations within KPMG Origins. Ideal state would be to disable this component of The Co-Op integration and receive this data directly from MSA.
    *   *Outcome*: Yes, MSA store more data than is currently being received directly from the processor integration into KPMG Origins. KPMG are awaiting a response on how this data might be accessed, permissioned and credentials to test accessibility.
    *   *Value*: Having this data provided directly from MSA will enable rapid and low-cost traceability platform onboarding of future processors.
4. eNVD's:
    *   *Assessment*: Does the MLA platform have the required data and integration capabilities to create an eNVD, in conjunction with the on-PIC/off-PIC movement data, in KPMG Origins, so that there is a clear source of eNVD data truth for all red meat clients.

- *Outcome*: eNVD has the required data recorded and available, via an API, to enable KPMG Origins to generate NVD Certificates. The challenge, however, is that eNVD's do not include uniquely identified animals, making it not fit for purpose for a uniquely identified animal management solution and traceability platform.
- *Value*: Having access to eNVD's would enable each movement and declaration to be automatically captured and shared with supply chain stakeholders via the traceability platform.

5. PIC Details:
   - *Assessment*: Is there the ability to query a PIC's address and owner organisation, with sufficient data, for KPMG Origins to automatically create a location (based on the PIC) in Origins and an Organisation owner. This is particularly relevant when Argyle purchase cattle from new suppliers that have not yet been onboarded to KPMG Origins.
   - *Outcome*: The NLIS PIC Register API allows third-party systems to search for the details related to a PIC, or the PIC associated with a trading name or location on the PIC Register. Challenge here is there is not a unique identifier for the Businesses (e.g. ABN). Currently the API returns the "BusinessName" but not any sort of a unique organisational key. There is an MLA project looking at how third parties can link data back to customers more efficiently. Although the inclusion of ABN is being scoped into projects moving forward, there has not been set a timeframe around this delivery. The project also researched the newly established GS1 National Location Registry, however, believes the adoption of the registry at a farm location level is too low to provide a solution in the short term.
   - *Value*: The addition of unique identifiers for organisations will enable system to system integrations of the PIC data sets without the need for manual intervention adding administrative costs and time delays.

6. Animal Ownership:
   - *Assessment*: Section 4.7.7 of this report provides a detailed scope of the focus areas and their requirements.
   - *Outcome*: No further progress has been made by MLA on this item yet.
   - *Value:* An accurate industry asset registry has broad reaching benefits that span across multiple use cases covered by this project including access to working capital financing and carbon emissions reporting.

4.3 Integration and data considerations

The project identified a range of items that need to be considered when integrating data between FMS, traceability platforms and LDL systems. These considerations will not only enable the initial integration, but also ensure the integrations ongoing operational success.

4.3.1 Authentication

4.3.1.1 FMS and KPMG Origins Authentication

As the traceability platform is only retrieving data from the FMS in this initial implementation, it makes sense that, the FMS should issue the API credentials (Keys) to provide the traceability solution access to a specific Enterprises data. The traceability platform is then responsible to securely store those API Keys on behalf of each customer and honour the customers rights to disable the integration at any time.

KPMG Origins has previously managed API authentication at an Organisation level meaning each organisation would have one set of API Keys. FMS, however, can manage this at a farm level meaning an Organisation with multiple farms, will have multiple API Keys to manage. This requirement will need to be supported within the traceability platform in this initial integration scenario.

4.3.1.2   LDL and KPMG Origins Authentication

The initial project objectives focussed on the ability for the MLA Data platforms and LDL to retrieve client data via KPMG Origins. This 'one-way' data flow is a key requirement as to how the two technical solutions will integrate and securely authenticate with each other.

There are two options as to how data could be transferred via the Application Programming Interface (API):

1. MLA Data Platform 'pulls' the data from KPMG Origins
2. KPMG Origins 'pushes' the data to the MLA Data Platform

Diagram 1 – Integration architecture approach options
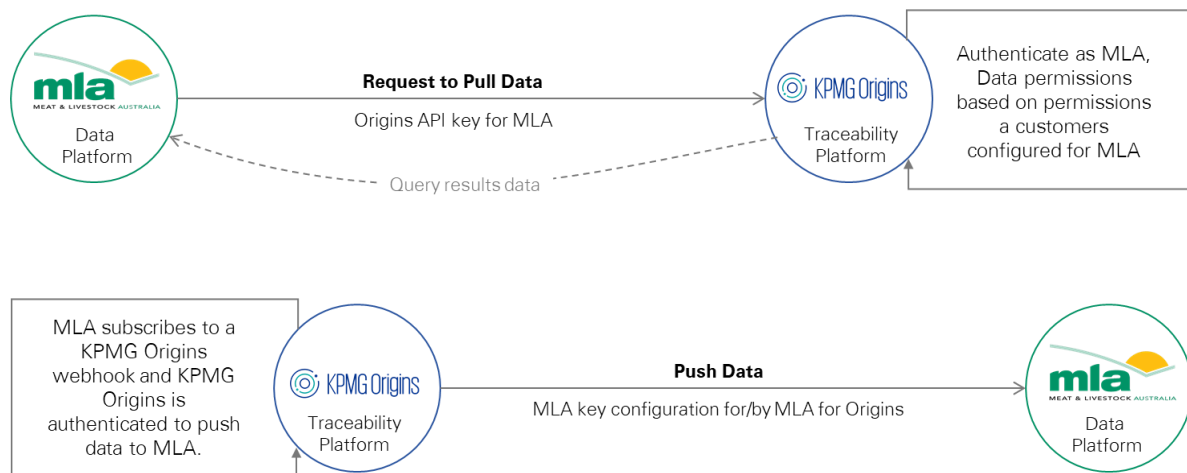
The technical discussions between the solution teams resulted in the decision, that the simplest approach to undertake for the initial integration trial, was for the MLA Data Platform to pull the data. This was done on a schedule that polls for new or updated data within KPMG Origins. It's likely that the poll will run once per day to retrieve any new or updated data from the last twenty-four hour period. These requirements will continue to be discussed and evolved by the technical solution teams.

KPMG Origins provides client access via a User Interface (UI) or API to interact with the platform. KPMG Origins public API is a RESTful API (level 2), authenticated using API keys. API documents are available through Swagger.

KPMG Origins API Authentication is based on a client id and secret (password) which is issued during the onboarding process. The client exchanges the client id and secret (password) for a short-lived auth token, which can be used for subsequent API calls until the token expires.

The current state would require KPMG Origins customers to configure permissions to share data for specified categories of products (Product Templates) with the MLA Data Platform. The MLA Data Platform would need to use the API search capabilities to identify the available product data for a specified customer. The KPMG Origins API endpoints will have an option to specify a timestamp offset so the client can only pull data that was created or updated after this timestamp offset. The API results will be paginated so the client will have to be able to handle large response data sets.

4.3.2   Master Data ID mapping

Submitting Traceability events into KPMG Origins assumes that the Organisation submitting events have established their Master Data already. This Master Data, however, needs to now be mapped to match the data that will be provided by the FMS. For example, the traceability platform might use an Australian Business Number as an organisation identifier, but the FMS might use a bespoke FMS Enterprise ID as the organisation identifier. These ID's, therefore, need to be mapped to each other so the Systems know they are in fact the same thing.

The mapping is achieved by KPMG Origins ability to store and manage multiple identifiers for each Organisation and Location. Therefore, by adding a new FMS identifier into KPMG Origins, the mapping is achieved, and the traceability event can be submitted.

4.3.3   FMS Data Challenges

There have been multiple challenges identified regarding the FMS data sets including:

- Non-standardised input methods: purchase and sales prices can be captured into the FMS using different methods such as actual animal transaction prices, mob average prices, or estimate animal prices. The method used by the growers is not, however, made available via the integration to enable the traceability platform and users to understand the integrity of the data.
- Singular organisation data perspective: FMS solutions have a very binary view of an animal; in that it can only have one purchase price and one sale price. A connected ecosystem via the traceability platform, however, needs the ability to trace the animal as it changes ownership through many organisations. This means it can have many sale prices and many purchase prices, governed instead by the time of the event. To enable a shared data set between organisations the 'Singular perspective' needs to be removed (e.g., I'm the buyer or seller).
- Lack of standardisation: the different FMS solutions will all have their own field names for the various value types as there is no industry standard. KPMG Origins aims to overcome this by capturing the data in simplified fields. As an example, 'Product Value' is used instead of the three different fields used by the FMS: purchase price per head, sale price per head, value per head.
- Data timeliness: FMS records don't currently distinguish between when a data record was entered vs the timestamp of the actual record event. An example of this could be that the transport time of an NVD may be captured when the truck left the farm, or it might be captured when the grower creates the record later (when they weren't as busy).
- Data inconsistency: as many fields and processes within an FMS are optional, this can create inconsistencies in the data sets. This means certain data fields may not always be present and therefore can't be relied upon. This hinders the ability for analysis to be performed.

4.3.4   Data syncing frequency

Timing and frequency of data integration can be critical, especially when multiple systems are integrated with the traceability platform. The timing also relates to parties and software that is unknown to each other. For example, a processor upon receiving cattle may assume that the most accurate weight records for that animal have been synced across the traceability platform. If, however there was a delay, such as the farmer had an internet outage, meaning the data hadn't yet uploaded to the FMS cloud database (and was therefore unavailable to the traceability platform to sync), the processor might rely on out-dated data to make decisions on the target market.

The aim, therefore, is to have access to near-real-time data in all circumstances. However, the ability to access this, is based on the integration capabilities of the FMS.

The FMS generally fall into one of three categories, where the traceability platform is required to:

- Receive notifications from the FMS that informs when new data exists, or data has been updated. This can be performed under an integration infrastructure called Webhooks.
- Scheduled Polling designed to see if any new data exists, or data has been updated. This schedule could occur daily or as frequently as every minute for example.
- Batch Process, where batches of new data are uploaded on an agreed schedule i.e., daily, weekly or monthly process. For example, the FMS might run an overnight process that generates a new XML file containing all the prior days new or updated data, that would be loaded the following day.

KPMG Origins can handle all three scenarios but prefers receiving near-real-time notifications of new or updated data.

The project also analysed how frequently data should be transferred into the MLA Data Platform. The fundamental starting point of this analysis was the frequency of data transfer, currently, into KPMG Origins from the below data source solutions as follows:

- NLIS Integration a run daily at ~10:00pm (AEST)

- FMS Integration a near-real time using webhooks

- Processor Integration a daily file import at ~11:00pm (AEST)

- Order Creation a manual process as required by Argyle (approx. 1 new order per month)

Table 5 – Options for data transfer from KPMG origins to the MLA data Platform

Frequency	Considerations
Near-real time	a potential goal for the future, but the solution technology teams have indicated this will require additional integration infrastructure (webhooks) to be developed that doesn't currently exist in either platform for the desired objective
Scheduled time (i.e. Hourly)	Every hour MLA Data Platform would check for new or updated data and retrieve as available. Whist this is a good solution, it is likely over-engineered based on the infrequent data availability and changes occurring from all data sources apart from the FMS. This also creates challenges for planned system outages with no windows for this type of maintenance without scheduled integrations running.
Daily	Once per day the MLA Data Platform would check for new or updated data and retrieve as available. This frequency is well aligned to the current updating of the source data

Weekly	Once per week the MLA Data Platform would check for new or updated data and retrieve as available. This will result in a delay of information and could result in lower usage of the MLA Data Platform. For example, if a user knows carcase feedback is available and they want to compare against FMS records in LDL, they don't want to have to wait for up to 7 days for the data to become available.

A Daily data transfer was the most suitable solution for the trial, as a starting point, to further test and validate the timeliness of the selected data sets.

4.3.5   Data updating

KPMG Origins utilises the immutable nature of blockchain technology ensuring that data added to the system can never be changed or tampered with, instilling trust between customers.

In practice, FMS need the ability to update data due to errors. KPMG Origins has implemented mechanisms to enable this, by appending the updated data to the existing blockchain record. This ensures that the original data remains, and is available for data audit purposes, but the updated data will be used as the latest record. Effectively ensuring all data remains immutable.

KPMG Origins integrations also support the updating of data, following this logic, to ensure the FMS data remains effectively 'in-sync' with the traceability platform data.

4.3.6   NLIS considerations

KPMG Origins has an existing integration with the NLIS as the source of truth for NLIS issued cattle tags. KPMG Origins uses the NLIS ID to create uniquely identifiable cattle Products via a Commission Event. To enable this, KPMG Origins is provided third party access to NLIS data for a customer and animals listed on that customers Property Identification Code (PIC). The FMS integration is then used to add additional data to that record, that is not available from NLIS, such as breed, weight etc.

The following are further considerations identified through the FMS integration analysis.

4.3.6.1   Authorisation to access a PICs NLIS records

Third party access to NLIS records for platforms like KPMG Origins is controlled by the PIC owner. A PIC, however, does not represent ownership of an animal. This distinction becomes important when a KPMG Origins and an FMS customer has cattle under agistment on another PIC. In this scenario, KPMG Origins would need to seek authorisation from the agistment PIC owner, to be able to access the NLIS records of these animals, to create the records. However, this KPMG Origins access permission is often unlikely to be granted as that PIC owner may not wish for third party platform providers to have access to all the other cattle on their PIC. To be clear, this does not mean Argyle are unlikely to be granted access, just the additional permissioning of the traceability platform.

The issue this creates for the KPMG Origins and FMS integration, is that we need to support multiple paths under which animal creation in KPMG Origins occurs:

a) If an animal is on the KPMG Origins customer PIC, then create the animal using the NLIS details and then add addition details from the FMS.

b) If an animal is NOT listed on the KPMG Origins customer PIC, then create the animal using the FMS data, and if

          i.   It returns to this customers PIC at a future date, then sync the record with NLIS for validation.

If it does NOT return to this customers PIC, then rely solely on the FMS records.

The last scenario (i) results in the traceability platform having to rely solely on the accuracy of the NLIS data within the FMS. The FMS may have also encountered similar NLIS authorisation issues meaning the FMS also hadn't validated the data directly with NLIS. The outcome of this scenario is that the accuracy of this data isn't known to the traceability platform and if incorrect, could erode the trust and integrity placed on all NLIS records in the traceability platform.

4.3.6.2   NLIS tag application delays

There may be cases where a calf is born and recorded into the FMS using a visual tag ID, not an NLIS tag. When this creation record is notified to KPMG Origins, via the integration, the animal will be created but will NOT be associated with an NLIS ID.

In addition to this process, NLIS may issue a new tag to the KPMG Origins customer which will result in the tag being created as a new Product in the traceability platform.

At a point in the future, when the animal is eventually tagged with the NLIS ID, KPMG needs the ability to 'merge' the existing animal Product record with the existing NLIS ID Product record as they now represent the same animal.

4.3.6.3   Animals losing their NLIS tags

It is our understanding that there isn't a supported NLIS process that handles the loss of a NLIS tag once it has been applied to an animal. Resulting in, the PIC owner, applying a new NLIS Tag (and ID) to that animal. This causes an issue for Traceability platforms like KPMG Origins, as they rely on unique identifiers, like an NLIS ID to identify a Product. Therefore, if a new tag is applied to the animal, this will create a new Product in the system and will not link to the previous Product (from the lost NLIS tag) and its data. Effectively creating a break in the traceability journey.

The mechanisms FMS have implemented, to manage this scenario, seem to vary and as a result we've decided to exclude this from the automated integration scope, opting for a manual solution to link the products within KPMG Origins as required. Addressing this item could be a future enhancement to the system integration capabilities.

4.3.7 Livestock ownership challenges

Currently NLIS and the MLA Data Platform captures and manages the location of an animal, not the ownership of an animal. The locations are accurately managed via Property Identification Codes (PICs). A PIC has an organisational owner, but a PIC owner is not necessarily the same as the animal owner.

The difference between a PIC owner and animal owner can be illustrated through the common industry practice of livestock agistment. Under an agistment arrangement, the livestock owner will arrange to have their cattle located on another PIC owner's farm under a commercial arrangement. From an NLIS perspective these animals will be associated with the agistment farms PIC, and not have any association with the actual owner.

In LDL, the PIC owner at the time of consignment has full visibility of all carcase data and animal disease data. The PIC breeder has visibility of carcase data only. In Meat Standards Australia (MSA) myMSA solution, the consignment owner of a carcase has access to the associated data. This results in access to a partial solution for carcase data but not for pre-processing live animal data.

The lack of an ownership registry has flow on effects for traceability platforms and their ability to access a customer's data, via integrations. This is due to the current Third-Party API access permissions being set at a PIC level and not at the livestock or brand owner level. For example, if a traceability platform customer has livestock located off-PIC, access to these animals is not granted unless the PIC owner, who has no commercial relationship with the traceability platform, also grants the traceability platform access to their NLIS data. This is often not granted as PIC owners are unable to specific a sub-set of livestock (i.e., just Argyles cattle) to be permissioned to the traceability platform and not their entire records.

The key impacts on traceability platforms, when cattle are not located on the same PIC as the livestock owner include:

- Accuracy of FMS NLIS data: the traceability platform must rely solely on the accuracy of the NLIS data within the FMS to create product records. The FMS may have also encountered similar NLIS authorisation issues or is not integrated with NLIS to source accurate NLIS data. The outcome of this is that the FMS may also not have validated the data directly with NLIS. The outcome of this scenario is that the accuracy of this data isn't known to the traceability platform and if incorrect could erode the trust and integrity placed on all NLIS records in the traceability platform.
- Inability to validate data: at no point throughout the life of an animal or carcase is access granted to a Third-Party to validate its accuracy in real-time or historically. This is despite MSA knowing the actual carcase owner directly linked to an NLIS record.

Potential solutions to enhance Livestock owner and Third-Party data access within NLIS/MSA:

- Real-time access: The addition of an 'Ownership' field within NLIS that can be assigned to a different organisation (identified by an ABN or similar), to that of the PIC owner.
    - The ownership field could default to the owner of a PIC for ease of implementation and to support the most common scenario without any additional administration.
    - This ownership assignment mechanism would then allow the PIC owner, after tagging or receiving livestock on their PIC that they do not own, to assign the correct ownership.
    - If these animals are moved to a new PIC, this process may need to be repeated by the next PIC owner, or an alternative solution identified to allow the ownership to remain accurate.
    - The Third-Party data permissions could then be granted by a livestock owner, in addition to a PIC owner, to provide wholistic record access to view, validate and contribute new data to enhance livestock performance reporting.
- Historical access: Utilising the MSA knowledge of the carcase owner, Third-Party permissions could be set to access historical NLIS and carcase data.
    - This would allow the ability to validate the data alignment to NLIS, including location traceability history, and flag any misaligned data.
    - The flagging of misaligned data could provide the product owner the ability to update the traceability platform with the NLIS data.

- Or, if left unchanged, it would alert data recipients (e.g., retailers or banks) that the data accuracy should not be relied upon.
- This solution ultimately aims to ensure there is no stakeholder trust erosion in the NLIS data integrity, within traceability platforms.

Potential solutions to enhance Livestock owner and Third-Party data access within the MLA Data Platform (should the above NLIS/MSA solutions not be viable):

- Real-time access: KPMG Origins could pass through the FMS NLIS records associated with an FMS account organisation. The MLA Data Platform could use this information to set permissions for the Livestock owner to access records via LDL and for Third-Party API access.
  - This is not recommended due to the lack of data validation within FMS and the risk of inaccurate records being permissioned incorrectly.
  - There is obviously the potential to work with FMS providers on measures to increase trust in the data and identification of data that may not be accurate.
- Historical access: Accredited processing facilities currently provide animal and carcase owners data relating to their animals and carcases. Through integrations, KPMG Origins accesses this data and stores it for historical use.
- This data could be used to update the permission settings with the MLA Data Platform (and LDL), to allow access to the NLIS and carcase records, based on the owner recorded by the processing facility.
- This process would then allow the same processes to occur, as detailed previously, such as the identification of misaligned data within the traceability platform to NLIS lifetime traceability records.

4.3.8 Data accuracy challenges identified

Throughout the project a number of data accuracy challenges were identified as a result of connecting the KPMG Origins platform to Argyles third party systems and providers. These data accuracy challenges were identified due to KPMG Origins standardised data approach which enables inconsistencies in data to be identified and rectified.

- Re-worked products are not identified in processors ERP:
  - Argyle currently receives re-worked product notifications via manual emails. The project identified the requirement for these re-worked products to also be updated in the processors ERP to enable the traceability journey to accurately reflect the re-worked product outcomes.
- Hormone Free results are not always properly identified in the processors ERP:
  - Occasionally the Hormone free status of Argyle animals is not accurately captured in the processors ERP. KPMG Origins was able to identify that these products were not in spec with the customer requirements and instigated the incorrect data to be updated. Noting, that this was just a data error, not an issue with the physical product lines meeting the required specification.
- NLIS tags lost in transit:
  - If animals arrive at the processor without a NLIS tag, the processor will create a new temporary tag that is sent via their ERP to KPMG Origins. Prior to the FMS

integration, KPMG Origins would have no record of these new tag id's and therefore no ability to trace which animals they belonged to and or track their movements.

- o Due to the KPMG Origins integration with the FMS, the NLIS tag details are captured at the time the animals depart the farm and updated in KPMG Origins. The connected systems can now reconcile the lost Tags and record the animal movements.
- FMS updated with incorrect animal weights:
  - o Occasionally cattle weights are not accurately captured by the scales due to an animal's behaviour. The FMS allowed the capture of incorrect data via their app, for example 2 kg.
  - o The FMS also accepts 0 kg as a weight value when Importing data from an app.
- NVD Numbers are not always captured correctly in NLIS Platform:
  - o The NVD system can occasionally receive an empty value.
  - o To enable complete traceability, the user must manually allocate the NVD (Certificate) to the List of animals within KPMG Origins.

5. Conclusion

This project successfully demonstrated how a complete lifetime performance data set could provide value to Argyle's supply chain, outside of the existing use cases and highlighted areas where future investment by MLA could provide greater value to the red meat industry, through improved management of red meat brands, supply chains and maximising Inventory.

The KPMG Origins platform was able to successfully connect a FMS solution to enable Argyle to set sharing permissions that provided MLA access to their data. This data was then used to assess the additional service offering that could be developed, into the Livestock Data Link solution. The aim of this was to demonstrate the improvement of inventory/asset management, through data connection, for greater decision making across brands to deliver optimal margins.

This project will pave the way for the future FMS and traceability platform integrations through the data and event mapping as well as the considerations detailed in this report. The project also enabled KPMG Origins to develop and expose the required APIs to integrate FMS data into the traceability platform. These API's will enable rapid and seamless integration of other FMS used by livestock producers. The project also demonstrated the linkage of NLIS data to FMS data within the traceability platform. This linkage is essential for continued development to integrate the MLA Data Platform with the traceability platform.

The project performed analysis to develop a two-way API between the MLA Data Platform and the KPMG Origins traceability platform. This analysis focused on the identified data sets that will enable enhanced lifetime performance analysis to be undertaken by red meat producers. The enhanced lifetime performance view of the animal, carcase, and output meat products will provide producers the ability to compare and analyse data from across their value chain to better understand the impacts of attributes on the associated products. The analysis uncovered that the technical integration of these data sets is possible and seems to be a reasonably viable technical effort to achieve the project objectives. This analysis however, also identified several challenges that will require further investigation and collaborative workshopping, to identify and validate the optimal solution for the industry and stakeholders. A key challenge that impacts several of the outlined opportunities, is that the MLA Data Platform permissioning of data access is currently based on the PIC owner and has no ability for it to be based on the actual animal owner.

Throughout the project there were several data inaccuracy challenges identified for industry participants to work through. These data inaccuracies only became apparent due to the standardised and connected solution approach and the increased transparency this created for participants.

The project concluded with several recommendations that require further research to enable the value to be realised by Argyle and other red meat producers. The recommended research areas including monetisation of carbon, access to working capital finance, and enabling animal benchmarking.

5.1 Key findings

- Integration between an FMS and traceability can be successfully validated and the data sets are compatible to provide red meat producers customers the farm to plate journey.
- Livestock lifetime performance feedback, analysis and decision-making capabilities can be enriched by a traceability platforms ability to standardised and connect the available data sets at each stage of the supply chain into a common format, with data made available for integration into existing industry solutions such as Livestock Data Link.
- An Integration between the MLA Data Platform with traceability platforms, will see additional data sets, contributing greater reporting to the red meat industry, once the MLA Data Platform has the capability.
- There is greater value generated, because of the integration beyond just lifetime performance that will benefit the Industry.

5.2 Benefits to industry

The connectivity of commercial on-farm management systems with a commercial traceability platform has demonstrated multiple product value generation opportunities. This project validated improved inventory/asset management through the data connection between a FMS and Livestock Data Link/MSA Data Platform data via the KPMG Origins traceability platform. The opportunities observed exist across multiple stages of the supply chain from farm through to the cold chain.

5.2.1 Key on-farm data impact and opportunities

5.2.1.1 Monetisation of Carbon

The most valuable opportunity within the integration work to date has been the ability to use the available platforms to manage, report and eventually monetise the carbon and ESG strategy within Argyle. The FMS and KPMG Origins will collectively store and report the 3 carbon credit projects Argyle has submitted with the Clean Energy Regulator; (1) soil carbon sequestration, (2) avoided emissions and beef herd management and (3) Human Induced Restoration (HIR). Argyle Pastoral will conduct baseline testing, with the soil sampling data and project information all being entered into the FMS and the KPMG Origins platform, as will be all associated testing and operations under each carbon project. This data will build and develop the value of the Argyle integrated meat brands as the company strives to be carbon neutral and equally the financial benefits the company intend to receive through monetising the excess carbon credits, with a focus on increased productivity and performance of the livestock systems in achieving these outcomes.

5.2.1.2   Sharing livestock raising program information

The ability to integrate and incorporate the on-farm practices, that are relevant to the livestock raising programs, is a major benefit and requirement in the current global consumer market. FMS's provide a single on farm software platform to store all paddock movements and operations, including fertiliser, planting and chemical applications and the associated withholding periods. The FMS platform supports functionality for staff management and KPI reporting as well as audit reporting and compliance. The audit compliance is unique for Argyle given the amount of unique raising claims and programs under management. For example, the Certified Humane program required regular fence and water maintenance reporting and this is conducted through the individual paddock management feature within the FMS.

5.2.1.3   Livestock raising attributes and claims

Argyle's most important brand segregation is based on diet and lifetime traceability of the animals. The FMS maintains the lifetime history of each individual beef animal on farm and their relevant diet and treatment status. Argyle operates a 100% grass fed livestock raising program that is also 100% no added hormones, 100% antibiotic free and 100% GMO free, never confined to a feedlot and is also breed specific for both Angus and non-Angus cattle. These validated product and marketing claims are then shared with Argyle's end-customers via KPMG Origins enabling automated and standardised product claim data sharing.

5.2.1.4   Certification sharing

Argyle also holds and markets beef under GAP4 and Certified Humane programs that are audited by Ausmeat and the US based Certified Humane Organisation. Such programs are not possible without the most robust lifetime traceability systems from the livestock birth through to delivery of finished goods to their final destination. The certifications of these programs are able to be uploaded and shared with Argyle's end-customers via the KPMG Origins Certification module, previously this was a manual process to share this information.

Figure 5 – Example LPA Certificate in KPMG Origins
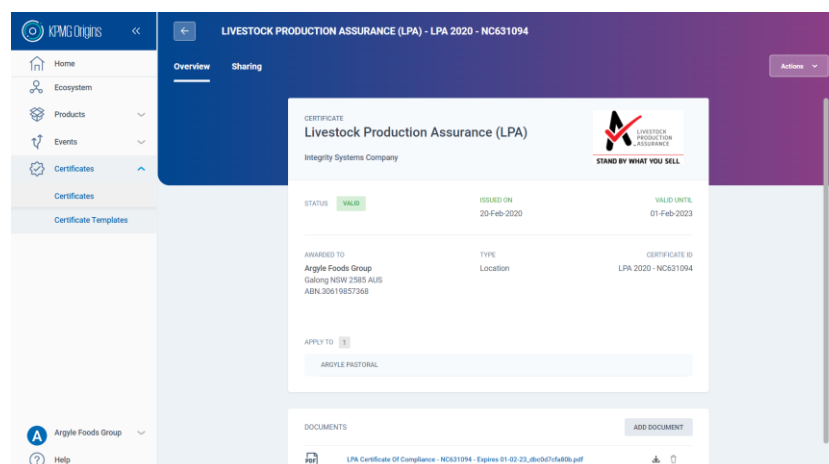
5.2.1.5   Validated breed identification

Breed identification for Argyle's Angus, Wagyu and non-breed specific programs is also managed through the FMS and verified through the KPMG Origins platform's integrations with the NLIS system, the eNVD, delivery documents for the livestock, and the processors receival assessment and production specifications. Previously this breed information was manually communicated to the required parties.

5.2.1.6   Enabling individual animal performance analysis

Individual animal performance, whilst on farm and in the Argyle system, is reported via average daily weight gain (ADG) and correlating that data with what paddock, pasture/crop the animals were grazing and length of days on farm to verify the actual cost of gain for each individual animal. The cost of weight gain is the key profitability driver for the pastoral business and key KPI's for farm management. The ability to enhance the un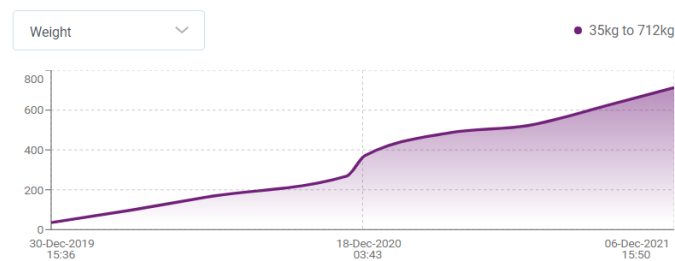derstanding of the variables impacting the key profitability drivers on-farm can come from greater access to data at both a supply chain level and industry level.

Figure 6 – Example animal weight history in KPMG Origins

5.2.1.7   Enabling individual animal performance forecasting

Improved individual animal performance forecasting and reporting has allowed Argyle to reduce the cost of capital associated with livestock financing via a new financier that provides capital for 100% of livestock purchase and further up to 80% of the forecast value of the animals sale value after 120 days. The finance facility requires extremely robust and trustworthy data that must be readily available from the software platform that presents purchase price, purchase location, induction weights, treatments, ADG and forecast exit weights and values at the 120-day trade completion. The reduced interest rate was significantly lower than the standard livestock financing market (approx. 5% lower interest cost). The reduction in interest rate can be attributed to the financiers reduced perceived risk of the livestock because of the increased visibility and trust in the asset collateral.

5.2.2 Key farm to processing data impact and opportunities

5.2.2.1   Empty livestock to carcase yield performance

Livestock processed within the case study were processed at The CO-OP in Casino and trucked 1050km from Argyle farm to the abattoir in Casino for processing. Trucks were weighed on arrival at

The CO-OP on a complete empty basis to study the empty livestock to carcase yield performance. On one production run the livestock arrived and were slaughtered on the next morning and an alternative production run the livestock arrived at the processor and had a day to rest and feed/drink before being processed 2 days after arrival. The weights were attributed back to individual animals based on the previous composition of animal weights captured in the FMS. These calculated individual animal weights were then also uploaded to the FMS. This data showed an increased carcase yield for the livestock that were spelled and fed post arrival at the abattoir across the 214 head in this trial and Argyle will continue to trial this and other changes, such as travel calm feed supplements pre-loading, to assess potential improvements in carcase yields.

5.2.2.2   Sharing transportation details & declarations

eNVD, MSA and program specific paperwork are required to accompany each delivery of cattle. Argyle currently uses eNVD and manually completes an MSA declaration for, Argyle Foods Group grass fed program declaration with each delivery within the case study. These documents are paramount for the livestock to be processed under the specific programs and respective brands, and the integration with the KPMG Origins ensures these are available for customers to review and ensures compliance requirements for the audited programs.

5.2.3 Key processing data observed and impact

Carcase and MSA data integrated back to the lifetime data of the animal, provides feedback on lifetime events and the correlating effect on carcase performance, yield and eating quality and as such, overall profitability on a single animal and mob-based assessment. The data provided insights into the impact the animals origin, lifetime movements, diet, days on farm, treatments, breed, and genetics had on the overall red meat yield, eating quality, MSA compliance and relative sales value through Argyle's branded distribution platform.

5.2.3.1   Carcase performance indicators

Carcase performance indicators and the MSA data on an individual animal basis is a mandatory requirement prior to the boning production of the animals. This ensures maximum carcase utilisation, profitability and customer order satisfaction as the carcasses are sorted in the chillers and run through the boning room, in the most efficient manner, based on the grading data. The most important data for the Argyle case study was hot standard carcase weight (HSCW), MSA compliance, MSA index, marble score, and cypher (Based on dentition).

Figure 7 – Example carcase performance indicators in KPMG Origins

5.2.3.2 Enabling animal benchmarking

The ability to analyse carcase data and lifetime data of an individual animal within Livestock Data Link (LDL) is some of the most powerful and beneficial information available to Argyle. This analysis can be achieved by connecting both the FMS and LDL to KPMG Origins to automatically share standardised data between the platforms. Argyle has started to develop benchmark data for all animals being processed internally. The data will highlight key indicators that improve livestock performance, productivity, and profitability through their entire life cycle from induction to finished sales value, in the form of boxed beef. This data allows Argyle to understand the benefits of purchasing cattle from a specific breeder, or a specific region (Monaro, as opposed to western NSW, as opposed to South Australia or Victoria etc). As such, Argyle can offer a premium price to a breeder, with the knowledge that those specific cattle have outperformed in on farm data, carcase performance and customer compliance in previous productions. Maximising on farm performance in terms of optimal days on farm, targeted minimum ADG and associated cost of gain KPI's, ensures improved productivity and profitability. The integrated data platforms also assist with multiple audit compliance and record keeping efficiency.

5.2.3.3 Sharing approved breeding and finishing farm traceability

Argyle currently engages with breeding and finishing farms to supply cattle into Argyles various beef quality lines. These farms are now able to also provide lifetime traceability data, equal to that of Argyle own farming operations, via the KPMG Origins traceability platform. This information is particularly powerful for Argyle as the company undertakes expansion of its approved breeding and finishing farms. This expansion is essential to continue Argyles growth into key domestic, Asian, US and UK customers. All approved breeders and finishing operations that sign up to the Argyle programs will be committed to the program compliance and lifetime traceability requirements, and the performance metrics made available through the on-farm software and LDL integration to continually improve compliance and performance.

5.2.3.4 Access to working capital financing

The ability to automatically integrate the inventory ERP system of The CO-OP into the KPMG Origins platform has allowed Argyle to improve working capital financing rates and leverage as financiers have visibility of (1) inventory stock, (2) sales orders and inventory values and (3) stock dispatch and

documents as the stock is released to fill orders. This utilises KPMG Origins data permissioning feature that provides Argyle with access controls to share the required data with financiers. This has allowed Argyle to partner with two major lenders offering integrated trade and debtor facilities. The unique data stack that Argyle provides, as well as the opportunity for the financier to integrate directly into the data stack API, has enabled Argyle to achieve a lower cost of capital with much less security collateral required as the financier can recognise, understand, and value the collateral of the inventory within the supply chain, whether it is biological assets (livestock) or inventory (boxed beef, grain, and feed commodities).

5.2.4 Key cold chain distribution data impact and opportunities

5.2.4.1 Quality validation

As demonstrated in the project P.PSH.1214, the integration between KPMG Origins and Emmerson (IOT data logging device) for all out bound export shipments has improved the Argyle supply chain control and the integrity of the Argyle products once they reach their export destination. The products are tracked in transit until receival destination and monitor temperature, time and locations. The improved control and visibility of the products always validates the product, the brands Provence and the lifetime traceability for the end consumer. This data is a mandatory requirement for the key customers accounts and in particular the global retailers that Argyle supplies. The access to this data is equally important for Argyle's finance partner in the required visibility of products and the transfer of ownership from Argyle to customers and as such the transfer of security for the financier.

Figure 8 – Example IoT temperature data in KPMG Origins
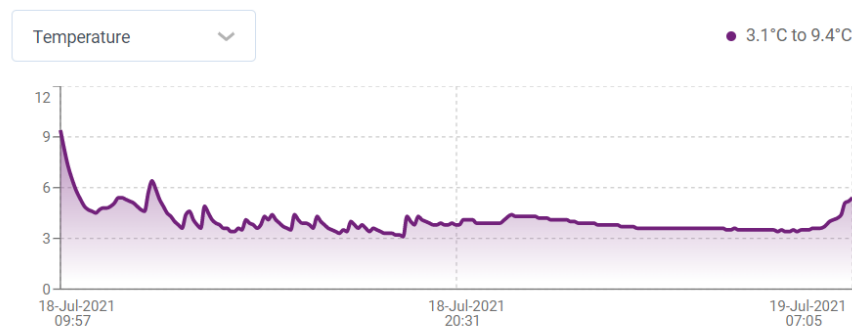
6. Future research and recommendations

This Project uncovered significant scope to continue enhancing and exploring the value generated from having an integrated FMS and traceability platform. This scope also includes the future recommendations that sharing data between the traceability platform and the MLA Data Platform provides and the new opportunities that would further enhance this offering for the industry. The future enhancements will focus on both the technical enhancements and the business recommendations that will provide future value generation for red meat supply chains.

6.1 Data Taxonomy Standard

Currently systems and participants across the red meat supply chain, including FMS and traceability platforms do not have a data taxonomy (common data definition) that describes a standard data set to enable seamless communication between systems and participants. Due to the lack of standardisation, each integration between an FMS and KPMG Origins will require extensive data mapping analysis and implementation to occur. With KPMG Origins such mapping is simplified and concentrated/isolated to a one-off integration data mapping and integration effort between FMS and KPMG Origins resulting in the simplification of all downstream system data dissemination effort.

6.2 Webhooks

A webhook is a way for a web-based software system to provide other systems with real-time information. A webhook delivers data to other systems as it happens, meaning you get data immediately. This is an enhancement from a REST API which in most cases requires a period scheduler to check if any new data is available in the data originating system. The instantaneous data synchronisation across systems would enable users instant access to the combined data sets in their systems of choice.

KPMG Origins is already integrated with a FMS using webhooks meaning that the FMS data sets are available within KPMG Origins in near-real time. If KPMG Origins we're to also implement webhook capabilities that the MLA Data Platform could subscribe to receive data from, then the transfer of data from the FMS's to the MLA Data Platform via KPMG Origins would occur in near-real time. For example, if a producer's latest weight data has just been captured in their FMS, the data will also be pushed to the MLA Data Platform via KPMG Origins which would provide the producer the option to view the weight data within their FMS or within the MLA Data Platform (and compare against industry benchmarks for example).

It's recommended that this type of capability across the red meat industry software providers should be further researched and reported on. Other sectors (like financial services) use open sockets-based subscription architecture to create a real-time and event-based data dissemination solutions. Such architecture should also be considered as future integration architecture.

Diagram 2 – Example webhook integrations
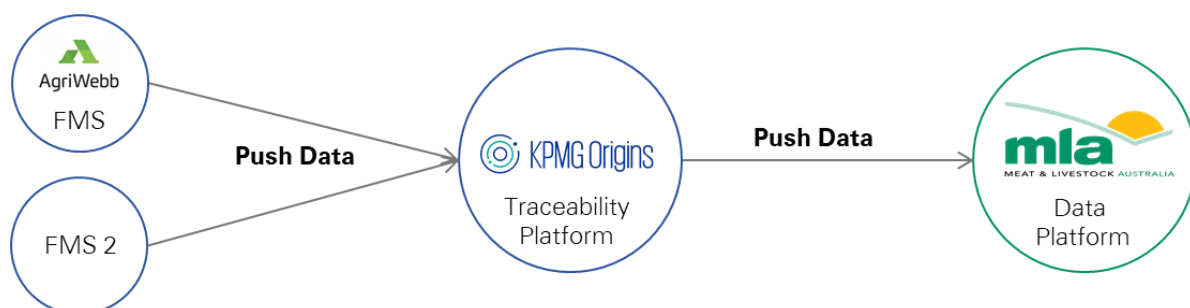
6.3 Two-way data flow

The project achieved the sharing of data from the FMS to KPMG Origins, but not yet from KPMG Origins to the FMS. This scope can be achieved technically in the future, once the FMS can establish data models and feature sets to house and display data from post-farm gate sources (e.g. processing). It's recommended that future project work would need to be undertaken to identify and analyse further use cases and value propositions as to what and why data will be valuable to share back into the FMS from KPMG Origins. This innovative research should provide sufficient incentive (brand/solution differentiation) for the FMS providers to engage and consider implementing such enhancements.

6.4 Data Sharing – Financing

By demonstrating the ability to integrate data from a FMS to a traceability platform, an evolution will be, to assess how this data can be permissioned to be shared with other stakeholders, outside of the traditional supply chain traceability participants, such as financiers. Argyles desire to explore this opportunity with KPMG Origins has already been detailed by MLA in the 'Commercial application of supply chain integrity and shelf life systems' (V.MFS.0447) report. Argyle continues to explore better ways to access working capital financing and believe that this is a significant issue across the industry. The ability to enable non-traditional financiers to participate in the red meat industry, due to asset visibility achieved via KPMG Origins and this project, can enable increased competition and significant gains for red meat participants

6.5 Enabling Animal Benchmarking

This project has provided some early insights as to the potential of achieving enhanced animal benchmarking via Livestock Data Link, enabled by the connectivity of KPMG Origins. However, this has been assessed with a relatively small data set and needs to be expanded to a larger participant base and animals before the full and true value can be understood.   It's recommended that KPMG and MLA continue to explore and integrate the data flow from MLA to KPMG Origins as the detailed functionalities are implemented and made available to third party software providers by MLA.

6.6 MSA data for traceability platforms

Currently the mechanism in which traceability platforms can capture processing stage data, including the Meat Standards Australia (MSA) carcase compliance data, is to integrate with each processors system. Each processor has implemented their own, often heavily customised, Enterprise Resource Planning (ERP) system to manage their facility, as well as capturing and storing a wide range of data sets. Each processor has also invested into implementing the required data transfer processes to capture and transfer standardised data to MSA, relating to carcase compliance.

There are costs associated for both the processor and the traceability platform provider when integrating their systems. This cost includes the analysis of available data formats and integration capabilities, the development of an integration, including the required data mapping, the testing of the integration, and then the ongoing operational and maintenance costs of the integration.

The future opportunity for the MLA Data Platform is to provide connectivity of this multi-processor MSA data set to KPMG Origins traceability platform and other stakeholders in a single, standardised integration. Essentially the MLA Data Platform becomes the industry repository of this trusted data that can then be made available to parties, permissioned to access it, in a scalable and cost-effective manner. Further analysis could be undertaken to calculate the cost saving of this initiate for the industry given historical integration costs, the number of red meat processing facilities and the growing number of traceability platforms servicing red meat clients.

6.7 Monetisation of carbon

The potential value generation of this initiate is significant, and Argyle are uniquely positioned to demonstrate this potential to the broader industry and assist MLA to achieve it's 2030 carbon neutral ambitions. Section 5.2.1.1 details the value of this opportunity for Argyle and like producers. Argyle is continuing to undertake research work with the MLA to explore this carbon opportunity but as a result of this project, it's recommended that further research be undertaken on the ability for FMS and traceability platforms to capture and integrate the additional carbon data sets to explore the additional value that this cane generate for producers.

1. References

Nil.

2. Appendix

2.1 Data field descriptions

KPMG Origins Events have several common fields, as per table 6 below, but also have fields specific to the Event type, as per table 7 below. The tables below provide a description of these fields and an example to illustrate how the data is applied in the integration JSON.

Table 6 – Event common field descriptions

KPMG Origins Field	Description	Example
Event ID	ID of the event as set by the creator	123456789
Event Type	The Event type as per the available options: • Commission • Object • Aggregation • Disaggregation • Dispatched • Received • Ownership Change • Transformation • Decommission	Commission
Event Name	A descriptive name of the event	Calving
Event Time	Time which the event occurred int UTC time	2020-11-26T20:05:00Z
Event Party	Organisation ID of the event submitter in the form of <id_type>.<id>	ABN.11234567001
Event Location	Location ID where the event occurred in the form of <id_type>.<id>	PIC.3ABCD123
Event Entitlement	The sharing permissions setting for the event. A value of 1 indicates that event is hidden from other parties, a value of 2 indicate that other supply chain parties may view this event	2
Event Accurate Timestamp	A true value indicate that the timestamp is accurate to the time of the day. A false value indicates the timestamp should be generalised to the date of the event only	True

Table 7 – Event additional field descriptions

KPMG Origins Field	Description	Example
Product SKU ID	ID of the Product Template used to create the product in the form of <id_type>.<id>	CATTLE.MALEBLACKANGUS
Product ID	ID of the product being created in the form of <id_type>.<id>	NLIS.QGWR9943LBN91713
Product Owner ID	Organisation ID of the product owner in the form of <id_type>.<id>	ABN.54321000123

Product Quantity Value	Quantity value of the product	335
Product Quantity UOM	Unit Of Measure (UOM) used for the above quantity	Kg
Product Count	Number of units of the product	1
Metadata	An array of optional metadata in key value pairs	{"key": Breed, "value": Angus}
Purchase Order ID	Purchase order ID associated with the product	28392193
Sales Order ID	Sales order ID associated with the product	54622013
Output Logistic Units	Logistics unit ID that products are being aggregated into in the form of <id_type>.<id>	NVD.1467093
Input Products	An array of product IDs for the products that are being aggregated	["NLIS.QGWR9943LBN91713", "NLIS.QGWR9943LBN12388"]
Dispatched To Organization	Organisation ID of the receiving organisation in the form of <id_type>.<id>	ABN.34564512345
Dispatched To Location	Location ID of the destination location in the form of <id_type>.<id>	PIC.4EFG213
New Owner ID	Organisation ID of the new owner in the form of <id_type>.<id>	ABN.54321000123

2.2 Event data examples

The following Events provide detailed descriptions of the specific integration requirements including the data fields, data examples and JSON example for each of the Events. This information also clearly shows the data mapping between requirements and examples between the integrated FMS and traceability platform.

Data is retrieved from the FMS using GET requests (and Webhooks) which is then used to create events through the POST Events REST API in KPMG Origins. All KPMG Origins Events are posted as JSON. All Events have several common fields, as per table 6 above, but also have fields specific to the Event type, which are described throughout the Event examples.

The full documentation of KPMG Origins exposed API's can be accessed via this web link: https://app.kpmgorigins.com/client-api/swagger/index.html

2.2.1   Commission Event

A Commission event creates one or several new active products, based on a product template, to represent the start of the product journey. In relation to livestock, a commission event will 'register' an animal that has been purchased or born on a farm. The example below is based on the commissioning of an animal from the FMS that has not already been commissioned by NLIS.

Table 8 – Commission Event common fields

KPMG Origins Field	FMS Data Source	Example
Event ID	Creation Record ID	FMS.8712feec-aa6b-4f2c-9f19-857f0cd014e4
Event Type		Commission
Event Name		Tag Applied
Event Time	Date of birth	2020-04-15T20:05:00Z
Event Party	Enterprise ID	FMS.d1fac32e-ed32-4605-a17b-c2629e694572
Event Location	Farm ID	FMS.d27b4ba3-f2b5-44a0-949c-53cf9f19674f
Event Accurate Timestamp		False

Table 9 – Commission Event additional fields

KPMG Origins Field	FMS Data Source	Example
Product SKU ID	Management Group ID	FMS.CATTLE
Product ID	Animal Identity EID	RFID.942000036154099
Product Owner ID	Enterprise ID	FMS.d1fac32e-ed32-4605-a17b-c2629e694572
Product Quantity	Weight Record Weight Value	323.43
Product Quantity UOM	Weight Record Weight Unit	Kg
Product Count	Animal ID Count	1
Metadata	Age Class Breed Assessed Sex	Breed: Angus Sex: Female
Purchase Order ID	Purchase Record ID	FMS.988cd877-f7ce-49c6-90b0-2b758be063b1

Table 10 – Commission JSON Example

	FMS GET API JSON	KPMG Origins POST API JSON
Request	<pre>{
animals (farmId: "d27b4ba3-f2b5-44a0-949c-
53cf9f19674f"
)

 {
  animalId
  identity {
   vid
   eid
  }
  characteristics{
   sex
   breedAssessed
   birthDate
   birthLocationId
   }
  purchasedFrom
  purchaseRecordId
  purchaseLocationId
              state {
   weights {
    liveWeight{
     value
     unit
    }
    liveWeightDate
   }
  }

 }
}</pre> | <pre>{
  "products":[
   {
     "skuId":"FMS.CATTLE",
     "id":"FMS.8712feec-aa6b-4f2c-9f19-
857f0cd014e4",
     "ownerId":"FMS.d1fac32e-ed32-4605-a17b-
c2629e694572",
      "productCount":"1"
    },
    "metadata":[
     {
       "key":"Breed",
       "value":"Angus"
     },
     {
       "key":"Sex",
       "value":"Female"
     }
    ],
    "purchaseOrderId":"FMS.988cd877-f7ce-49c6-
90b0-2b758be063b1",
    }
  ],
  "id":"FMS.8712feec-aa6b-4f2c-9f19-
857f0cd014e4",
  "type":"COMMISION",
  "name":"Tag Applied",
  "eventTime":"2020-04-15T20:05:00Z",
  "party":"FMS.d1fac32e-ed32-4605-a17b-
c2629e694572",
  "location":"FMS.d27b4ba3-f2b5-44a0-949c-
53cf9f19674f",
  "entitlement": 2,
  "accurateTimestamp": false
}</pre> |
| **Response** | <pre>{
 "data": {
  "animals": [
   {
     "animalId": "01b21cf1-ade9-4e68-9f17-
4e936fd3ebe6",
      "identity": {
       "vid": "222UK123456701199",
       "eid": null
      },
      "characteristics": {
       "sex": "Female",
       "breedAssessed": "Angus",
       "birthDate": 1538834400000,
       "birthLocationId": null
      },
      "purchasedFrom": null,
      "purchaseRecordId": "988cd877-f7ce-49c6-
90b0-2b758be063b1"
      "purchaseLocationId": null,
      "state": {
       "weights": {
        "liveWeight": {
         "value": null,</pre> | |

```
        "unit": null
    },
    "liveWeightDate": null
  }
 }
}
```

2.2.2   Weight Object Event

An Object event is used to track or add other relevant data, related to a product. In livestock management that is a way to add weight data to an animal record.

Table 11 – Weight Object Event common fields

KPMG Origins Field	FMS Data Source	Example
Event Id	Record ID	FMS.e4926b29-ffe8-4896-b930-d65da97aae4d
Event Type		Object
Event Name	Record Type	Weigh
Event Time	Observation Date (Unix Epoch Time format)	2021-06-05T18:35:00Z
Event Party	Enterprise ID	FMS.d1fac32e-ed32-4605-a17b-c2629e694572
Event Location	Farm ID	FMS.d27b4ba3-f2b5-44a0-949c-53cf9f19674f
Event Accurate Timestamp	(Always True)	True

Table 12 – Weight Object Event additional fields

KPMG Origins Field	FMS Data Source	Example
Products	Animal Identity EID	RFID.942000036154099
Metadata	Weight	Weight: 253.45 Weight UOM: Kg

Table 13 – Weight Object JSON Example

	FMS GET API JSON	KPMG Origins POST API JSON

Request	{
	animals (farmId: "d27b4ba3-f2b5-44a0-949c-53cf9f19674f")
	 {
	  animalId
	  identity {
	   vid
	   eid
	  }
	  records (filter: {recordType: {_eq: weigh}}) {
	   recordType
	   recordId
	   observationDate
	      ... on WeighRecord {
	    weight {
	     value
	     unit
	    }
	   }
	  }
	 }
		{
		  "products":[
		    "RFID.942000036154099"
		  ],
		  "metadata":[
		    {
		      "key":"weight",
		      "value":"253.45"
		    },
		    {
		      "key":"weightUom",
		      "value":"Kg"
		    }
		  ],
		  "id":"FMS.e4926b29-ffe8-4896-b930-d65da97aae4d",
		  "type":"OBJECT",
		  "name":"Weighing",
		  "eventTime":"2021-06-25T03:44:53",

	`}`
	`}`
		`  "party":"FMS.d1fac32e-ed32-4605-a17b-c2629e694572",`
		`  "location":"FMS.d27b4ba3-f2b5-44a0-949c-53cf9f19674f",`
		`  "entitlement": 2,`
		`  "accurateTimestamp": false`
		`}`

Response	`{`
	`     "animalId": "800b1325-6a2b-4977-bcda-c46ec8c1e1cf",`
	`     "identity": {`
	`      "vid": null,`
	`      "eid": "942000036154099"`
	`     },`
	`     "records": [`
	`      {`
	`       "recordType": "weigh",`
	`       "recordId": "e4926b29-ffe8-4896-b930-d65da97aae4d",`
	`       "observationDate": 1604466544749,`
	`       "weight": {`
	`        "value": 253.45,`
	`        "unit": "kg"`
	`       }`
	`      }`
	`     ]`
	`    }`	

2.2.3   Treatment Object Event

An Object event is used to track or add other relevant data related to a product. In livestock management that is a way to add treatment data to an animal record.

Table 14 – Treatment Object Event common fields

KPMG Origins Field	FMS Data Source	Example
Event ID	Record ID	FMS.54af0926-2a98-4d6b-8ffa-bcc1d430ba2e
Event Type		Object
Event Name		Treatment
Event Time	Observation Date	2021-05-26T17:10:00Z
Event Party	Enterprise ID	FMS.d1fac32e-ed32-4605-a17b-c2629e694572
Event Location	Farm ID	FMS.d27b4ba3-f2b5-44a0-949c-53cf9f19674f
Event Accurate Timestamp		True

Table 15 – Treatment Event additional fields

KPMG Origins Field	FMS Data Source	Example
Products	Animal Identity EID	RFID.942000036154099
Metadata	Treatment Medicine Treatment Reason Treatment Dosage Value Treatment Dosage Units	Medicine: Antibiotics Reason: Abscess Dosage Value: 100 Dosage Units: ml

Table 16 – Treatment JSON Example

	FMS GET API JSON	KPMG Origins POST API JSON

Request	{
	animals (farmId: "d27b4ba3-f2b5-44a0-949c-53cf9f19674f")
	 {
	  animalId
	  identity {
	   vid
	   eid
	  }
	  records (filter: {recordType: {_eq: treatment}}) {
	   recordType
	   recordId
	   observationDate
	    ... on treatmentRecord {
	    Dosage {
	     value
	     unit
	    },
	    reason
	    medicine
	    }
	   }
	  }
	}
		{
		 "products":[
		  "string"
		],
		 "metadata":[
		  {
		   "key":"Medicine",
		   "value":"string"
		  },
		{
		   "key":"Reason",
		   "value":"Abscess"
		  },
		{
		   "key":"Dosage Value",
		   "value":"100"
		  },
		{
		   "key":"Dosage Units",
		   "value":"ml"
		  }
		],
		 "id":"FMS.54af0926-2a98-4d6b-8ffa-bcc1d430ba2e ",
		 "type":"OBJECT",
		 "name":"Treatment",
		 "eventTime":"2021-05-26T17:10:00Z",
		 "party":"FMS.d1fac32e-ed32-4605-a17b-c2629e694572",
		 "location":"string",
		 "entitlement": 2,
		 "accurateTimestamp": false
		}

Response	{
	   "animalId": "800b1325-6a2b-4977-bcda-c46ec8c1e1cf",
	   "identity": {
	    "vid": null,
	    "eid": "942000036154099"
	   },
	   "records": [
	    {
	     "recordType": "treatment",
	     "recordId": "54af0926-2a98-4d6b-8ffa-bcc1d430ba2e",
	     "observationDate": 1604466544749,
	     "dosage": {
	      "value": 100,
	      "unit": "ml"
	     },
	     "reason": "Abscess",
	     "medicine": "Antibiotics"
	    }
	   ]
	  }	

2.2.4   Aggregation Event

Movement for traceability purposes is represented by a series of four events that allow aggregation of products into a vehicle or logistics unit, dispatch and receival and disaggregation. For livestock that likely means aggregation into an NVD group and subsequent movement. An Aggregation event aggregates products into a group.

Table 17 – Aggregation Event common fields

KPMG Origins Field	FMS Data Source	Example
Event ID	Movement Record ID	FMS.0d726ca8-995b-4d6d-b8a4-632556057ac7
Event Type		Aggregation
Event Name		Truck Loading
Event Time	Movement Date	2021-05-26T13:24:00Z
Event Party	Enterprise ID	FMS.d1fac32e-ed32-4605-a17b-c2629e694572
Event Location	Farm ID	FMS.d27b4ba3-f2b5-44a0-949c-53cf9f19674f
Event Accurate Timestamp		False

Table 18 – Aggregation Event additional fields

KPMG Origins Field	FMS Data Source	Example
Output Logistic Units	eNVD ID	NVD.CO413
Input Products	Animal Identity EID	RFID.942000036154099
Metadata		
Sales Order ID	Sale Record ID	FMS.9e4e85a1-ea1e-4139-b886-1e3417a558d7

Table 19 – Aggregation JSON Example

	FMS GET API JSON	KPMG Origins POST API JSON

Request	*JSON example not available*	`{`
		`  "output":"NVD.CO413",`
		`  "inputProducts":[`
		`    "RFID.942000036154099"`
		`  ],`
		`  "metadata":[`
		`    {}`
		`  ],`
		`  "salesOrderId":"FMS.9e4e85a1-ea1e-4139-b886-1e3417a558d7",`
		`  "id":"FMS.0d726ca8-995b-4d6d-b8a4-632556057ac7",`
		`  "type":"Aggregation",`
		`  "name":"Truck Loading",`
		`  "eventTime":"2021-05-26T13:24:00Z",`
		`  "party":"FMS.d1fac32e-ed32-4605-a17b-c2629e694572",`
		`  "location":"FMS.d27b4ba3-f2b5-44a0-949c-53cf9f19674f ",`
		`  "entitlement": 2,`
		`  "accurateTimestamp": false`
		`}`

Response		

2.2.5 Dispatch Event

Movement for traceability purposes is represented a series of four events that allow aggregation of products into a vehicle or logistics unit, dispatch and receival and disaggregation. For livestock that likely means aggregation into an NVD group and subsequent movement. A Dispatched event will contain all associated products that have been recorded as departed from the origin location.

Table 20 – Dispatch Event common fields

KPMG Origins Field	FMS Data Source	Example
Event ID	eNVD ID	NVD.CO413
Event Type		Dispatch
Event Name		Truck Departure
Event Time	Movement Date	2021-05-26T13:38:00Z
Event Party	Enterprise ID	FMS.d1fac32e-ed32-4605-a17b-c2629e694572
Event Location	Farm ID	FMS.d27b4ba3-f2b5-44a0-949c-53cf9f19674f
Event Accurate Timestamp		False

Table 21 – Dispatch Event additional fields

KPMG Origins Field	FMS Data Source	Example
Input Products	Animal Identity EID	RFID.942000036154099
Dispatched To Organization	Consigned to Enterprise	FMS.888e6aa0-4425-4adf-9e9a-556d17f1ed4a
Dispatched To Location	Consigned to PIC	PIC.NC66103
Metadata	Vendor Declaration	HGP Status: Free
Sales Order Id	Sale Record Id	FMS.9e4e85a1-ea1e-4139-b886-1e3417a558d7

Table 2 – Dispatch JSON Example

	FMS GET API JSON	KPMG Origins POST API JSON

Request	*JSON example not available*	{
		  "inputProducts":[
		    RFID.942000036154099
		  ],
		  "dispatchedToOrganization":"FMS.888e6aa0-4425-4adf-9e9a-556d17f1ed4a ",
		  "dispatchedToLocation":"PIC.NC66103",
		  "metadata":[
		    {
		      "key":"HGP Status",
		      "value":"Free"
		    }
		  ],
		  "salesOrderId":"FMS.9e4e85a1-ea1e-4139-b886-1e3417a558d7",
		  "id":"NVD.CO413",
		  "type":"DISPATCH",
		  "name":"Truck Departure",
		  "eventTime":"2021-05-26T13:38:00Z",
		  "party":"FMS.d1fac32e-ed32-4605-a17b-c2629e694572",
		  "location":"FMS.d27b4ba3-f2b5-44a0-949c-53cf9f19674f ",
		  "entitlement": 2,

		"accurateTimestamp": false }
Response		

2.2.6 Decommission Event

A Decommission event deactivates an active product to represent the end of the product's journey. In relation to livestock this means either death of an animal or sale of a product to an end consumer.

Table 23 – Decommission Event common fields

KPMG Origins Field	FMS Data Source	Example
Event ID	Death Record ID	FMS.3dc77d6e-75cb-4a6e-8801-54e6a36127a1
Event Type		Decommission
Event Name		Deceased Cattle
Event Time	Death Date	2021-05-26T20:05:00Z
Event Party	Enterprise ID	FMS.d1fac32e-ed32-4605-a17b-c2629e694572
Event Location	Farm ID	FMS.d27b4ba3-f2b5-44a0-949c-53cf9f19674f
Event Accurate Timestamp		False

Table 24 – Decommission Event additional fields

KPMG Origins Field	FMS Data Source	Example
Product ID	Animal Identity EID	RFID.942000036154099
Metadata	Cause of Death	Reason: Death

Table 25 – Decommission JSON Example

	FMS GET API JSON	KPMG Origins POST API JSON

Request	*JSON example not available*	{
		  "products": [
		    "RFID.942000036154099"
		  ],
		  "metadata": [
		    {
		      "key": "Reason",
		      "value": "Death"
		    }
		  ],
		  "id": "3dc77d6e-75cb-4a6e-8801-54e6a36127a1",
		  "type": "DECOMMISION",
		  "name": "Deceased Cattle",
		  "eventTime": "2021-05-26T20:05:00Z",
		  "party": "FMS.d1fac32e-ed32-4605-a17b-c2629e694572",
		  "location": "FMS.d27b4ba3-f2b5-44a0-949c-53cf9f19674f",
		  "entitlement": 2,
		  "accurateTimestamp": false
		}

Response		