final report

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Digital integrity systems: Connecting international consumers with Australian red-meat for increased value

Abstract

The purpose of this project was to understand how the development of digital integrity systems connect Chinese consumers with Australian red meat for increased value. A design led innovation method was adopted to explore the problem and to converge on practical business outcomes to share with the Australian red meat industry. This involved an intensive innovation sprint to explore opportunities and challenges, together with a China pilot across three different sales channels. Findings from the project include: 1) value propositions for digital integrity systems from the Chinese customer perspective, 2) identification of three different business models and their implications for Australian companies seeking to implement digital integrity systems, and 3) a commercially viable solution for digital traceability to extend beyond an identified primal pack. The results have significant practical implications for growth oriented Australian red meat companies.

Executive summary

To survive in the 21st Century, every business needs a digital strategy to compete and create new value. It's exciting to consider the possibilities of IoT for farm management, automated carcase processing, objective carcase measurement and feedback, ecommerce platforms and social media and the potential of data analytics and optimisation. In all the excitement, the digital economy creates both opportunities and challenges. Moreover, there are threats that must be confronted for the Australian red meat industry to continue to thrive within global food networks. In this project, we explored the value proposition for digital integrity systems. We validated the opportunities in a commercial context and derived insights into the implementation challenges of digital integrity systems.

The specific purpose of this project was to understand how the development of digital integrity systems connect Chinese consumers with Australian red meat for increased value. Given the project focus was on increasing commercial value for Australian businesses, the research problem was approached from the demand side and explored the value proposition from the perspective of the Chinese market. This method contrasts with other methods that focus on how to identify or prevent food fraud, or on the pros and cons of digital technology options. A sub-set of the project was to explore digital integrity systems that go beyond the uniquely identified primal package to final consumer retail packaging. To ensure that the project was focussed and delivered on its purpose, we asked two questions:

Under what circumstances are Chinese customers (retail, HORECA, ecommerce) and end-consumers willing to pay a premium to Australian red meat companies for digital integrity systems?

How might Australian red meat company business models be adapted to incorporate digital integrity systems?

A design led innovation method was adopted to explore the two questions and to converge on practical business outcomes to share with the Australian red meat industry. Data was collected from the following sources:

- a desktop literature review to clarify the digital integrity system knowledge base within and external to the red meat industry,
- interviews and focus groups with Chinese customers and consumers, digital experts and with Australian red meat industry subject matter experts,
- an innovation sprint to explore and converge on project design concepts, and
- a pilot in the Chinese market.

The design led method also helped to address some adoption challenges for digital integrity systems by balancing between customer desirability and industry feasibility. Viability was validated through the China pilot where the value and price of digital integrity systems was discussed and negotiated with potential Chinese customers and food industry experts, as well as undertaking cost benefit analysis and financial modelling.

General project findings as well as deeper insights suggest that digital integrity systems could create value propositions for processing companies, customers (different sales channels) and end-consumers in different ways. The key value proposition findings are presented in T1.

Table 1. Stakeholder value propositions for digital integrity systems.

Processing company value propositions	Chinese customer (sales channels) value propositions	Chinese consumer value propositions
Creating a premium price in high-end retail markets and niche closed markets, i.e. using digital traceability as a point of negotiation with potential customers	Increase sales by using digital integrity as a marketing tool to improve brand perception of premium products	"I can access the best quality products that others cannot"
Business model innovation and improved integration through the value chain	Increase data sources to better understand consumer profiles and inform off-line online integration and marketing strategy	"I will purchase a product with digital traceability over a product that does not''
Creating direct relationships with end-consumers for product differentiation and consumer insights	Social responsibility and commitment to selling healthy and safe food	Focus group data showed that traceability and source of origin is extremely important for consumers
Data log of time, date, temperature, location and weight of product	Emotional appeal to consumers to show empathy and increase confidence through some demonstration of transparency and brand provenance	
Useful for shelf life testing, particularly in chilled products	Method for customer to validate the legitimacy and quality of processing company	

Insights into viable business model options for digital integrity systems and their respective levels of desirability and feasibility in the China market were the major achievement of this project. Lamb product was digitally traced through different sales channels and customer segments with feedback from: end consumers, premium retailers, food services including high-end chefs, private online ecommerce platform direct to householders and a private WeChat group. Three business model options for digital integrity systems were identified, namely niche, integrated and transactional.

Transactional
Australian companies should be cautious about partnering with Chinese companies who prefer transactional business models. Some Chinese retailers present themselves as having close relationships with consumers and traceability through to the producer, however in practice they have no tangible evidence of a digital integrity system.

Integrated
Australian companies looking to establish digital integrity systems should investigate whether they may be able to successfully partner with Chinese retailers who adopt integrated business models with online ecommerce platforms and offline stores. There may be significant financial rewards, however

the collaboration may be short term unless Australian companies find ways of co-designing the business model to ensure long term sustainability.

Niche
Australian companies looking to establish digital integrity systems should investigate whether they may be able to successfully partner with Chinese companies who adopt niche business models. As these business models are niche they may be low volume but attract a premium.

Benefits and implications to the Australian red meat industry from this project include:
- The importance of integrating digital integrity systems into robust business models
- Identification of premium Chinese markets willing to pay a premium for digital integrity systems
- Discouraging a 'silver bullet' approach or bias toward specific technology solutions
- Commercial implications for Australian red meat companies when their product integrity is compromised
- Building low-cost digital integrity system prototypes for trialling, prior to investing in more expensive commercial systems

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1   Background

1.1   Why was this project undertaken?

1.1.1   Determining customer/consumer value propositions for digital integrity systems

As the demand for protein increases and the global competition to supply red-meat becomes more intense, the opportunity and need to differentiate Australian red-meat from other global competitors is even greater. Red meat digital integrity systems are a way of differentiating Australian red meat products. Consumers are becoming increasingly concerned with food safety, country of origin and environmental sustainability. This is a major concern for Chinese consumers. More discerning and affluent markets are also becoming well developed. Exploring the value propositions for these consumers and the various sales channels that target them is essential to the aims of this project. To this end, the project identified two research questions:

1. *Under what circumstances are Chinese customers (retail, HORECA, ecommerce) and end-consumers willing to pay a premium to Australian red meat companies for digital integrity systems?*

2. *How might Australian red meat company business models be adapted to incorporate digital integrity systems?*

1.1.2   Ensuring digital integrity beyond primal cuts

Digital integrity systems and smart packaging solutions that uniquely identify each pack are quite common and not innovative in themselves. Furthermore, fabrication of uniquely identified primals in market lose their product integrity. This project combined packaging and digital technologies to research and develop a process to address this problem. Currently there are no known digital integrity systems that extend beyond the identified primal pack. The implication is that for any further value-added product that the integrity may be compromised, and opportunity exists to falsely label product.

1.1.3   Building on MLA's research and development into digital value propositions

Digital research and development is not a new space for Meat and Livestock Australia (MLA), as there have been several projects completed over the last few years. MLA focuses on innovation and they are currently leading the development of a digital strategy for the Australian red meat industry. Following are several projects completed by Greenleaf in collaboration with MLA and other industry bodies. In contrast with the present project, the focus of past projects has been on the supply side.

- Review of the National Sheep health monitoring project was completed for Animal Health Australia which provided an updated cost of disease to the sheep industry and a strategic direction on how the current program could be expanded and digitised.
- Livestock Data Link (LDL) was developed to increase the analysis and utilisation of carcase data. Greenleaf completed a strategic direction of the platform to increase the uptake in industry.
- Digital Innovation Platform review was completed to develop a potential framework to support the red meat industry in a cohesive and constructive manner in relation to enhanced use of data and what role MLA may play in facilitating its development.

- Objective Measures Strategy was completed to assess the lost opportunity through inaccurate measurement or appraisal systems and that this could be improved by addressing the current objective measurement-related limitations. This project also estimated that around $420 million of potential gross benefit per annum could exists by 2030 through the adoption of objective measurements.
- Sheep genetics database review developed a framework to expand the current database. Recommending a solution which provided scope for data access and the sharing model while giving full manageability and ownership to both industry and the breeder.

2   Project objectives

The purpose of this project was to work with red meat supply chains to scope the development of a digital integrity system that goes beyond the uniquely identified primal package to final consumer retail packaging.

The specific objectives are:

- Identify, trial and prove the best tamper-proof packaging integrity system for primals, sub-primals and consumer packaging including cloud based unique codes.
- Test the best way to substitute traditional cloud database integrity systems with Blockchain and crypto currency systems.
- Explore the most efficient mechanism for providing digital mass balance from livestock supply to finished consumer purchase considering multiple pack, unpack and repack stages in the supply chain.
- Explore methods for connecting to end consumers that will leverage the Australian red-meat value propositions. Prioritise the propositions that create the greatest value and differentiator for Australian supply chains.
- Determine the value proposition and best business model to commercialise the finding.

3 Methodology

3.1 Overview of the method

A design led innovation method was adopted to explore the research questions and to converge on practical business outcomes to share with the Australian red meat industry. Data was collected from the following sources:

- a desktop literature review to clarify the digital integrity system knowledge base within and external to the red meat industry,
- interviews and a focus group with Chinese customers and consumers, digital experts and with Australian red meat industry subject matter experts,
- a week-long innovation sprint to explore and converge on project design concepts, and
- a pilot project in China.

The design led method also helped to address adoption challenges by balancing between customer desirability and industry feasibility. Viability was validated through the China pilot where the value and price of digital integrity systems was discussed and negotiated with potential Chinese customers and food industry experts, as well as undertaking cost benefit analysis and financial modelling.

The original intention of the project was to pilot digital integrity in beef and lamb value chains. However, the methodology was adjusted to only include the lamb pilot. This was due to the significant learnings of the lamb pilot as well as the complexity of working with different sales channels and markets in China.

3.1.1 Project phases

The design led innovation method was conducted over five phases:

- Discovery
- Interpretation
- Ideation
- Experimentation
- Evolution

3.1.1.1 Phase 1: Discovery

In this phase, the team delved into the many possibilities by reviewing existing research to refine and re-frame the problem specific to the project. The core team utilised a value proposition canvas and supporting questions. This is a framework based around the idea of understanding the customer first, and thereafter creating products and services that address customer pains and gains. Drawing on available research, the team analysed the 'pains' of current systems and discovered 'gains' that a new multi-level integrity system can offer.

3.1.1.2 Phase 2: Interpretation

The interpretation phase involved a four-day design-led innovation sprint. The purpose of the innovation sprint was to diverge and converge on the key design concepts associated with digital integrity systems. This process engaged external thought leaders and subject-matter experts to capture the collective knowledge, ideas and perceived customer value propositions to inform the lamb pilot in China.

Day 1 of the sprint was framed around a stakeholder workshop, where participants were given time to 'blue sky', tell stories about the human aspects of the problem, hear non-red meat case studies and

different perspectives. The main output of the stakeholder workshop was to frame opportunities and competitive advantage for the Australian red meat industry.

Figure 1. Innovation sprint participants.

Table 2. Sprint participants.

Name	Organisation	Sprint role
Dr Matthew Flynn	Greenleaf	Sprint facilitator
Philip Green	Greenleaf	Key note speaker and sprint participant
Monica Bradley	Global Scale Ups & Board Advisor, Corporate Innovation Investment	Panel host
Keren McNally	Keren McNally Communication	Presenter, Blockchain case study
Sam Pospischil	Blockchain Developer, Systems Architect, Consensys	Digital and Blockchain expert
Katrina Dogherty	Co-chief Executive Officer of Civic Ledger	Blockchain expert
Philip Slade	Managing Partner, Decida	Presenter, Digital behaviour and decision making
Erik Cai	Greenleaf	'A day in the life' persona - Chinese salary man
Edie Cheng	Greenleaf	'A day in the life' persona - The Calorie Counter
Kiri Rogan	Greenleaf	'A day in the life' persona - A modern day millennial in Australia
Ken Bryan	Greenleaf	Industry expert
Dales Miles	V&V Walsh	Industry expert – red meat supply chain manager
Richard Lovell	C.P Foods	Industry expert - Regional Head, Australia/ New Zealand & Pacific Islands Assistant Vice President at C.P Foods (Thailand) Public Company
Michael lee	MLA	Presenter, smart packaging

The sprint brought together subject matter experts and external thought leaders in a close meeting of the minds. Present in the room and integral to the success of the sprint were a range of experts and industry influencers in blockchain technology and systems architecture, innovation leaders, marketing and communications consultants, behavioural scientists, red meat industry experts. The innovation sprint participants were given a key question to guide the process:

Why should potential Global Food Network stakeholders innovate with digital integrity systems?

The sprint involved numerous convergence and divergence points, where the team were inspired and pushed to think outside the box. The team underwent extensive synthesising and refinement of information to develop design criteria to answer the research questions.

3.1.1.3   Phase 3: Ideation

Part of the innovation sprint focussed on potential opportunities associated with digital integrity systems. This phase provided participants with an opportunity to 'blue sky'. The ideas are not likely to be realised soon. A range of activities were undertaken, including a value proposition activity based on a stakeholder value map, ideation sessions around the specific components of the pilots, as well as practical business model options. The main output was a proof of concept to be implemented during the pilot.

3.1.1.4   Phase 4: Experimentation

In this phase the core team implemented the China. Extensive feedback from different stakeholders was collected, from producers, processors, import agents, variety of sales channels, chefs, consumers, WeChat influencer). This phase was divided into to two phases:
- Prototype trial
- Commercial trial

The prototype trial involved establishing a digital integrity system for chilled lamb. The system was tested in a Tier 1 city across high-end retail customers and a focus group with food industry experts. During the interviews and the focus group, the digital integrity system was demonstrated, and feedback was captured during discussion and via a questionnaire.

Participants were asked,

How important is it for consumers to be able to trace the lamb in the supply chain?
How important is it to provide the source of origin to consumers?

Follow-up probing questions sought to understand the specific value propositions for different sales channels. As a direct result of meetings with Chinese customers and food industry experts, the digital integrity system presented to the market was redefined for commercial trial. This involved discussion and negotiation between different sales channels and a red meat processor as to the commercial desirability, feasibility and viability of the digital integrity system.

Table 3. Sales channels included in the China pilot.

Sales channel	Description
SC1	Rapidly expanding premium retailer merging offline and online. Customers scan and pay for products via an app, able to scan products to get traceability information and recipe ideas. Stores double as distribution centres where employees roam around filling online orders, then place them on a conveyor belt to the deliver centre. Customers within a three-kilometre radius receive their groceries within 30 minutes. Total of 65 stores with plans for 200.
SC2	Premium retailer (Mega Lifestyle Speciality Store) offering fresh ingredients online and offline. Imports from around the world. Targets busy urban professionals who pursue premium quality. Total of 21 stores.
SC3	Niche ecommerce platform targeting Australian expat community and high net worth Chinese. Specifically designed for Australian growers and producers to supply fresh produce.

3.1.1.5   Phase 5: Evolution

The final phase evolved all the insights from the previous phases by: 1) answering the project's research questions, 2) determining value propositions for different stakeholders, 3) informing business model options, 4) validating viable options for digital integrity beyond primal breakdown, and 5) overall implications for the Australian red meat industry.

4   Results

4.1   Results approach

Results derived from the design-led process offered up novel solutions and examples that could be commercially implemented and communicated broadly across the Australian red meat industry. This section presents results from:
- Cost benefit analysis and financial modelling of digital integrity systems
- Meetings and ongoing communications with three different sales channels
- In store visits
- Focus group
- Beyond primal pack system
- Innovation sprint

4.2   Cost benefit analysis and financial modelling of digital integrity systems

This project produced results on the cost benefit of digital integrity systems in the Shanghai market. Financial modelling of the projected costs was also undertaken across multiple sales channels. The raw data is commercial in confidence; however, we can report that the establishment of a digital integrity system was estimated at a cost of $3 per kg. This figured was bundled into the cost of value adding a ready retail pack of lamb. Items included in the $3 per kg were:
- Digital integrity system hardware and software,
- Lamb pack QR code labelling (or similar systems), and
- Additional labour hours.

The following are important to note:

1. Costs are based on a manual system which would require an operator to apply the labels on retail packs which has been included in the costings.
    a. If processing companies have demand for higher volumes of lamb packs, there are automated applicators that will reduce the labour requirement.
2. The numbers are based on 3 years of production, using the digital traceability system.
3. 0.1 FTE has been allocated to the management of the system/ marketing product.
4. 1 labour unit has been included to operate the machine when required.
5. Assumed $2.00/hd benefit for traceability. This allows $1.00/hd for the cost of packing the value-added products.
6. The cost of labels is based on quotes during the trial and would come done in price as the volume increased.

The utilisation of a customer's software platform would reduce the set up costs. However, some of the benefit would he realised by the customer not the plant.

Table 4. Overhead costs for digital integrity system establishment.

Expense	Year 1	Year 2	Year 3
Overhead costs			
Software	$ 45,505	$ 6,340	$ 6,340
Project Scoping	$ 9,991		
Develop Platform	$ 24,250		
Onsite setup	$ 2,328		
Platform training	$ 1,746		
Hosting & Ongoing Maintenance	$ 7,190	$ 6,340	$ 6,340
Traceability Hardware	$ 16,700		
Printer system	$ 16,700		
Operational Costs	$ 15,000	$ 15,000	$ 15,000
Management - Labour	$ 15,000	$ 15,000	$ 15,000
Annualised Costs			$ 39,962

Table 5. Assumptions for digital integrity system establishment.

Assumptions	Cost	Unit
Labels	$ 0.25	$/Pack
Production Labour	$ 31.20	$/Hr
Weight per pack	1.00	Kg
Hours per day	7.60	Hours/Day
Days per annum	240	Days/Annum
Weight per shipment	1,000	Kg's/Shipment
Annual production	750,000	Lambs/year
Average carcase weight	23	Kg/Lamb
Financial benefit	$ 2.00	$/kg

Table 6. Hardware costs for digital integrity system establishment.

Hardware capabilities	Throughput rate
Production rate (Packs per minute)	10
Daily Production capability	4,560
Annual Production	1,094,400

Table 7. Financial opportunity for digital integrity system.

Financial opportunity through traceability (PA)			
Orders (packs/annum)	**25,000**	**75,000**	**150,000**
Percentage of production	0.1%	0.4%	0.9%
Hardware utilisation	2.3%	6.9%	13.7%
Shipments Per Month	2	6	13
Total cost per pack	$ 1.90	$ 0.83	$ 0.57
System cost per pack	$ 1.60	$ 0.53	$ 0.27
Labour & consumables per pack	$ 0.30	$ 0.30	$ 0.30
Labour	$ 0.05	$ 0.05	$ 0.05
Labels	$ 0.25	$ 0.25	$ 0.25
Benefit per pack	$ 2.00	$ 2.00	$ 2.00
Net Benefit per pack	$ 0.10	$ 1.17	$ 1.43
Annual Benefit for plant	$ 2,488	$ 87,388	$ 214,738

Section 4.3 presents findings on three different sales channels (SC 1,2,3), and found that two of the sales channels had already established their own digital integrity systems. Obviously, this finding is a significant saving to Australian companies if they can successfully collaborate with Chinese companies.

4.3 Sales channel results

The pilot was conducted with three different sales channels. Findings and implications from each sales channel are presented below.

Table 8. Sales channel 1 findings and implications.

Sales channel	Findings	Implications
SC1	Prototype digital integrity system (DIS) was demonstrated. SC1 listened to an explanation about how system worked, and then described their own DIS.	SC1 has invested in their own DIS hardware and software.
	At our request, SC1 said that we could use their system if we became a lamb supplier.	Australian lamb suppliers may benefit from SC1 existing DIS. Focus can be on achieving a premium if they don't have to spend on DIS hardware and software, while presenting brand story.
	SC1 showed videos demonstrating provenance of various products they sell (e.g. salmon, cherries).	SC1 value DIS and traceability and transparency from paddock to plate.

	During site visits to SC1 store we found approximately 50% of red meat products had traceability via a QR code. The product was linked through to a website showing the brand story and evidence of origin.	SC1 have not been able to achieve DIS implementation with all their current red meat suppliers. May be a competitive advantage for Australian red meat companies to collaborate with SC1 on DIS.
	SC1 did not show traceability of the product journey through the supply chain when QR codes were scanned in store.	May be that SC1 is more interested in using DIS as a brand value proposition for customers rather than for transparency and traceability through the value chain.
	They followed up after the prototype trial to request access to the prototype.	SC1 were interested in the prototype system as a way of validating the product and potential customer relationship.

Table 9. Sales channel 2 findings and implications.

Sales channel	Findings	Implications
SC2	Prototype digital integrity system (DIS) was demonstrated. SC2 were not very interested in listening to the explanation about how system worked, or the value proposition for DIS.	SC2 have not invested in their own DIS hardware and software.
	During a site visit to the SC2 store we were unable to identify any red meat retail products with DIS capability.	SC2 do not implement DIS for red meat.
	SC2's website and online platform promoted themselves as a seller of the freshest products from all around the world, including Australia.	Despite SC2 promoting to their consumers that they import product from around the world, they are not able to demonstrate it tangibly as a value proposition to their consumers.
	SC2 were not interested in ordering retail ready packs for sale from their stores. Sc2 want to repack lamb product into their own retail pack and brand.	Digital traceability of the product will be broken. Australian product may be supplemented with counterfeit product.

Table 10. Sales channel 3 findings and implications.

Sales channel	Findings	Implications
SC3	Prototype digital integrity system (DIS) was demonstrated. SC3 were very interested in listening to the explanation about how system worked, and the value proposition for DIS.	SC3 value DIS.
	SC3 described their niche expat and high net worth Chinese market. They spoke about the importance of DIS for their market. During a meeting SC3, described their own DIS in detail. They described the technology used and the data log that they collect.	It may be easier to establish and maintain DIS with niche online markets SC3 have deep knowledge of how DIS works commercially in China.
	SC3 offered for us to use their DIS system.	SC3 believe in and implement DIS with their suppliers.
	SC3s online platform markets to suppliers who want to track their own product and manage their own premium brand through to high net worth Chinese consumers	SC3 have a collaborative approach with suppliers.

4.4   In store visits

During the China pilot the project team visited a variety of sales channels in Shanghai. These included retail stores (SC1 and SC2), food service chains including high-end red meat restaurants, high end hot pot restaurant specialising in red meat and lamb restaurant chains. The instore visits were an additional source of data to help validate the findings in interviews and the focus group. Store visits were conducted prior to the interviews so that we were able to validate and ask probing questions during the interviews. For instance, we asked, "I noticed in your stores that about 50% of your red meat products have digital traceability, can you tell us about how you set up your system?". We also took photos of packaging and scanned QR codes. The packaging photos presented in Figure 2 show a wide variety of what's on offer. For instance, they show photos of products with and without DIS. They also show photos that may be fraudulent.

Figure 2. Photos taken in Shanghai retail stores from SC1 and SC2.

4.5 Focus group results

The focus group was conducted with food industry experts including premium hotel and restaurant chefs, restaurant owners, red meat wholesalers and a WeChat influencer. Participants were asked to scan retail pack QR codes and provide feedback on the digital integrity system. Most participants commented on the importance of traceability given the problems they encounter in China with food fraud and health scares. Focus group participants were asked to respond to two questions to gauge perspectives on the importance of digital integrity systems. Findings indicated that focus group participants believe that digital integrity systems are valued by 100% of Chinese consumers.
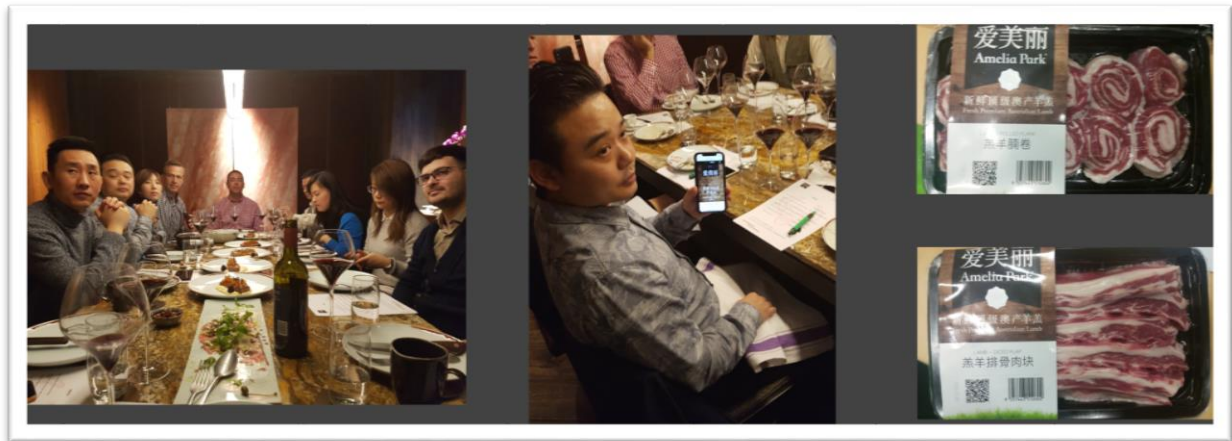

Figure 3. Focus group participants testing and discussing DIS.

Question: *How important is it for consumers to be able to trace the lamb in the supply chain?*

Not at all	0%
Important	20%
Very important	20%
Extremely important	60%

Question: *How important is it to provide source or origin information to consumers?*

Not at all	0%
Important	20%
Very important	20%
Extremely important	60%

When participants scanned the QR code they were able to view a traceability table that showed the journey of the lamb product through the supply chain. Data collected via the digital integrity system included time, date, GPS location, product weight and product temperature. A sample of the website that focus group participants viewed is presented in Figure 4.

Figure 4. Website linked through QR Code on retail pack.

4.6 Beyond primal pack traceability

A key sub-set of why this project was undertaken was to explore digital integrity systems that go beyond the uniquely identified primal package to final consumer retail packaging. During the early phases of this project and during the innovation sprint, time was spent ideating options to trial for digital traceability beyond the primal pack. Initially, a method using Blockchain technology was designed. The system is presented in a series of steps in Table 11.

Table 11. Blockchain method for beyond primal pack digital traceability.

Step	Activity
1	Each animal will be assigned a blockchain ledger
2	NLIS data will still be used on farm and in the feedlot and processing plant
3	NLIS tag linked to the animal's blockchain ledger

|	
4	During boning, the carcass weight of the animal will be entered into the animal's unique blockchain ledger (4a in most instances this would occur for batches of animals, not individual animals as a result of hardware in plants).
5	QR code used on the packaging of the meat will be linked to the blockchain ledger
6	As the piece of meat is further deconstructed by the distributors, the weight of each primal and cut is uploaded to the blockchain ledger
7	A new QR code is generated for each specific primal and cut. This is linked to the animal's blockchain ledger.
8	When the distributor packages each cut from the animal, the QR code for that cut, which is linked to the animal's blockchain ledger is printed onto the packaging.
9	The consumer will scan the QR code which will bring them to a webpage portal showing the visualised data from every participant of the supply chain
10	At point of purchase, the QR code associated with the specific cut of the animal is registered to have been sold and is no longer valid.
11	The consumer can then interact and provide direct feedback to the producers, processors or distributors as they fit. The feedback will be uploaded onto the blockchain ledger on that animal.

Despite the above method being conceptually possible, it did not meet the feasibility test from a retail sales channel customer perspective or from a viability perspective of the red meat processing company involved. Therefore, we were unable to trial the method in the China pilot. Having taken a design led approach, the project team explored solutions that were commercially viable and feasible for most stakeholders.

The trial system for beyond primal pack digital traceability was a two-way product verification process. Linkages between the feedforward and feedback of data demonstrated integrity of the products through the supply chain. Where data did not match product was identified as potentially fraudulent.

Table 12. Feedforward and feedback product verification.

Feedforward	Feedback
Producer (where possible)	Consumer feedback
Processing information	Purchase location
Cold chain	Scanning locations
Retailer and location	Sale date
Shelf life	Sale location
Packed weight	Weight of product sold

The product was scanned via individual QR codes on all products.
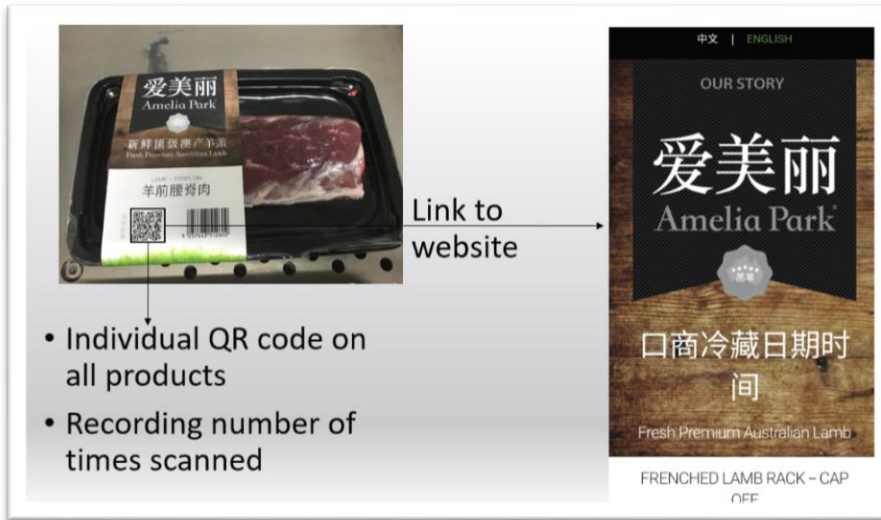
Figure 5. QR scanned retail pack.
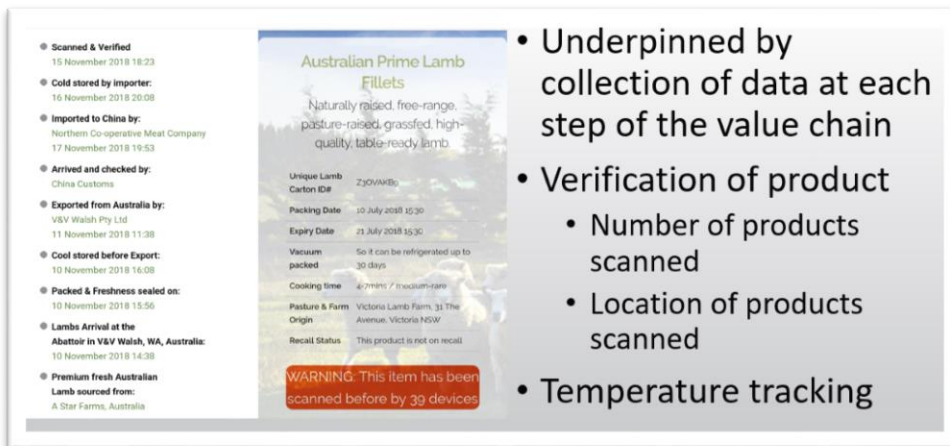
Figure 6. Air freight product integrity table.

Figure 7. Consumer locations when scanning product.

Data collection points presented in Figure 8 ensured that the product was:

- Monitored to ensure product integrity,
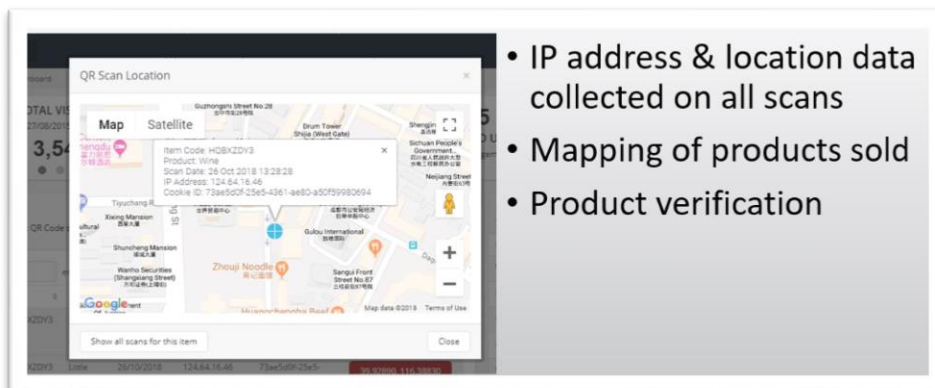- Product was tracked for quality and shelf life, and
- Processing data collection could be completed using hardware solution on the packing line.
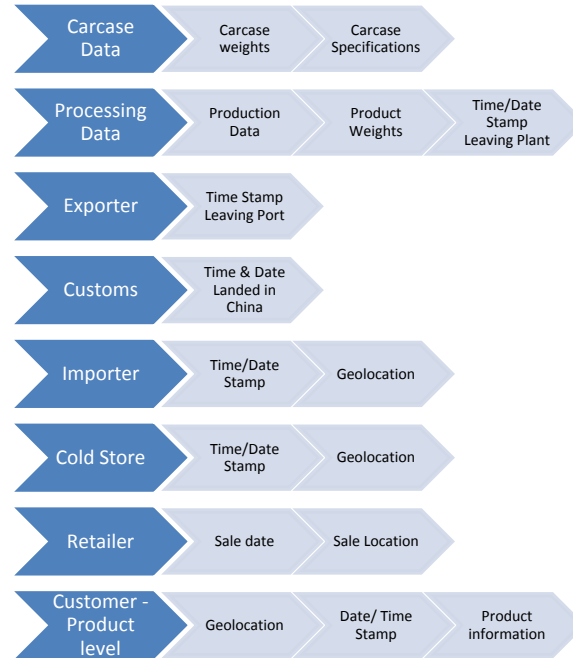
Figure 8. DIS data collection points.

The solution for dealing with the breakdown of cuts beyond primals was to issue QR codes to a retail partner or import agent. Issued codes for sub-primals are linked to a central repository that records them against the primal codes. This method enables primals to be sent to an importer who can further breakdown primals into smaller cuts for retail packs and assign the appropriate issued QR code.

In the scenario below in Fig 9, a mixed pallet of lamb is exported to Shanghai (Grandparent QR code). The pallet has five cartons of lamb racks, with 6 racks per carton (Parent QR code). Inside each carton is a set of QR codes for retail pack application of sub-primal cuts. Each rack is split into eight cutlets, of which four cutlets are apportioned into a retail ready pack with an individual QR code. In total there will be 60 retail ready packs with individual QR codes.
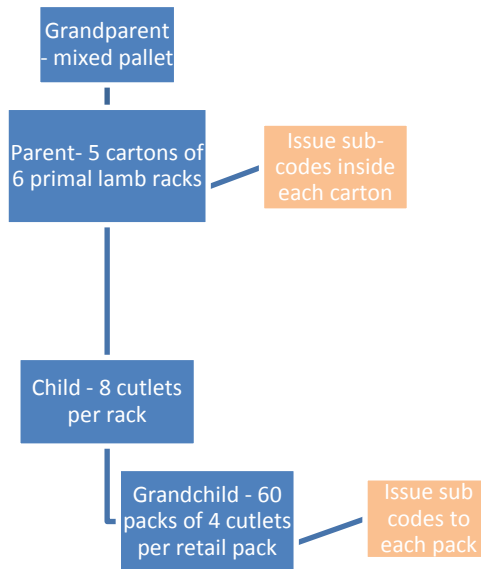
Figure 9. Implemented system for beyond primal pack digital traceability.

4.7   Blockchain panel discussion with subject matter experts

The panel was asked to discuss and answer the following questions:
- *How are megatrends influencing people's eating behaviours globally?*
- *How might Blockchain change the lives of future protein consumers?*
- *How might Blockchain disrupt current red meat value chains?*
- *What might be the new value propositions derived from Blockchain for stakeholders in red meat value chains?*

Figure 10. Blockchain panel of experts.

Table 13. Blockchain opportunities and barriers identified by the panel**.**

Opportunities	Panel comments	Barriers	Panel comments
	Consumers are increasingly using digital technology and they are ripe for the change to blockchain and associated food packaging.		Australia is lacking a regulatory framework and government roadmap.
	Growing opportunity for blockchain technology in Australia with the government committing research funds.		Businesses need to be critical as to whether Blockchain is the right solution for their business model.
	There are opportunities for Blockchain within supply chains and it has been proven to work.		There is a need to re-engineer business processes and business models.
	Relative ease of developing a blockchain for Everledger, which provided traceability in the diamond sector.		Blockchain needs to be used alongside other stack technologies such as algorithms, machine learners, sensors, data collections, and IoT sensors.
			There are only 25000 blockchain programmers worldwide. Shortage of skills to implement and manage blockchain technology.
			Adoption – little education, awareness and understanding in the community and in the supply chain of what is blockchain.

4.8   Red meat industry panel discussion

The second panel discussion captured the responses from red meat industry experts. The purpose of the panel was to answer the questions:

How do you see digital technology impacting the future of the global protein industry?

What are the implications of digital traceability systems (like Blockchain) on the red meat industry?

Figure 11. Red meat industry panel of experts.

Interestingly, the panel discussion produced several strategic red meat industry questions rather than solutions.

- *How do we create economies of scale, but mass personalise the product to the final consumer?*
- *How do participants in the global food network use digital integrity systems to become more efficient?*
- *How do organisations overcome traditional, linear mindsets to introduce modern technology?*
- *How can blockchain technology better connect all participants within the network?*

4.9 Value propositions produced during the innovation sprint

During the innovation sprint a 'Digital Network Value Map' was developed. The map is an extension from the value proposition canvas, which is underpinned by the belief that value is created by products and services that fit customer needs and desires. The map explores the customer's pains and gains, as well as the pain relievers and gain creators throughout the value chain process. The map aims to highlight customer pains and find new value propositions to alleviate these pains in the pursuit of customer desires such as food trust, sustainability, and transparency. The value propositions in the centre of Figure 14 were produced by innovation sprint participants during a scheduled activity.

Table 14. Digital network value map findings.

| Value prop element	Origin	Farming	Processing	Distributor	Consumer
Customer jobs 1	Product selection	Compliance	Supply & demand alignment	Food trust	Protein selection
Customer jobs 2		Meet the specs			
Pains 1	Fragmented supply chain	Increased compliance paperwork	Lack of consumer feedback	Food safety	Lack of trust in protein
Pains 2		Unable to meet the specs		Food fraud	
Pain relievers 1	Transparency across the value chain	Paperwork workflow digitisation	Connectivity	Traceability	Transparency to create trust in the product
Pain relievers 2		Data analytics & capability building	Transparency	Quality control	
Gains 1	Increased rate of gain	Increased compliance	Brand performance	Increased market value/share	Satisfaction
Gains 2	Emotional bond	Increased income			
	Lower cost				
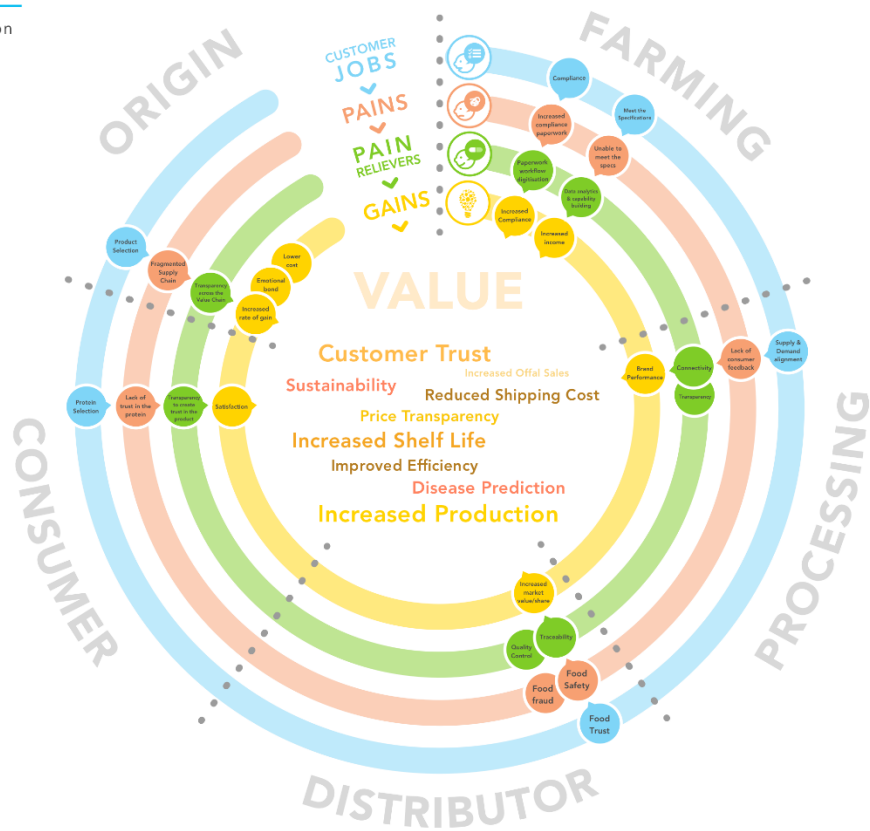
Figure 12. Digital network value map.

Table 15. Final value propositions produced from network value map activity.

Customer trust	Increased offal sales	Improved efficiency
Sustainability	Reduced shipping costs	Increased shelf life
Increased production	Price transparency	Disease prediction

4.10 Ideation results

During the innovation sprint, time was allocated for ideation around future possibilities associated with digital integrity systems. Five concepts were developed and are presented below.

4.10.1 Blockchain platform

Create a data aggregation, analysis and communication platform for all parties within the blockchain network. This platform will allow:

- Transactions using tokens or FIAT currencies among the parties in the network
- Communication among the parties in the network
- Product tracking tools
- Data sharing & data auditing tools
- Customer feedback tools
- Data analysis & decision-making dashboards
- Dispute resolution tools

This platform will provide additional value to the participants in the blockchain and can be used to attract new participants into the blockchain network, potentially creating a network effect.

4.10.2 AUSCOW Coin

AusCow Coin is a cryptocurrency token that will be offered to all parties in red meat industry blockchain networks. Tokens can represent any tangible or intangible value that can be exchanged, and are therefore proposed for the following purposes:

- Streamlining transactions within the blockchain network
- Provide a fast, secure and direct channel for international payments
- Allows tokenization and transactions of non-monetary value
- Raise initial coin offering to acquire capital investment
- Provide user retention and stickiness

As more parties adopt the AUSCOW Coin, its value will rise, and so will its prominence in the Australian red meat industry. This will create a network effect and incentivise more parties and investors to join the blockchain.

4.10.3 Virtual farm

In China, there is a growing trend of wealthy individuals purchasing their own farms. The landowners employ their own farmers to supply fresh produce exclusively to themselves. This is seen as a form of prestige among the wealthy Chinese. A Virtual Farm is a marketing concept that allows high net worth

Chinese to purchase exclusive rights to the products directly from Australian producers. The concept is akin to owning a farm in Australia, except the Chinese stakeholders only own the right to a portion of the produce from that farm. The consumers will be able to track each piece of meat they consume directly to the specific animal from the specific farm, and all intermediaries within the supply chain. This can be marketed as a subscription-based business model for high net worth Chinese. Different tiers of subscription can be offered to satisfy different levels of premiumisation.

Bottom level subscription can include fresh meat only, but higher-level subscriptions can include value-added options such as tourism to the farms, and even real-estate that allows the members to purchase farms outright. Additionally, famous Australian or Chinese chefs can be employed as a value-added option to cook the meat for the higher-level subscribers, thus providing catering services as well. These concepts are possible because wealthy Chinese consumers are willing to pay premium for authenticity, high quality, convenience, high-level services, new experiences, and above all 'trust'.

4.10.4 Margaret river on a plate

This concept allows Chinese diners to eat a variety of fresh protein and vegetable dishes directly from one specific region in Australia. The diners will be able to trace each ingredient of their meal to the specific farm or animal in that region and read information on the details of the surrounding area. This kind of marketing would increase the brand awareness to a specific region in Australia and promote the specific products from that region.

Diners will have the opportunity to purchase the fresh produce directly from the restaurants. Therefore, the restaurant experience is also transformed into a high-end grocery shopping experience. Since Western food is still rarely consumed in Chinese business dinners, and rarely consumed by the older generation, the target market should be wealthy, Western-centric younger Chinese consumers, who are willing to experience new and innovative types of culinary delights.

4.10.5 Trojan horse

The 'Trojan Horse' concept is a marketing strategy that aims to sell Australian red meat directly to Chinese students and residents living in Australia. Rather than marketing to Chinese wealthy consumers directly, which can be prohibitively expensive and competitive, the Trojan horse concept targets Chinese students overseas. This is because most Chinese students already come from economically well-off families. Plus, they have personal experiences with Australian produce. Currently, many Chinese students in Australia purchase Australian products for their families and friends back in China, in a phenomenon called 'Dai Gou'.

The 'Dai Gou' market exists because of Chinese consumers' distrust of the conventional distribution channels in China. They are afraid of tampering or adulterated imported products, so they would rather trust their friends or family from overseas to purchase for them and ship the products to them directly.

5   Discussion

5.1 Value propositions and business model insights

5.1.1   Value propositions for digital integrity systems

Discussion point

Our research found that Chinese sales channel customers are willing to pay for digital integrity systems under certain circumstances. For example, one of the major premium retailers that we met had implemented their own system (SC1). In our view their system was primarily a marketing tool to increase brand perception rather than a digital integrity system. The system was not applied universally across all their products so presumably they were flexible with some of their suppliers, or for their own internal reasons they did not always implement. Our project involved setting up our own system, so we could not comment on how their system worked from a supplier perspective. The second retailer that we interviewed was not interested in paying extra for a digital integrity system (SC2). They commented that their consumers would purchase products with digital integrity systems over products that do not. However, they stated that their consumers would not pay extra for products with digital traceability. The third sales channel that we interview also had their own traceability system (SC3). Their sales channel was a niche online ecommerce platform for expats and high net worth Chinese. For this reason, they determined that digital integrity was a strong proposition for their consumer base and worth the investment.

Insight

The primary insight is that Chinese sales channel customers are employing digital integrity systems as a way of demonstrating a premium offering. This contrasts with using digital integrity systems to demonstrate transparency and traceability. A secondary insight is that if Australian companies are to successfully implement their ow digital integrity systems it may be easier to build they may benefit from building their own business models that shorten the supply chain and connect them directly with end consumers.

Our approach to determining whether a Chinese customer is willing to pay extra for digital integrity was not as simple as asking them a closed question. We approached the market in a relational manner so that we did not receive yes/no answers. In this way, we were able to draw out the customers and gain insights into their reasoning for or against. For example, in the context of sales orders, including price, volume and red meat cut types, we included digital traceability as an input cost. This approach allowed us to use digital traceability as a point of negotiation with customers over a series of conversations rather than a one-off interview. If a customer predictably responded to our price point with, 'Your price is too high' we were able to say, 'Our price has included traceability, would you like to remove traceability?'. Ensuing was a more open conversation.

Insight

Approach Chinese customers with a sales strategy so that you can negotiate digital traceability into product offerings.

Discussion point

Chinese sales channels may be using digital integrity systems to better understand the personas and demographics of their customers. SC1 talked about their technology systems and data analytic capability. They told us about how they know the geolocations of their customers and the different customer segmentations. It seemed to us that they were interested in collecting consumer data (purchase location, purchase time) from digital integrity systems. Presumably they can integrate

digital integrity system data into consumer databases (online ecommerce platforms) from which they draw insights and design marketing strategies.

Insight
Australian companies may benefit from Chinese sales channels that combine digital integrity systems with ecommerce platforms for data analytics and market insights.

Table 16 shows potential value propositions for Australian processing companies, Chinese customers and end-consumers. There may be additional value propositions of digital integrity systems not identified in this project.

Table 16. Stakeholder value propositions for digital integrity systems.

Australian processing company value propositions	Chinese customer (sales channels) value propositions	Chinese consumer value propositions
Creating a premium price in high-end retail markets and niche closed markets, i.e. using digital traceability as a point of negotiation with potential customers	Increase sales by using digital integrity as a marketing tool to improve brand perception of premium products	"I can access the best quality products that others cannot"
Business model innovation and improved integration through the value chain	Increase data sources to better understand consumer profiles and inform off-line online integration and marketing strategy	"I will purchase a product with digital traceability over a product that does not''
Creating direct relationships with end-consumers for product differentiation and consumer insights	Social responsibility and commitment to selling healthy and safe food	Focus group data showed that traceability and source of origin is extremely important for consumers
Data log of time, date, temperature, location and weight of product	Emotional appeal to consumers to show empathy and increase confidence through some demonstration of transparency and brand provenance	
Useful for shelf life testing, particularly in chilled products	Method for customer to validate the legitimacy and quality of processing company	

5.1.2   Business model insights for digital integrity systems

Insights into viable business model options for digital integrity systems and their respective levels of desirability and feasability in the China market were the major achievement of this project. Lamb product was digitally traced through different sales channels and customer segments with feedback

from: end consumers, premium retailers, food services including high-end chefs, private online ecommerce platform direct to householders and a private WeChat group. Three business model options for digital integrity systems were identified, namely Transactional, Integrated and Niche.
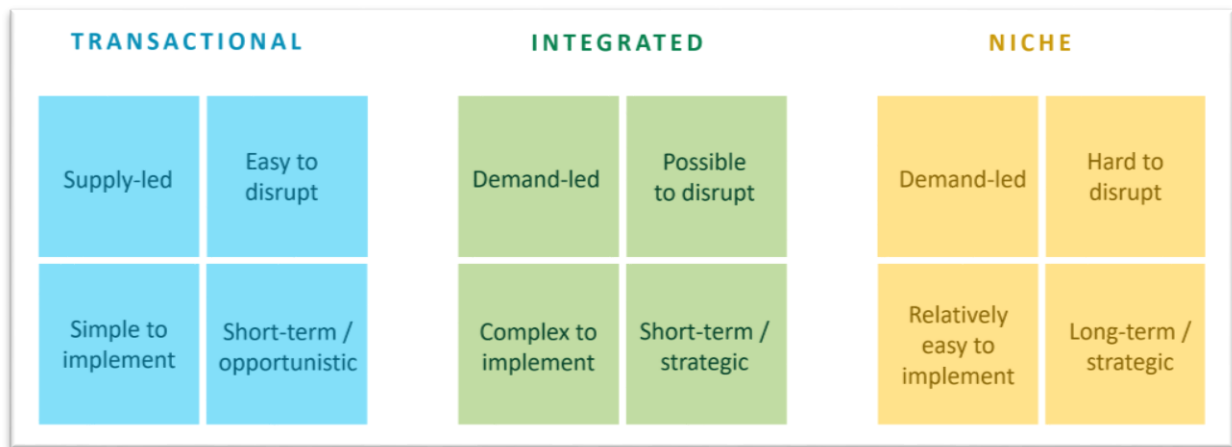
TRANSACTIONAL		INTEGRATED		NICHE	
Supply-led	Easy to disrupt	Demand-led	Possible to disrupt	Demand-led	Hard to disrupt
Simple to implement	Short-term / opportunistic	Complex to implement	Short-term / strategic	Relatively easy to implement	Long-term / strategic

Figure 13. Business model types for digital integrity systems.

In this project we understand business models to consist of four high level elements: 1) profit formula accounting for costs and price point, 2) resources needed for capability, 3) systematic processes for efficient implementation, and 4) a market/ customer required for purchasing products.

5.1.3   Discussion on transactional business models

The transactional business model is a way of describing companies that are primarily interested in selling high volume for the best possible price. For example, in the red meat industry this would describe a company attempting to sell whole carcases through a Chinese wholesaler into a commodity market. The approach does not easily enable the implementation of digital integrity systems through the supply chain. This is because the red meat product is exported from Australia for repacking in China. Hence, it is not possible to trace products beyond carcases or primal cuts.

Companies who only adopt a transactional business model do so because they are easier to implement from the supply side, and are 'business as usual' in terms of processing in a plant. However, this model and their supply chains are more easily disrupted by competitors who win on price. Australian companies that partner with Chinese companies who have a transactional mindset may only enjoy short-term opportunistic business relationships. Even if the Australian company is personally committed to digital integrity systems, it will not be feasible with transactional partners. In some instances, Chinese companies with transactional business models may be supplementing Australian red meat with inferior product.

Insight
Australian companies should be cautious about partnering with Chinese companies who prefer transactional business models. Some Chinese retailers present themselves as having close relationships with consumers and traceability through to the producer, however in practice they have no tangible evidence of a digital integrity system.

5.1.4   Discussion on integrated business models

Integrated business models are adopted by innovative Chinese companies seeking to combine their online ecommerce platforms with offline retail stores. These companies have massive digital capability and tend to lead their ecosystem. Their business model is driven by the demand side and connection with the end consumer through social media, ecommerce platforms and digital integrity systems. These business models are complex to implement. Australian companies may benefit from collaborating with Chinese companies who implement integrated business models. The advantage is that their digital integrity system is already established. However, there are serious risks if fraudulent product is detected by their system. Australian companies must think about the commercial and ethical implications. For instance, what happens if a Chinese consumer purchases your product from a Chinese retailer and is subsequently poisoned? How might the Chinese government or media be involved? What damage might this do to your brand? What happens if people end up very ill or die?

Building collaborative and accountable relationships with the Chinese companies from the outset is essential. This may involve the Australian company inviting key stakeholders to Australia and taking them to farms and processing plants so that they gain a first-hand knowledge of the supply chain. There may be significant financial opportunities for Australian companies who can successfully collaborate with Chinese companies that adopt integrated business models. Primarily this is due to their digital connection with consumers, their digital capability with data analytics and frictionless payment systems. Their control over their ecosystem will likely mean that they will negotiate hard on price and that they switch out suppliers to their advantage.

Insight
Australian companies looking to establish digital integrity systems should investigate whether they may be able to successfully partner with Chinese retailers who adopt integrated business models. There may be significant financial rewards, however the collaboration may be short term unless. Australian companies should look for ways of co-designing the business model to ensure long term sustainability.

5.1.5   Discussion on niche business models

The niche business model is a premium offering direct to Chinese consumers via an ecommerce platform. Consumers tend to be expats and high net worth Chinese looking for premium products with food safety assurance, traceability and provenance. For this reason, digital integrity systems are common practice in these sales channels. Their business models are demand led because they rely on door to door delivery of products purchased directly from an online ecommerce platform. Australian companies supplying to Chinese niche channels may be able to attract a premium price if they can provide products that the consumer believes they are unable to purchase elsewhere.

During our research in China we interview two different niche suppliers. One was an Australian company coordinating suppliers into China and selling fresh produce via an online platform. The other sold premium products via a closed WeChat channel. We spoke directly to a Chinese based WeChat influencer who has a large following of high net worth Chinese. We provided the influencer with a selection of retail packs of lamb. The influencer was able to scan the QR code and verify the traceability path through the supply chain. They then cooked up Chinese style lamb dishes and posted photos out to the private WeChat group. The WeChat group then expressed their interest in the product.

Insight

Australian companies looking to establish digital integrity systems should investigate whether they may be able to successfully partner with Chinese companies who adopt niche business models. As these business models are niche they may be low volume but attract a premium.

5.2   What worked and what could have been improved

The innovation sprint was an excellent way of exploring the problem space and engaging multiple experts. We recommend that MLA allow for intensive innovation sprints in further project. The sprints were a great context to apply the design led method and to build capability across those involved.

The design led innovation method ensured that the research questions were addressed from the demand side, that is, from the perspective of Chinese sales channel customers and end consumers. Our method did not dismiss the value propositions for the supply side. The project team acknowledged that because we are Australian, we are inherently biased to the supply side. During the project we literally sat across the table from Chinese customers and consumers; we understood our dual role of 1) research investigators, and 2) proud Aussies. However, if we were to have any hope of answering the two challenging research questions we needed to focus on the demand side. Overall the design led approach worked well.

The project was a significant undertaking involving an extensive number of hours across many project stakeholders. More detailed scoping of the method in the early phases of the project would have been an advantage.

5.3   Extent to which project objectives were met

The purpose of this project was to work with red meat supply chains to scope the development of a digital integrity system that goes beyond the uniquely identified primal package to final consumer retail packaging.

Table 17. Extent to which project objectives were met.

Project objectives	Extent to which it was met
Identify, trial and prove the best tamper-proof packaging integrity system for primals, sub-primals and consumer packaging including cloud based unique codes.	This project implemented a viable and feasible system for a tamper proof packaging with cloud based unique codes.
Test the best way to substitute traditional cloud database integrity systems with Blockchain systems.	This project did not find Blockchain to be a viable or feasible technology for the Australian red meat industry now.
Explore the most efficient mechanism for providing digital mass balance from livestock supply to finished consumer purchase considering multiple pack, unpack and repack stages in the supply chain.	This project successfully explored ways of providing digital mass balance to finished consumer. We were unable to involve livestock producers in this process.
Explore methods for connecting to end consumers that will leverage the Australian red-meat value propositions. Prioritise the	This project successfully explored methods to connect consumers to Australian red meat value propositions to create new value.

propositions that create the greatest value and differentiator for Australian supply chains.	
Determine the value proposition and best business model to commercialise the finding.	This was a significant achievement of the project.

6   Conclusions

6.1   Future R&D

This project was not able to research how livestock producers can create value from digital integrity systems. Understanding digital integrity system opportunities and challenges from the perspective of the livestock producer is an important area of further research and development. Additional research could investigate:

- Value propositions for producers
- Business model options for producers and processors (e.g. service kill and direct supply via ecommerce platforms with digital integrity system)
- Collaborative aggregation of livestock suppliers into digital integrity systems in a region
- Additional value propositions over and above traceability
- Cost effective technologies
- Integration with existing databases such LDL

6.2   Practical implications for the Australian red meat industry

The practical implications to the Australian red meat industry from this project include:

- Integration of digital integrity systems into robust business models.
- Identification of premium Chinese markets willing to pay a premium for digital integrity systems.
- Discouraging a 'silver bullet' approach or bias toward specific technology solutions, particularly given the lack of interest from Chinese customers in the actual technology.
- Strategic consideration of the commercial implications for Australian red meat companies when/if product integrity is compromised in China.
- Building low-cost digital integrity system prototypes for trialling, prior to investing in more expensive commercial systems.

6.3   Development and adoption activities

Given the high level of interest in digital integrity systems and smart packaging across the Australian red meat industry, it is recommended that findings and practical implications contained with in this report are shared broadly. It is particularly important that these findings are shared with processing companies and producers at the outset of establishing their own digital integrity systems. Early communication will increase research adoption and avoid costly mistakes. Integrating findings into the agenda of workshops and conferences where participants have opportunities to discuss the opportunities and challenges is essential.

7 Key messages

7.1 New behaviours for Australian red meat companies

- Every Australian red meat processing company should have a digital strategy. Part of this strategy is a commercially viable digital integrity system.
- Adopt a customer design led approach to new business ventures, particularly those that have a digital focus. This approach will give Australian companies the best chance of competing globally.
- Digital integrity systems are not stand-alone technology, they must be built into robust business models.
- Prior to implementing a digital integrity system, spend time prototyping and conducting commercial trials to manage internal risks and external threats.