Final report – Project 2016/2202

APL project code:	2016/2202
APL project title:	Enhancing supply chain profitability through reporting and utilization of peri-mortem information by livestock producers – business case development
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Executive Summary

This project was undertaken to deliver the first outcome, a business case for a peri-mortem data capture and delivery system, of the overarching project “Enhancing supply chain profitability through reporting and utilization of peri-mortem information”. This business case is addressing the needs of the sheep, goat, pork and beef industries, to form a basis for other sub-projects to implement outcomes and provide direction to the remainder of the overall project.

The objectives of this project were to:

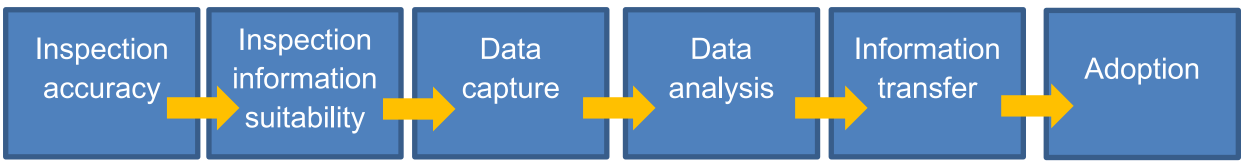
1. Develop business cases for the beef, sheep, goat and pork sectors to set a foundation for standards, systems, reporting mechanisms and programs to be built/established to address these needs.
2. Identify opportunities to improve capture and animal health information transfer to increase supply chain value. Value propositions will be quantified and prioritised for each area. Gaps or barriers to adoption will be identified, coupled with recommendations to address these barriers.
3. Define a proposed path forward for development of standards, data collection capabilities and information transfer, considering synergies and differences between species as well as hardware and software considerations for system design.

Peri-mortem information systems

The use of the term ‘peri-mortem’ is in reference to the information being collected and transferred, within a peri-mortem system, is for diseases or conditions that can’t be easily identified pre-slaughter but can be identified during post slaughter inspection. In the context of this report the terms peri-mortem and post-mortem could be used interchangeably.

The core value proposition in peri-mortem information capture and transfer systems is the suitable supply of information back to livestock production so that specific treatment/management can be undertaken to reduce the impact and cost of the specific disease/conditions for both the production and processing sector. Six system components have been considered (Figure 1), which are required to deliver this outcome and realise the potential value.

Figure 1: Components of peri-mortem information systems



1. Inspection accuracy – refers to whether the decision made by the person undertaking the inspection is correct or incorrect. Is the disease/condition that the animal has, the same as what has been reported by the inspector?
2. Inspection information suitability – refers to the suitability of the inspection relative to the disease/condition and how the information could be acted upon. This includes detail such as:
    a. Consistency of description and nomenclature

   b. Connection with treatable/manageable disease/condition rather than simply reporting a symptom
   c. Location of disease/condition on animal (e.g. abscess on right hindquarter)
   d. Severity information (e.g. grading for pleurisy)
   e. History of the disease/condition. When did the animal have the disease/condition? (e.g. with liver fluke – was it from the present season or is this scarring from 2 years ago)
   f. Photographic record
   g. Further testing of collected sample (e.g. histology, pathology).
3. Data capture – refers to the capture of the inspection decision and related information.
4. Data analysis – primarily refers to analysis of the data in regard to individual and lots of animals from an individual livestock supplier. Depending on the supply chain, analysis could be undertaken by individual processor, producer, vet and/or at an industry wide level.
5. Information transfer – refers to how the inspection data is appropriately packaged and delivered to livestock suppliers (producers, feedlots).
6. Adoption – this refers to specific changes in disease/condition treatment/management undertaken by livestock suppliers, as a result of information received, to reduce prevalence and impact of disease/condition.

For value to be realised, all system components must be operating at a suitable performance level. The flow of data/information and suitable accompanying communication and collaboration, along the system, is crucial to improve management decisions that must result in physical actions being undertaken that will improve animal health.

Value Opportunity

The estimated total opportunity from fully operative peri-mortem information systems range from $0.27 million/annum (goat industry) to $62.28 million/annum (sheep industry), for the different species (Table 1). The values are presented as net gain for the production sector (gross gain minus treatment/management costs [2.2.1, 2.2.2, 2.2.3]; except for beef which is gross gain and only includes processing component [2.2.4]) and gross gain for the processing sector. Many important diseases/conditions in the sheep industry could be included in a peri-mortem information system (2.2.1). However in both the pork and beef industries many of the most important diseases/conditions are not relevant to a peri-mortem system (2.2.3, 2.2.4, 2.3, 4.6.3).

Table 1: Total opportunity of core value proposition of peri-mortem information systems (per annum)

Species	Production sector – net gain	Processing sector – gross gain	Total
Sheep	$43,932,549 $0.58/head	$18,344,561 $0.57/head	$62,277,110
Goat	$238,833 $0.60/head	$32,961 $0.16/head	$272,794
Pork	$10,174,894 $1.89/head	$1,980,000 $0.39/head	$12,154,894

Beef	$2,440,398*	$6,076,571 $0.68/head	$8,516,968

*This figure is the estimated gross gain for the processing component (lost carcase weight due to full carcase condemnation and trimming). This does not include the gain for the pre-processing (on-farm) component, due to a lack of data available on disease/condition costs.

Other potential benefits (Table 37) have been considered as additional to the core value proposition (Table 1). Most of the value from these benefits can be summarised as:

- compliance to increased future animal information requirements,
- increased efficiency of inspection process,
- increased efficiency of animal health surveillance programs, or
- utilisation of disease/condition information together with other animal information (genetics, production performance, meat quality).

Current system performance and options for increasing value realisation

The current performance levels (estimated between 0-100%; 2.4), and modes of operation, for the various system components (Figure 1) are briefly summarised in Table 2 (there is wide variation within industries, which is discussed in Chapters 3 and 4). The pork industry is the clear leader but estimated data capture still only represents half of animals processed. Similarly, data capture is the lowest performing component in both the sheep and goat industries (as the goat industry has very low current performance [2.2.2] and would be included as part of operations through sheep abattoirs it has been excluded from separate consideration [3.2, 4.3]). Information transfer is the lowest performing component in the beef industry. Figure 2 shows the impact of current system component performance on the % realisation of the total opportunity (see further detail in 2.4).

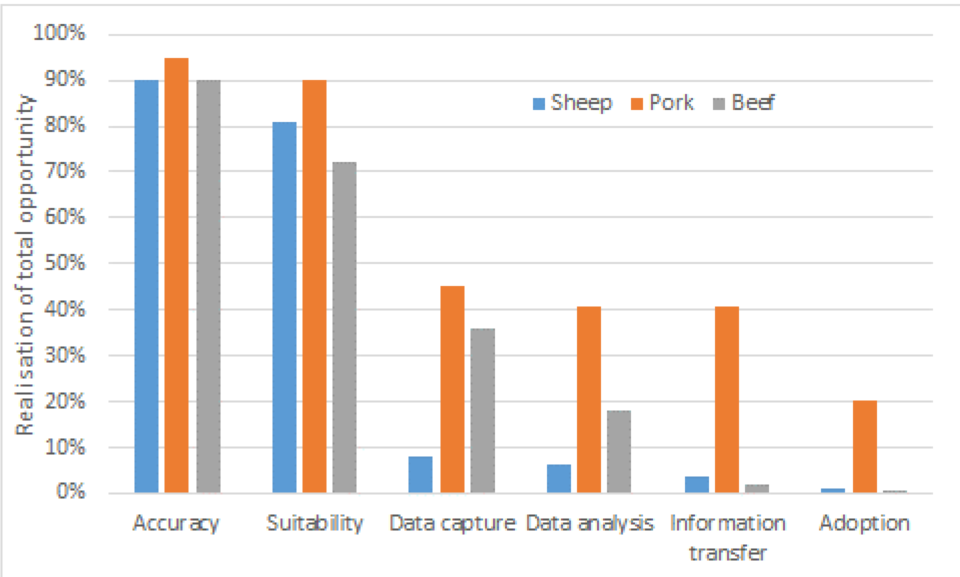
Table 2: Summary of current system component performance

System component	Sheep	Goat	Pork	Beef
Inspection accuracy	**90%** (4.2.1)	**90%** (2.2.2)	**95%** (4.4.1)	**90%** (4.5.1)
Inspection information suitability	**90%** (4.2.2)	**90%** (2.2.2)	**95%** (4.4.2)	**80%** (4.5.2)
Data capture	• **10%** (4.2.3) • NSHMP: collected by third-party inspectors • EAS: collected by plant-based meat inspectors • Non-electronic capture • Captured by lot	• **0.5%** (2.2.2) • GPCP: collected by AHA inspectors • Non-electronic capture • Captured by lot	• **50%** (4.4.3) • Collected by: 1) meat inspectors 2) consultant vets (majority) • Some electronic data capture • Captured by lot	• **50%** (4.5.3) • Collected by: meat inspectors • Electronic capture • Captured by individual animal id
Data analysis*	• **80%** (4.2.4) • As prevalence by lot	**0%** (2.2.2)	• **90%** (4.4.4)	• **50%** (4.5.4)

			• As prevalence by lot • Prevalence by time graphed	• Mostly as prevalence by lot • Offal downgrade rate
Information transfer	• **60%** (4.2.5) • Prevalence information is posted to producer by state governments • Relevant information provided regarding disease/conditions	**0%** (2.2.2)	• **100%** (4.4.5) • Various methods: 1) emailed to producers, 2) via PIGMON data base, 3) transfer from consultant vets to producers	• **10%** (4.5.5) • Information is sent directly from processor to livestock supplier • Often only in response to higher prevalence of disease/ condition • Often lacks suitability due to inconsistency in reporting
Adoption#	**25%** (4.2.6)	• Rangeland: **0%** (2.2.2) • Farmed: **25%** (2.2.2)	**50%** (4.4.6)	**25%** (4.5.6)

NSHMP=National sheep health monitoring project; EAS=enhanced abattoir surveillance; GPCP=goat production condition project. *Data analysis is referring to compiling prevalence rates for each lot of animals and determining offal condemnation rates by lot/supplier and disease/condition. In the beef industry there is scope for integration of data into feedlot systems that monitor live animal performance and health. Analysis related to integration with other data/information is relevant for other benefits (Table 37) but not required to realise the core value (Table 1). #Adoption is referring to the estimated rate at which an individual producer will make a treatment/management decision when they receive information. This is contingent on the fact that information needs to be received to act on. For example, only ~5% of sheep producers receive this information through the NSHMP (10% data capture x 80% data analysis x 60% information transfer) and are thus able to make a treatment/management decision.

Figure 2: Impact of system component performance on realisation of total opportunity (showing stepwise multiplication of component performance from left [starting with accuracy] to right [finishing with adoption]; described in 2.4)



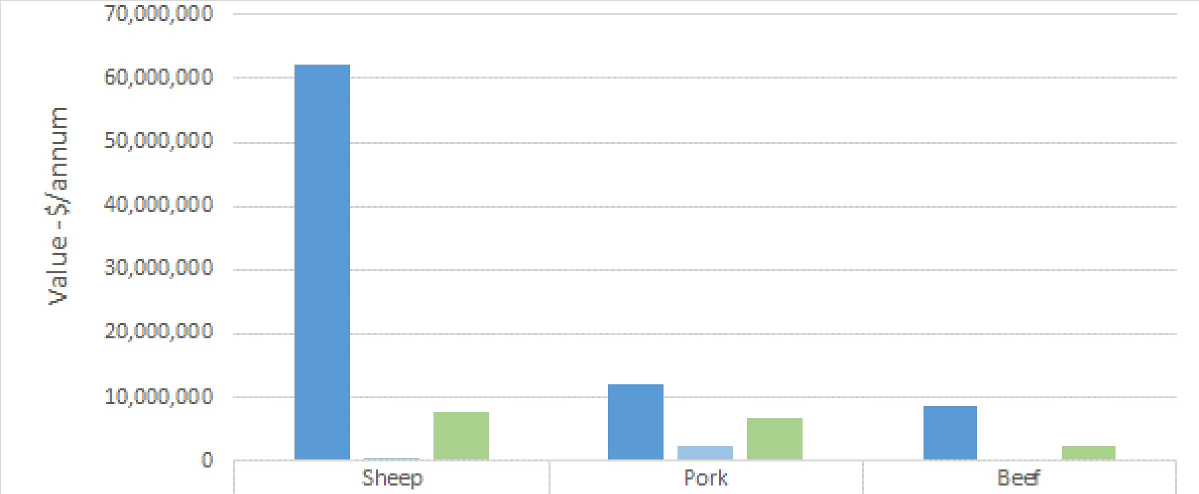
For each component, there are factors and potential options that could increase performance and enable more value to be realised. This is summarised in Table 3.

Table 3: Factors and potential options for increased component performance to realise greater value

System component	Factors and options	Value
Inspection accuracy	• Training for in-plant meat inspectors • Validate accuracy • Capture digital images • Utilisation of technologies	• Increase accuracy • Engender trust in the accuracy level • Ability to review inspection • Labour saving; increased accuracy
Inspection information suitability	• Training for in-plant meat inspectors • Capture digital images • Utilisation of technologies	• Increase suitability • Ability to send further information to producers/vets to improve treatment efficacy • Labour saving; increased suitability
Data capture	• Plant-based meat inspectors collect data • Electronically • Capture data by individual animal identifier	• Increase efficiency • Increase number of animals • Allow for real time analysis of inspection performance (3.5.5) • Ability to connect inspector to other animal information (3.5.5) • Increase efficiency in data capture and subsequent analysis. • Ability to connect to other animal information (3.5.5) • Ability to satisfy future market requirements (3.5.1,3.5.2,3.5.3)
Data analysis	• Report information to different suppliers based on their requirements and want (e.g. small extensive producer will want prevalence; large producer with genetics program, or feedlot with live animal performance analytics, will want individual animal information in format that can be easily integrated into their systems) • By individual animal id	• Ability to satisfy different production system requirements via customised data analysis (4.5.4) • Ability to leverage information via connection to genetics, meat quality, production condition information (3.5.7) • Satisfy future market requirements
Information transfer	• Transition to supply chain driven information transfer: 1. Direct supply chain 2. Indirect supply chain mechanism (e.g. processors upload into Livestock Data Link)	• Increase efficiency • Decrease lag time between animal slaughter and information feedback • Allow for greater incentives via direct supply chain transfer • Allow for tailored information supply
Adoption	• Provision of tailored information including ROI calculation to make decision as simple as possible • Pricing incentives together with liaison programs	• Increase adoption rates • Increase adoption rates

With changes and increased performance, within the next five years, it is anticipated that an extra $7.06 million/annum (sheep), $4.11 million/annum (pork) and $2.41 million/annum (beef) of value could be realised, for each industry (Figure 3; see 3.1.1, 3.3.1, 3.4.1 for assumptions).

Figure 3: Total opportunity, current and potential value realisation



	Sheep	Pork	Beef
Total opportunity	62,277,110	12,154,894	8,516,968
Current	605,334	2,468,203	38,326
Potential	7,667,558	6,581,875	2,452,887

Recommendations

1. The **biggest barrier to increase supply chain value**, in the **sheep and pork** industries, is the **capture of data**. To overcome this, it is recommended that there be:
   - Transition from current programs and approaches to inspection undertaken and captured by meat inspectors, as part of the chain, and
   - Electronic capture of data.

   Based on current performance of the other system components, an **increase of 10% in data captured** is estimated to be **worth $605,334 for the sheep industry** (4.2.3, 4.2.7) and **$493,641/annum for the pork industry** (4.4.3).

2. The **biggest barrier to increase supply chain value** in the **beef** industry is the **transfer of suitable information**. To overcome this, it is recommended that:
   - Information transferred have consistency in reporting across the industry, in regards to disease/condition 1) name/terminology/description, 2) location on animal [carcase and/or specific offal], 3) severity [where appropriate], 4) action [e.g. trim carcase; liver downgrade to pet food] and 5) photographic record [for specific conditions such as adhesions].
   - Supply chain information transfer systems be enhanced and tailored to different sectors (feedlot, large extensive production company, small extensive producer).
   - Models be developed and implemented (together with suitable information packages) that provide ROI for each specific disease/condition to be utilised by production and potentially processing sector.
     - Expected to increase adoption rates in extensive beef from 25 to 40%.

- Animal health liaison officer roles be developed and implemented in supply chains.

Based on current performance, there is a **potential 20-fold increase in the value realised,** which is estimated to be **worth $728,201/annum** (at processing [4.5.7], not including on-farm gain [3.4]), **if data** that is currently captured **is transferred as suitable information** (data analysis, information transfer and adoption rates all increase). As relevant, **the feedlot sector should be involved in projects prior to the extensive sector**, as feedlots already receive peri-mortem information, are familiar with handling and integrating data, there is some vertical integration, there is potentially greater production system gain, and have direct connection with vets and nutritionists. It is also envisaged that problems could be more easily ironed out in trials with the feedlot sector and make transition to the extensive sector (less used to receiving and utilising peri-mortem information) much easier.

3. In each industry, **all system components need to be suitably operative within a supply chain for value to be realised** (Figure 1). Thus, it is recommended that initial **projects be focussed within specific supply chains**, as other system components will also synergistically increase in performance when part of integrated systems (Chapter 5).

   Estimated ROI for a sheep or pork processor to invest in hardware, software and staff to suitably capture data and transfer information is (assuming details in Table 18 and Table 19 [sheep], Table 27 and Table 28 [pork]):

   - **Sheep abattoir** (processing 1.6 million head/annum)
     - **Net benefit: $0.15/head**
     - Pay back: 1.25 years
   - **Pork abattoir** (processing 492,480 head/annum)
     - **Net benefit: $0.12/head**
     - Pay back: 2.02 years.

   Estimated net benefit for **beef abattoir** (already capturing data; processing 200,000 head/annum) to transfer information is estimated to be **$0.10-0.23/head** (Table 33-Table 36).

4. Separate to the supply chain specific projects, **the recommended priority for a cross-industry (including each of the four species) project is**:
   - **Integration with DAWR reporting to increase efficiency and better utilise information from full carcase condemnations and ante-mortem inspection.**

   This is based on:

   - Current loss from full carcase condemnations in export abattoirs is $29.6 million/annum (3.5.6).
   - There is an expectation that auditable ante-mortem and peri-mortem information will become a future market requirement (3.5.1, 3.5.2, 3.5.3).

Contents

Glossary

Term	**Definition**
AHA	Animal Health Australia
ALFA	Australian Lot Feeders' Association
APL	Australian Pork Limited
DAWR	Department of Agriculture and Water Resources
GPCP	Goat Production Condition Project
MLA	Meat and Livestock Australia
NSHMP	National Sheep Health Monitoring Project

1 Introduction

Greenleaf Enterprises was contracted by Australian Pork Limited (APL) to deliver the first outcome of "Enhancing supply chain profitability through reporting and utilization of peri-mortem information", a business case for a peri-mortem data capture and delivery system. This business case is addressing the needs of sheep, goat, pork and beef industries and will form a basis for other sub-projects to implement outcomes and provide direction to the remainder of the overall project.

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Each of the four species have differences in the history and current practice of inspection, data collection, information transfer, and adoption rates by livestock producers. Furthermore, within each industry there is large variation in the method and extent to which peri-mortem information is utilised.

In overview this report:

1. Details the estimated costs of relevant disease/conditions, together with treatment/management costs and efficacy.
2. Outlines the components of peri-mortem information systems, current performance and operation of these systems, and opportunities and requirements for increased realisation of value.
3. Presents business cases for supply chain driven peri-mortem systems.
4. Proposes funding models for changing and developing systems.
5. Provides examples of current and potential specific supply chain systems.
6. Provides recommendations and associated project activities, to bring about these changes and developments.

2 Data sources, cost of disease information and peri-mortem system component outline

2.1 Data collection

Data was collected by a combination of reviewing previous reports and accessing sources, including:

- Review of National Sheep Health Monitoring Project[1]
- Cost benefits of e-surveillance system for animal health monitoring[2]
- Priority list of endemic diseases for the red meat industries[3]
- Assessing the economic and operational impact of establishing a national ‘real time’ slaughter chain reporting scheme for pig producers, processors and industry regulators (APL2015-2209)[4]
- National beef quality audit-1991: Survey of producer-related defects and carcase quality and quantity attributes[5]
- National beef quality audit-1995: Survey of producer-related defects and carcase quality and quantity attributes[6]
- Carcase condemnation data from Department of Agriculture and Water Resources (DAWR, Export Plant Condemnation Statistics)
- Disease/condition prevalence from the National Sheep Health Monitoring Project (NSHMP), as well as Ovine Johne’s disease prevalence, from Animal Health Australia (AHA)
- Disease/condition prevalence from the Goat Production Condition Project (GPCP), as well as Ovine Johne’s disease prevalence, from AHA
- Pork processing facility information from APL
- Individual beef processor offal condemnation data
- Options for the control of parasites in the Australian goat industry (B.GOA.0014)[7]
- Review of Livestock Data Link[8]
- Various reports from the Enhance Abattoir Surveillance Program (EAS) being operated by Primary Industries and Regions South Australia.

[1] Review of the National Sheep Health Monitoring Project – K Bryan, L Webb, P Green (2016)
[2] Cost benefits of e-surveillance system for animal health monitoring – GHD (2011)
[3] Priority list of endemic diseases for the red meat industries – GHD (2015)
[4] Assessing the economic and operational impact of establishing a national ‘real time’ slaughter chain reporting scheme for pig producers, processors and industry regulators – D Hudson and D Hamilton (2016)
[5] National beef quality audit: Survey of producer-related defects and carcase quality and quantity attributes - CL Lorenzen, DS Hale, DB Griffin, JW Savell, KE Belk, TL Frederick, MF Miller, TH Montgomery, GC Smith (1993)
[6] National beef quality audit- 1995: Survey of producer-related defects and carcase quality and quantity attributes - SL Boleman, SJ Boleman, WW Morgan, DS Hale, DB Griffin, JW Savell, RP Ames, MT Smith, JD Tatum, TG Field, GC Smith, BA Gardener, JB Morgan, SL Northcutt, HG Dolezal, DR Gill, FK Ray (1998)
[7] Options for the control of parasites in the Australian goat industry – M Lyndal-Murphy, P James, P Bowles, R Watts, S Baxendell (2007)
[8] Review of Livestock Data Link – P Green, S Fischer, S Parry, K Johnston (2017)

A range of interviews were undertaken to discuss current systems, and potential benefits, opportunities and challenges relevant to peri-mortem data capture and transfer systems. The interviewees included veterinarians (from pork, beef and sheep industries), beef processors, sheep and goat processors, leading researchers, beef feedlots, Australian Lot Feeders' Association (ALFA), meat inspection companies, Meat and Livestock Australia (MLA) and DAWR.

2.2 Calculation of disease/condition costs and treatment

2.2.1 Sheep industry

The disease/condition costs were broken into production and processing sectors. For each disease, the below factors were considered:

Producers:

- Mortalities (on-farm)
- Reduced growth rates of animals
- Underweight at sale (decreased saleable meat weight to average from lost weight and/or trimming).

Processors:

- Mortalities
- Condemns (full carcase)
- Offal condemns
- Trimming.

Wool production:

- Quality
- Condemn
- Reduced fleece weight.

A desktop analysis was undertaken to attribute values for each factor. Total values were calculated using the data from the desktop analysis and prevalence data from AHA (prevalence rate used was average of 2014-2016). The disease impact was multiplied by the current sale price for lamb or mutton obtained from MLA. The summary of the costs to the production and processing sectors is summarised in Table 4. The net gain for the production sector (Table 5) was calculated as

- Production sector cost x % reduction in disease/condition – (cost of treatment/management)
  - % reduction in disease/condition was based on treatment efficacy (Table 4).

The gross gain for the processing sector (Table 5) was calculated as

- Processing sector cost x % reduction in disease/condition.

Table 4: Annual disease/condition cost and treatment option cost and efficacy

Disease	Production cost ($)	Processing cost ($)	Treatment cost ($/hd)	Treatment efficacy
Arthritis	24,141,461	4,484,564	0.64	0.50
Caseous lymphadenitis	14,675,339	6,266,651	0.14	0.70
Cysticercus tenuicollis	0	1,282,595	0.15	0.50
Grass seed lesions	26,589,792	9,472,628	1.56	0.70
Hydatids	0	12,882	0.15	0.50
Liver flukes	9,198,290	210,829	1.12	0.80
Johne's Disease	609,447	22,317	0.58	0.80
Pleurisy	2,425,296	2,435,349	0.66	0.70
Pneumonia	2,935,247	490,982	0.66	0.70
Sarcocystis	2,114,176	2,112,830	0.22	0.70
Sheep measles	594,444	1,043,184	0.15	0.20
Vaccination lesions of any cause	643,100	643,100	0.20	0.80
Total	**83,926,593**	**28,477,910**		
Grand total	**112,404,503**			

Table 5: Annual cost of treating disease/condition and net gain for production and gross gain processing sectors

Disease	treatment costs		Reduced production cost	Net gain - production	Gross gain - processig=ng sector	Total opportunity
	lamb	sheep				
Arthritis	126,113	626,960	12,070,731	11,317,658	2,242,282	13,559,939
Caseous lymphadenitis	26,190	379,587	10,272,737	9,866,960	4,386,656	14,253,615
Cysticercus tenuicollis	694,313	762,096	0	-1,456,408	641,297	-815,111
Grass seed lesions	464,989	2,644,909	18,612,855	15,502,958	6,630,839	22,133,797
Hydatids	1,228	12,292	0	-13,520	6,441	-7,079
Liver flukes	52,178	1,316,276	7,358,632	5,990,178	168,663	6,158,841
Johne's Disease	0	29,232	487,557	458,325	17,854	476,179
Pleurisy	434,336	1,781,433	1,697,708	-518,062	1,704,744	1,186,682
Pneumonia	155,396	139,514	2,054,673	1,759,763	343,687	2,103,450
Sarcocystis	5,564	177,065	1,479,923	1,297,294	1,478,981	2,776,276
Sheep measles	271,675	248,425	118,889	-401,211	208,637	-192,575
Vaccination lesions of any cause	204,581	181,284	514,480	128,615	514,480	643,095
Total	**2,436,563**	**8,299,072**	**54,668,184**	**43,932,549**	**18,344,561**	**62,277,110**

2.2.2 Goat industry

The estimated production and processing sector costs were estimated for the goat industry based on the same approach as for the sheep industry. Similar to the NSHMP, the GPCP monitors the prevalence of disease/conditions in a % of the slaughter population. The average prevalence rates for 2014-2016 are presented in Table 6. The data from the GPCP is mostly (and possibly exclusively; details aren't currently captured in the reporting) for rangeland goats (~90% of animals used for meat processing).

Table 6: Disease/conditions prevalence for goat industry (GPCP data, 2014-2016)

Disease	Prevalence
Arthritis	0%
Caseous lymphadenitis	1.84%
Cysticercus tenuicollis	1.86%
Grass seed lesions	0%
Hydatids	0%
Liver flukes	9.37%
Johne's Disease	0%
Pleurisy	3.29%
Pneumonia	0.13%
Sarcocystis	0%
Sheep measles	0%
Vaccination lesions of any cause	0%

The estimated cost of these disease/conditions is $5.16 million per annum (Table 7), with 91% of the cost to the production sector ($4.67 million) and 9% for the processing sector. This equates to a cost of $0.93/head for production sector (~5,000,000 rangeland goats for meat processing plus ~400,000 farmed goats) and $0.25/head for processing sector (~2,000,000 goats processed annually). However, due to a presumed adoption rate of 0% for rangeland goats, the net gain for the production sector has been calculated as only considering the farmed goats (400,000 in production and 200,000 processed annually):

- Cost of disease/condition x % reduction based on treatment/management efficacy (Table 7) – cost of treating/managing disease.

The gross gain for the production sector has been used calculated as:

- Cost of disease/condition x % reduction based on treatment/management efficacy (Table 7).

Table 7: Estimated costs to production and processing sectors, treatment cost and efficacy, and net gain for production sector and gross gain for processing sector

Disease/condition	Production cost ($)	Processing cost ($)	Treatment cost ($/hd)	Treatment efficacy	Treatment cost ($)	Net gain - producer ($)	Gross gain - processor ($)
Caseous lymphadenitis	45,957	23,165	0.14	70%	1,031	31,139	16,216
Cysticercus tenuicollis	0	1,998	0.15	50%	1,115	-1,115	999
Liver flukes	314,230	8,502	1.12	80%	41,964	209,420	6,801
Pleurisy	10,245	12,143	0.66	70%	8,689	-1,518	8,500
Pneumonia	3,214	635	0.66	70%	343	1,907	444
Total ($)	373,646	46,443			53,142	239,833	32,961
Grand total ($)	420,089					272,794	

The current system performance of the GPCP realises 0% of the total opportunity for capturing, transferring and acting on peri-mortem information (Table 8).

Table 8: Estimated current performance of system components in the GPCP

Current system performance	
Accuracy of inspection	90%
Suitability	90%
Data capture	0.5%
Data analysis	0%
Information transfer	0%
Adoption	25%
% of total opportunity	0%

2.2.3 Pork industry

The 12 disease/conditions listed in Table 9 were included in APL2015-2209 (Hudson and Hamilton, 2016) and would presumably form the basis for peri-mortem systems.

Table 9: List of peri-mortem disease/condition with frequency of being responsible for slaughter chain intervention, treatment costs and treatment efficacy (APL2015-2209)

Disease/condition	% of interventions	Treatment cost ($/hd)	Treatment efficacy
Abscess	30%	4	65%
Abscess (inoculation)	7%	0.1	80%
Anaemia	0%	0.95	70%
Arthritis	34%	2.33	70%
Bile contamination	1%	0.1	80%
Bruising	14%	0.1	90%
Dermatitis	2%	0.83	80%
Erysipelas	4%	1.35	85%
Septiceamia	1%	1.5	50%
Melanoma	1%	0.1	80%
Peritonitis	2%	2.17	50%
Pleurisy (minor or major)	5%	3.25	60%

As part of APL 2015-2209, the annual total cost of these diseases at processing has been estimated to be $10.3 million, with the net gain of treating each disease/condition being $3.73 million per annum for the production sector (reduced full and partial condemnations resulting in increased dressed weights) and $1.98 million per annum for the processing sector (reduced offal loss and increased processing efficiency). These figures were based on the following assumptions:

- Accuracy and suitability of peri-mortem data of 100%
- 100% of producers receiving post-slaughter animal health information
- An adoption rate of 100% for producers to treat disease/condition, following the receipt of animal health information
- Costs to treat and efficacy of treatment as detailed in Table 9.

The estimated total net gain for production (pre-processing) for each of the disease/conditions is estimated to be $5.91 million per annum (Table 10). Five of the twelve disease/conditions have negligible production impact. Four disease/conditions were not quantified, due to a lack of data to make an informed estimate, but were all at estimated prevalence levels of 0.1-1%

(anaemia [<0.5%], dermatitis [<0.5%], septicaemia [0.1%], peritonitis [1%]), and are thus thought to only make a minor contribution to the total potential net gain. Feedback from vets was that for the common diseases most veterinarians will have a medication program in place. However, they are unlikely to implement a control program for a condition that affects 1% of the kill unless it is recognised as a serious disease and most of these disease/conditions aren't. It is important to note that the estimated production costs for arthritis and erysipelas lack specific data for Australian production systems and practices. It is thus recommended that more data is collected to enable a better estimation of actual production costs. Similar to the approach with the sheep and goat industries, the % reduction based on treatment/management efficacy (Table 10) was used to calculate net gain for production sector and gross gain for processing sector.

Table 10: Estimated production costs (pre-processing) for disease/conditions

Disease/condition	Prevalence in Australian herd	Production costs - $/pig	Efficacy of preventives/treatments	Net gain for production - $
Abscess	1.32%	no production impact	65%	0
Abscess (inoculation)	0.31%	no production impact	80%	0
Anaemia	<0.5%	couldn't quantify	70%	couldn't quantify
Arthritis	1.00%	32.42	70%	1,742,575
Bile contamination	0.04%	no production impact	80%	0
Bruising	0.62%	no production impact	90%	0
Dermatitis	<0.5%	couldn't quantify	80%	couldn't quantify
Erysipelas	0.50%	14.97	85%	402,319
Septiceamia	0.10%	couldn't quantify	50%	couldn't quantify
Melanoma	0.50%	no production impact	80%	0
Peritonitis	1.00%	couldn't quantify	50%	couldn't quantify
Pleurisy	10.00%	8	60%	4,300,000
Total				**6,444,894**

2.2.4 Beef industry

The current list of relevant major disease/conditions (Table 11) was developed using the following approach:

1. Review of relevant disease/conditions listed in literature
2. Review of DAWR carcase condemn data for the last 4 years, and identification of major causes of full carcase condemnation
3. Review of data from NQBA 1991 and 1995
4. Review of data from 3 beef processors and identification of highest prevalence rates
5. Complied short list of disease/conditions, based on steps 1-4, and submitted the list to vets and beef processors, for their assessment and comments. The list was refined based on this feedback.

The estimated carcase trimming and offal downgrade/condemn prevalence (Table 11) is based on data from three beef processors. An extrapolation has been made based on the range and averages, of the data received, and the production areas and systems represented by the animals processed (combination of low and high rainfall areas; various geographic regions; both grass and grain fed). It is important to stress that this is an estimate.

The disease/condition costs were broken into production and processing sectors (Table 12). The costs for the production sector have been calculated as the sum of,

- Loss of full carcase (prevalence [DAWR data] x carcase price and weight)
- 50% of trimming cost
    - prevalence [data from single beef processor] x 0.6 kg [average value of trimming due to bruising from NQBA 1995] x $/kg value of carcase

- No production cost pre-processing was calculated. In consultation with vets and researchers it was identified that there is currently very little data available to make an estimate of these costs.

The costs for the processing sector have been calculated as the sum of,

- 50% of trimming cost
  - prevalence [data from single beef processor] x 0.6 kg [average value of trimming due to bruising from NQBA 1995] x $/kg value of carcase
- Offal downgrade/condemn
  - prevalence [based on data from 3 beef processors] x average % of downgrade [to pet food] and condemned offal [data collected from single beef processor] x price [for human consumption and pet food] and weight of offal.

Similar to the approach with the sheep, goat and pork data, the % reduction based on treatment/management efficacy (currently estimated as 70%) has been used to calculate gross gain for processing sector.

Table 11: Estimated prevalence of peri-mortem disease/conditions carcase and offal condemn, and related production costs (pre-processing)

Disease/condition	Full carcase condemn (DAWR data)	Carcase trimming	Offal downgrade/condemn	Production cost (pre-processing)
Abscess	0.0039%	0.3639%	2% (mostly liver, but also heart, kidney, lung)	?
Adhesions	0%	0%	2% (mostly liver)	?
Bruising	0.0043%	0.2648%	0%	no production impact
Hydatids	0%	0%	15% (liver [15%], lungs [4.5%])	?
Jaundice	0.0074%	0.0022%	0%	?
Liver fluke	0%	0%	5% (liver)	?
Pleurisy	0.0046%	0.6610%	0.27% (lungs)	?
Scarring	0%	0.6029%	0%	no production impact
Nephritis	0%	0%	2% (kidney)	?

Table 12: Estimated cost of peri-mortem disease/conditions carcase and offal condemn

Disease/condition	Cost of full condemns - $	Cost of trimming - $	Cost of Offal downgrade/condemn - $
Abscess	593,396	159,656	602,440
Adhesions	0	0	602,440
Bruising	653,493	116,199	0
Hydatids	6,625	0	5,378,217
Jaundice	1,126,222	945	0
Liver fluke	0	0	1,506,100
Pleurisy	690,876	290,026	62,548
Scarring	0	264,518	0
Nephritis	0	0	113,399
Total	3,070,610	831,344	8,265,143
Grand total		12,167,097	

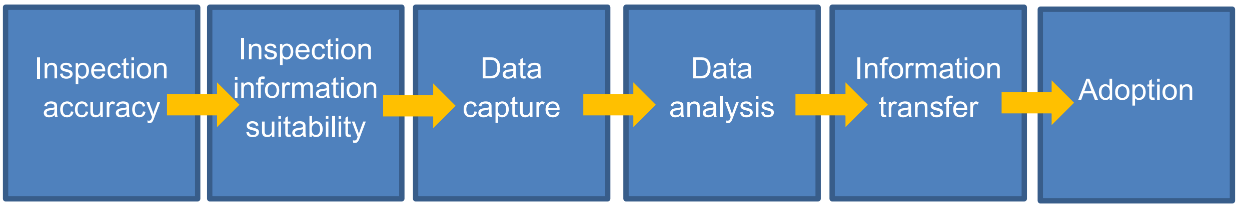
2.3 Requirement for more accurate information

Through the data collection process, it has been highlighted that a lack of accurate and specific information exists (for many of the disease/conditions of interest; particularly in pork and beef) regarding the actual costs of the disease/condition. There is a requirement for future work to be undertaken to fill in the knowledge and data gaps so that a more informed and accurate assessment of the actual costs and potential benefits of treating/managing these disease/conditions can be made.

2.4 Peri-mortem information systems and estimation of performance

The core value proposition in peri-mortem information capture and transfer systems is the suitable supply of information back to livestock production so that specific treatment/management can be undertaken to reduce the impact and cost of the specific disease/conditions for both the production and processing sector. Six system components have been considered (Figure 4), which are required to deliver this outcome and realise the potential value.

Figure 4: System components of peri-mortem information systems



1. Inspection accuracy – refers to whether the decision made by the person undertaking the inspection is correct or incorrect. Is the disease/condition that the animal has, the same as what has been reported by the inspector?
2. Inspection information suitability – refers to the suitability of the inspection relative to the disease/condition and how the information could be acted upon. This includes detail such as:
    a. Consistency of description and nomenclature
    b. Connection with treatable/manageable disease/condition rather than simply reporting a symptom
    c. Location of disease/condition on animal (e.g. abscess on right hindquarter)
    d. Severity information (e.g. grading for pleurisy)
    e. History of the disease/condition. When did the animal have the disease/condition? (e.g. with liver fluke – was it from the present season or is this scarring from 2 years ago)
    f. Photographic record
    g. Further testing of collected sample (e.g. histology, pathology).
3. Data capture – refers to the capture of the inspection decision and related information.
4. Data analysis – primarily refers to analysis of the data in regard to lot of animals from an individual livestock supplier. Depending on the supply chain, analysis could be undertaken by individual processor, producer, vet and/or at an industry wide level.
5. Information transfer – refers to how the inspection data is appropriately packaged and delivered to livestock suppliers (producers, feedlots).
6. Adoption – this refers to specific changes in disease/condition treatment/management undertaken by livestock suppliers, as a result of information received, to reduce prevalence and impact of disease/condition in production system.

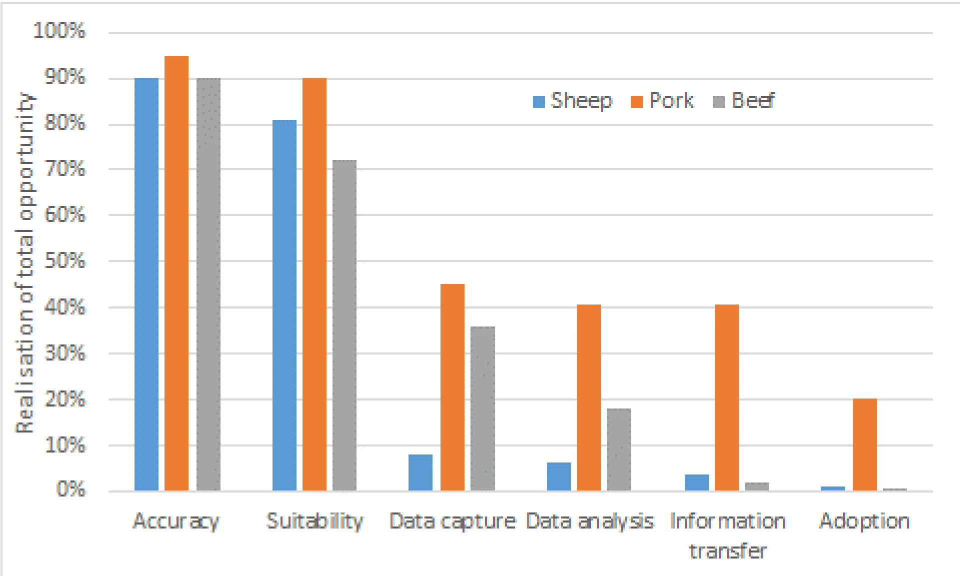
For value to be realised, all system components have to be operating at a suitable performance level. The flow of data/information and suitable accompanying communication and collaboration, along the system, is crucial.

The current and potential performance of various system configurations have been estimated by multiplying each component together. An example of this is provided below where the levels of current system component performance for each of the sheep, pork and beef industries (listed in Table 13) have been multiplied in order of component (accuracy x suitability x data capture x data analysis x information transfer x adoption) as shown in Figure 5.

Table 13: Current system component performance for sheep, pork and beef industries

System component	Sheep	Pork	Beef
Accuracy	90%	95%	90%
Suitability	90%	95%	80%
Data capture	10%	50%	50%
Data analysis	80%	90%	50%
Information transfer	60%	100%	10%
Adoption	25%	50%	25%
% total opportunity realised	**1.0%**	**20.3%**	**0.5%**

Figure 5: Impact of system component performance on realisation of total opportunity



In Chapters 3 and 4, the current and potential performance (in various scenarios) of these system components, as well as important factors and considerations relevant to optimising component performance, are presented and discussed.

Sensitivity analysis was undertaken on the estimated potential performance, and associated range (Table 14), using @RISK software.

Table 14: Estimated system component performance and range used for sensitivity analysis

System component	Sheep	Pork	Beef
Accuracy	90% (80-100%)	95% (90-100%)	90% (80-100%)
Suitability	90% (80-100%)	95% (90%-100%)	80% (80-100%)
Data capture	40% (30-40%)	80% (70-80%)	80% (70-80%)
Data analysis	100%	100%	100%
Information transfer	76% (50-76%)	100% (80-100%)	100% (80-100%)
Adoption	50% (40-60%)	75% (70-80%)	50% (40-60%)

2.5 Steering committee feedback

Feedback received from the steering committee for two oral presentations, two milestone reports and draft final report was utilised in refining the project.

3 Business case model of opportunities

The first section of opportunity consideration (3.1-3.4) is the actual value as a result of data capture, information transfer and subsequent treatment/management to realise a reduction in the current costs of the relevant disease/conditions. This is the core value proposition in a peri-mortem capture and transfer system. Each species is considered individually and business cases are presented for supply chain driven peri-mortem capture and transfer systems. The recommendation for specific supply chain systems is because:

- all system components need to be suitably operative within a supply chain for value to be realised (Figure 4)
- all system components will synergistically increase in performance when part of integrated systems.

It is important to note that a non-supply chain mechanism for information transfer is discussed for each species and has been labelled as LDL-like. This acknowledges that there is a great deal of investment, time and hard work required to 1) upgrade and improve the current LDL to make it suitably operational, and 2) to get sheep and beef producers to use LDL (see 4.6.2 for specific discussion).

Section 3.5 examines opportunities that will arise from the system in regards to fulfilling probable future reporting and information requirements, as well as operational efficiencies and synergies with current processes and programs.

3.1 Sheep industry

The total opportunity (net gain for the production sector and gross gain for the processing sector, Table 15) for the sheep industry is estimated to be $62.28 million per annum, with $43.93 million for the production sector (71%) and $18.34 million for the processing sector (29%).

Table 15: Total opportunity for sheep industry

	Total opportunity	$/Hd
Production sector	43,932,549	0.58
Processing sector	18,344,561	0.57
Total	62,277,110	

The existing framework of the NSHMP has ensured that inspection accuracy and suitability are high but the data capture rate is low. The recommended business case for the sheep industry is to transition to a more supply chain driven model. Some of the key changes to the existing framework would include:

1. Inspection and electronic data capture being undertaken exclusively by fulltime meat inspectors who are part of the chain in processing plants.
2. Information transfer occurring by a combination of direct information transfer, from processors to producers, and potentially by indirect transfer via Livestock Data Link (LDL)-like mechanism (if required).
3. Increased direct supply chain incentives to treat/manage disease/condition to maximise returns for both producers and processors.

4. Utilisation of models by both producers and processors, which are currently being developed, to provide cost benefit analysis of treating/managing each disease/condition based on individual producer's information.
5. Transition to collecting peri-mortem data by individual animal identifier and connecting with other information such as ante-mortem inspection data.

3.1.1 Total, current and potential value realisation

The total opportunity, current value realised and potential value realised from peri-mortem systems are summarised in Figure 6. This is based on the system component performance in Table 16. Based on the sensitivity analysis (2.4), the potential value ranged from $4.81 (5% percentile) to $7.97 million (95% percentile).

Figure 6: Total opportunity, current and potential value realisation ($/annum)

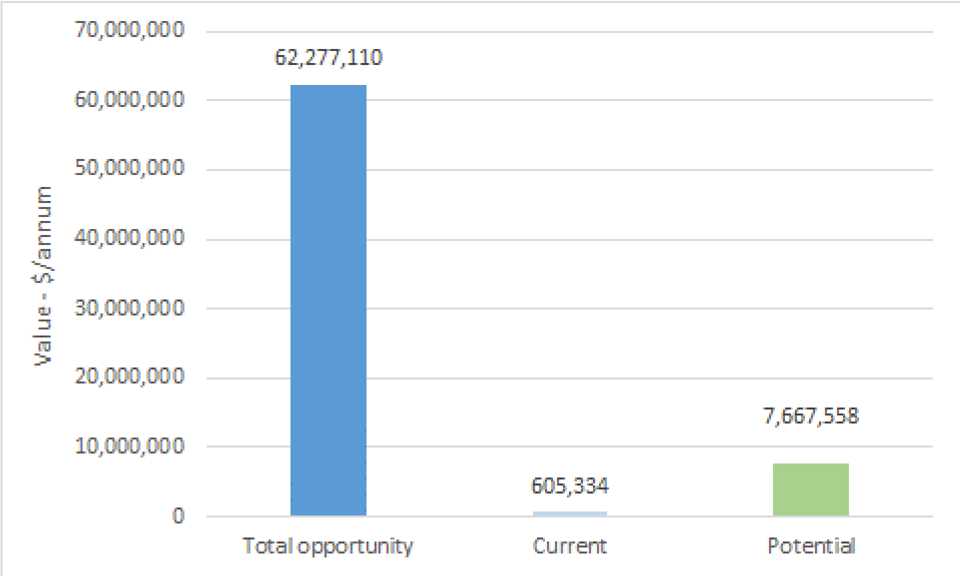


Table 16: System component performance

System component	Total	Current	Potential
Accuracy	100%	90%	90%
Suitability	100%	90%	90%
Data capture	100%	10%	40%
Data analysis	100%	80%	100%
Information transfer	100%	60%	76%
Adoption	100%	25%	50%

The proposed changes in 'Current' to 'Potential' are:

- Transition from inspection as part of NSHMP to being undertaken by plant-based meat inspectors
- 100% of data being captured by these meat inspectors at 50% of export plants
  - Data capture = 50% x 80% (animals processed through export plants) = 40%
- 100% of data being analysed by abattoirs
- Information being transferred back to producers via direct transfer (e.g. kill sheet) or via LDL-like mechanism

  - Information transfer = 76% based on number of direct lines
- Utilisation of ROI calculators give producers $ value for treating/managing their specific disease/conditions
  - Adoption increases from 25% to 40%
- Pricing incentives are established and animal health liaison officers support production sector
  - Adoption increases from 40% to 50%.

3.1.2 Business case for processing sector

The business case for the majority of export processing plants to implement systems within their plants for a combination of information transfer via direct supply chain transfer and via LDL-like mechanism, is a net gain of $0.08/head for the processing sector and pay back of 2.39 years (Table 17). The following assumptions have been made:

- these plants (~50) represent ~80% of all animals processed (majority of export abattoirs)
- gross gain of $0.16/head
- system performance as average of Table 18
- set up costs of $70,000/plant (Table 19)
- operational costs of $30,000/year (Table 20)
- equipment life of 10 years and discount rate of 7%.

Table 17: Summary of business case for processing sector

	Sheep
Hd / annum	25,606,712
Capital cost (pmt option, upfront)	$3,500,000
Gross return Per head	$0.16
Total costs Per head	$0.07
Net Benefit Per head	$0.08
Annual Net Benefit for the plant	$ 2,170,254
Annual Net Benefit for the ex cap	$ 2,520,254
Pay back (years)	2.39
Net Present Value of investment	$24,736,580

The business case for an individual processing plant, which processes 5% of total annual kill (~1.6 million head), to capture data and transfer information by direct supply chain transfer (25% of animals) and indirect transfer via LDL-like mechanism (75% of animals) is that there is a gross opportunity of $0.917 million per annum and estimated net benefit of $0.15/head (Table 18). This scenario assumes:

- there is currently some ad hoc manual collection of data, by plant-based meat inspectors, and subsequent transfer of information to producers accompanying deductions for specific disease/condition
- the system performance in Table 19
- costs in Table 20 (setup costs as an initial outlay and ongoing yearly operational costs)

- non-incentivised system (e.g. no deductions for specific disease/conditions and associated trimming and/or lost offal) would operate for 1 year to adequately engage and communicate with suppliers, and let them know about the planned shift to incentive based payment system (e.g. deductions for lost offal)
- incentivised system (e.g. deductions for specific disease/conditions) would start after 1 year of non-incentivised system operating
- LDL-like mechanism suitably delivers information (including model that gives producer $ value of disease/condition treatment/management) and can be accessed by producers, and associated communication and engagement strategy is undertaken by MLA and AHA to get large proportion of producers accessing and using it.

Table 18: Business case for individual sheep processor to capture data and transfer information both directly and indirectly

	Sheep Processor
Hd / annum	1,597,824
Capital cost (pmt option, upfront)	$70,000
Gross return Per head	$0.18
Total costs Per head	$0.03
Net Benefit Per head	$0.15
Annual Net Benefit for the plant	$237,619
Annual Net Benefit for the ex cap	$244,619
Pay back (years)	1.29
Net Present Value of investment	$1,893,928

Table 19: Estimated system performance for sheep processor

System component	non-incentivised	incentivised
Accuracy of inspection	90%	90%
Suitability	90%	90%
Data capture	100%	100%
Data analysis	100%	100%
Information transfer	76%	76%
Adoption	40%	50%

Table 20: Estimated costs for sheep processor

	Setup - $	Operational (per year) - $
Data capture and transfer (hardware, software and system support)	60,000	25,000
Analysis/communication/liaison/reporting (10% FTE for first year; 5% FTE from then on; salary $100K)	10,000	5,000

3.1.3 Business case for production sector

Based on the scenario presented above the net gain opportunity for the production sector is estimated to be $0.30/head (Table 21). This assumes:

- the system performance in Table 19
- is applicable to 80% of Australian flock (animals processed in export abattoirs)
- efficacy and treatment costs as per Table 4.

Table 21: Business case for production sector

Production sector	
Gross gain - $/Hd	0.38
Cost - $/Hd	0.08
Net gain - $/Hd	0.30
Annual net gain - $	18,078,082

3.2 Goat industry

The total opportunity (net gain for the production sector and gross gain for the processing sector, Table 22) for the goat industry is estimated to be $0.27 million per annum, with $0.24 million for the production sector (88%) and $0.03 million for the processing sector (12%). This equates to an estimated net gain of $0.60/head for production sector and gross gain of $0.16/head for processing sector.

Table 22: Total opportunity for goat production and processing sector

	Total opportunity - $/annum	$/Hd
Production sector	239,833	0.60
Processing sector	32,961	0.16
Total	272,794	

As all export goat processing is done through abattoirs that also process sheep, it is expected that systems set up for sheep could fairly easily accommodate goat. Due to this, no extra or specific recommendations or considerations, further to that detailed for the sheep industry, are provided for the goat industry.

3.3 Pork industry

The estimated total opportunity (net gain for the production sector and gross gain for the processing sector), for the pork industry, is $12.15 million (Table 23), with 84% to the production sector and 16% to the processing sector.

Table 23: Total opportunity for pork industry

	Total opportunity	$/Hd
Production sector	10,174,894	1.89
Processing sector	1,980,000	0.39
Total	12,154,894	

The pork industry has a history of health monitoring connected to post mortem inspection (Pig Health Monitoring Scheme), and practice of consultant vets undertaking post-mortem inspection to manage herd health. The key opportunities for the pork industry in the context of peri-mortem capture and transfer systems are as follows:

1. Engage with veterinarians and abattoirs to develop suitable frameworks that support increased information utilisation rather than creating competition in regards to post-mortem inspection data (this is most relevant in NSW and Victoria)
2. Transition to inspection and electronic data capture being undertaken exclusively by fulltime meat inspectors who are part of the chain in processing plants
3. Increased direct supply chain incentives to treat/manage disease/condition to maximise returns for both producers and processors
4. Determine production costs of relevant disease/conditions, to better understand net benefit of treating/managing each disease/condition
5. Transition to collecting peri-mortem data by individual animal identifier and connecting with other information such as ante-mortem inspection data.

Due to the integration, collaboration and direct supply nature of the pork industry, it is recommended that information transfer be predominantly via direct supply chain communication. The value proposition for establishing an industry wide mechanism (such as LDL-like) for information transfer is not clear. Subsequently it is not recommended that such mechanisms be pursued until routine electronic data capture and subsequent information transfer is undertaken.

3.3.1 Total, current and potential value realisation

The total opportunity, current value realised and potential value realised from peri-mortem systems are summarised in Figure 7. This is based on the system component performance in Table 24. Sensitivity analysis (2.4) showed that potential value ranged from $3.50 million (5% percentile) to $5.50 million (95% percentile).

Figure 7: Total opportunity, current and potential value realisation ($/annum)

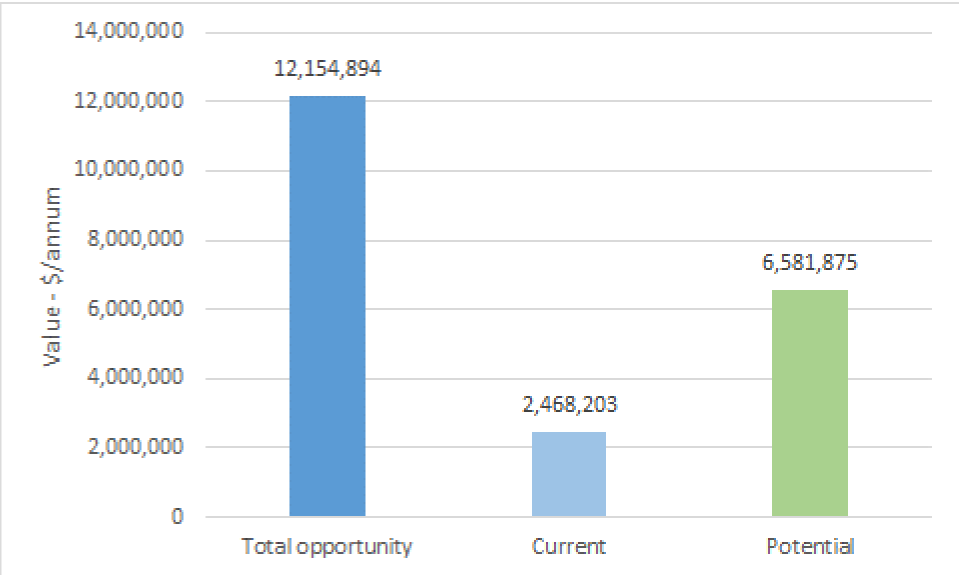


Table 24: System component performance

System component	Total	Current	Potential
Accuracy	100%	95%	95%
Suitability	100%	95%	95%
Data capture	100%	50%	80%
Data analysis	100%	90%	100%
Information transfer	100%	100%	100%
Adoption	100%	50%	75%

The proposed changes in ‘Current’ to ‘Potential’ are:

- Transition to inspection and data capture by plant-based meat inspectors
- 100% of data captured at export plants
    - Data capture = 100% x 80% (animals processed through export plants) = 80%
- 100% of data being analysed by abattoirs/consultant vets
- 100% of information being transferred back from abattoirs to producers/vets
- Utilisation of ROI calculators and pricing incentives
    - Adoption increases from 40% to 50%.

3.3.2 Business case for processing sector

The business case for all seven of the large export processing plants to implement systems within their plants for information transfer via direct supply chain, is a net gain of $0.17/head for the processing sector and pay back of 1.67 years (Table 25). The following assumptions have been made:

- no benefit in the first year
- these plants (7) represent ~80% of all animals processed
- gross gain of $0.24/head (Table 25)
- system performance as per Table 27
- set up costs of $70,000/plant (Table 28)
- operational costs of $30,000/year (Table 28)
- equipment life of 10 years and discount rate of 7%.

Table 25: Summary of business case for processing sector

	Pork
Hd / annum	3,911,386
Capital cost (pmt option, upfront)	$490,000
Gross return Per head	$0.24
Total costs Per head	$0.07
Net Benefit Per head	$0.17
Annual Net Benefit for the plant	$ 679,733
Annual Net Benefit for the ex cap	$ 728,733
Pay back (years)	1.67
Net Present Value of investment	$6,103,265

The business case for an individual processing plant, which processes 10% of total annual kill (~490,000 head), to capture data and transfer information by direct supply chain transfer mechanism (100% of animals) is that there is a net gain of $0.12/head and pay back on investment of 2.02 years (Table 26). This scenario assumes:

- no benefit in the first year
- there is a level of data capture continuing from the former Pig Health Monitoring Scheme
- the system performance in Table 27
- costs in Table 28 (setup costs as an initial outlay and ongoing yearly operational costs)
- non-incentivised system would operate for 1 year to adequately engage and communicate with suppliers and their vets, and let them know about the planned shift to incentive based payment system (e.g. deductions for lost offal)
- incentivised system would start after 1 year of non-incentivised system operating.

Table 26: Business case for individual pork processor to capture data and transfer information directly

	Pork processor
Hd / annum	492,480
Capital cost (pmt option, upfront)	$70,000
Gross return Per head	$0.20
Total costs Per head	$0.08
Net Benefit Per head	$0.12
Annual Net Benefit for the plant	$ 61,496
Annual Net Benefit for the ex cap	$ 68,496
Pay back (years)	2.02
Net Present Value of investment	$621,795

Table 27: Estimated system performance for pork processor

	non-incentivised	incentivised
Accuracy of inspection	90%	90%
Suitability	90%	90%
Data capture	100%	100%
Data analysis	100%	100%
Information transfer	100%	100%
Adoption	50%	75%

Table 28: Estimated costs for pork processor

	Setup - $	Operational (per year) - $
Data capture and transfer (hardware, software and system support)	60,000	25,000
Analysis/communication/liaison/reporting (10% FTE for first year; 5% FTE from then on; salary $100K)	10,000	5,000

3.3.3 Business case for production sector

Based on the scenario presented for the pork processing sector, the net gain opportunity for the production sector is estimated to be $0.99/head (Table 29). This assumes:

- the system performance in Table 27
- is applicable to 80% of Australian herd (animals processed in export abattoirs)
- efficacy and treatment costs as per Table 9.

Table 29: Business case for production sector

Production sector	
Net gain - $/Hd	0.99
Annual net gain - $	3,904,733

3.4 Beef industry

The estimated total opportunity (gross benefit), for the beef industry, at processing is estimated to be $8.52 million (Table 30), with 29% to the production sector and 61% to the processing sector. Due to the lack of data to be able to calculate production costs, it is recommended that a project be undertaken to determine these costs and subsequent net gain (see section 6.4). In the sheep industry, 70% of net gain for the production sector is the production costs (pre-processing). Based on this, net gain for production costs in the beef industry may be in the order of $10-20 million.

Table 30: Estimated total opportunity (gross benefit) for Australian beef industry at processing

	Total opportunity - $	$/Hd
Production sector	2,440,398	0.27
Processing sector	6,076,571	0.68
Total	8,516,968	

Peri-mortem capture and transfer systems in the beef industry are being supply chain driven. As a result, it is expected that there will be relatively rapid increases in the realisation of the total opportunity. Key dimensions of the system in the beef industry include:

1. Development and use of consistent reporting across the industry, in regards to disease/condition 1) name/terminology/description, 2) location on animal (carcase and/or specific offal), 3) severity (where appropriate), 4) action (e.g. trim carcase; liver downgrade to pet food) and 5) photographic record (for relevant disease/conditions such as adhesions).
2. Information transfer occurring by a combination of direct supply chain information transfer, from processors to producers and feedlots, and potentially by indirect transfer via LDL-like mechanism (if required).
3. Tailored detail of information provided to different livestock suppliers/producers.
4. Abattoirs employing staff who have a specific role as an animal health liaison officer, to help communicate and manage the relationship with livestock suppliers/producers. Production companies (feedlots and extensive) employing consultant vets to engage directly with abattoirs to request and manage information requirements.

5. Increased direct supply chain incentives to treat/manage disease/condition to maximise returns for both producers and processors.
6. Determine production costs of relevant disease/conditions, to better understand net benefit of treating/managing each disease/condition.
7. Development of models, for utilisation by producers (similar to that being currently developed for sheep), to provide cost benefit analysis of treating/managing each disease/condition based on individual producer information.
8. Connecting peri-mortem information with other information such as ante-mortem inspection data (at processing) and with other genetics, performance and live health data (particularly in the feedlot industry).

3.4.1 Total, current and potential value realisation

The total opportunity, current value realised and potential value realised from peri-mortem systems are summarised in Figure 8. This is based on the system component performance in Table 31. Sensitivity analysis (2.4) showed that potential value ranged from $1.19 million (5% percentile) to $2.01 million (95% percentile).

Figure 8: Total opportunity, current and potential value realisation ($/annum)

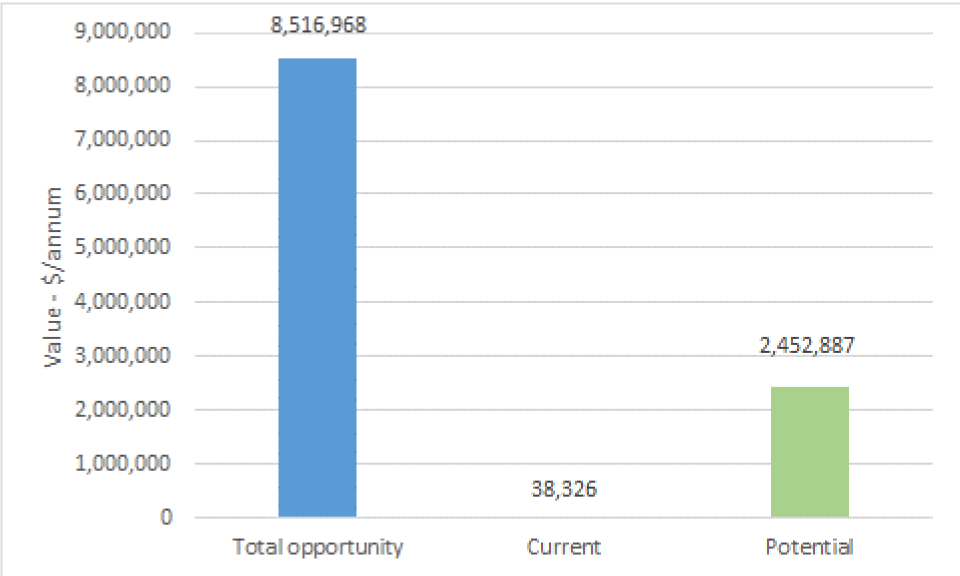


Table 31: System component performance

System component	Total	Current	Potential
Accuracy	100%	90%	90%
Suitability	100%	80%	80%
Data capture	100%	50%	80%
Data analysis	100%	50%	100%
Information transfer	100%	10%	100%
Adoption	100%	25%	50%

The proposed changes in 'Current' to 'Potential' are:

- 100% of data being captured by export plants

  - Data capture = 100% x 80% (animals processed through export plants) = 80%
- 100% of data being analysed by abattoirs
- 100% of information being transferred back to producers via direct transfer (e.g. kill sheet) or via LDL-like mechanism
- Utilisation of ROI calculators give producers $ value for treating/managing their specific disease/conditions
  - Adoption increases from 25% to 40%
- Pricing incentives are established and animal health liaison officers support production sector
  - Adoption increases from 40% to 50%.

3.4.2 Business case for processing sector

The business case for the majority of export processing plants to implement systems within their plants for a combination of information transfer via direct supply chain transfer and LDL-like mechanism, is a net gain of $0.09/head for the processing sector and pay back of 3.87 years (Table 32). The following assumptions have been made:

- no benefit in the first year
- these plants (~50) represent ~80% of all animals processed
- gross benefit of $0.26/head (Table 32)
- system performance as average of Table 35
- set up costs of $50,000/plant (estimated industry average based on Table 36)
- operational costs of $20,000/year (estimated industry average based on Table 36)
- equipment life of 10 years and discount rate of 7%.

Table 32: Business case for beef processing sector

	Beef
Hd / annum	7,198,525
Capital cost (pmt option, upfront)	$2,500,000
Gross return Per head	$0.26
Total costs Per head	$0.17
Net Benefit Per head	$0.09
Annual Net Benefit for the plant	$ 621,617
Annual Net Benefit for the ex cap	$ 871,617
Pay back (years)	3.87
Net Present Value of investment	$10,645,452

The business case for three individual beef processing plants, which each process ~200,000 head/year, to capture data and transfer information is that there is a net benefit/head of -$0.03 to $0.23 (Table 33). The three scenarios (Processor 1, 2 and 3) have been modelled to estimate net gain for processors servicing different supply chains in different ways. These three scenarios are summarised in Table 34, and brief introduction to each processor is as follows:

- Processor 1

- Is setting up systems to supply information to the whole of their supply chain via direct transfer. They are not interested in using LDL-like mechanism.

- Processor 2
  - Is happy to start providing information back to producers and feedlots, either via direct transfer (for those who are 'pulling it' – such as production companies and feedlots) or via LDL-like mechanism.
- Processor 3
  - Only deals with feedlots (some very large) and has some vertical integration. Data will be transferred directly to feedlots for integration into feedlot (vet) systems that monitor and review live animal performance and health.

Table 33: Summary business case for beef processors

	Beef Processor-1	Beef Processor-2	Beef Processor-3
Hd / annum	199,181	199,181	199,181
Capital cost (pmt option, upfront)	$120,000	$10,000	$5,000
Gross return Per head	$0.26	$0.13	$0.26
Total costs Per head	$0.29	$0.03	$0.03
Net Benefit Per head	($0.03)	$0.10	$0.23
Annual Net Benefit for the plant	-$ 5,213	$ 19,894	$ 46,287
Annual Net Benefit for the ex cap	$ 6,787	$ 20,894	$ 46,787
Pay back (years)	18.68	1.48	1.11
Net Present Value of investment	$243,730	$171,865	$358,730

Table 34: Information for beef processor scenarios

	Processor 1	Processor 2	Processor 3
Data capture operational	no	yes	yes
Information transfer operational	no	yes - on request	yes - on request
Production system	grass	grass/grain	grain
Direct transfer of information	yes	yes	yes
Indirect transfer (LDL-like mechanism)	no	yes	no

The estimated net gains have been calculated based on:

- the system performance in Table 35
- costs in Table 36 (set up costs as an initial outlay and ongoing yearly operational costs)
- non-incentivised system would operate for 1 year to adequately engage and communicate with suppliers, and let them know about the planned shift to incentive based payment system (e.g. deductions for lost offal)
- incentivised system would start after 1 year of non-incentivised system operating.

Table 35: Estimated system performance for beef processor

System component	Processor 1 non-incentivised	Processor 1 incentivised	Processor 2 non-incentivised	Processor 3 non-incentivised
Accuracy of inspection	90%	90%	90%	90%
Suitability	90%	90%	90%	90%
Data capture	100%	100%	100%	100%
Data analysis	100%	100%	100%	100%
Information transfer	100%	100%	100%	100%
Adoption	25%	50%	25%	50%

Table 36: Estimated costs for beef processor

	Processor 1		Processor 2		Processor 3	
	costs - setup	costs - operational	costs - setup	costs - operational	costs - setup	costs - operational
Data capture and transfer (hardware, software and system support)	60,000	25,000	0	0	0	0
Analysis/communication/liaison/reporting (5-20% FTE for first year; 5-10% FTE from then on; salary $100K)	30,000	15,000	10,000	5,000	5,000	5,000
Communication strategy	30,000	5,000	0	0	0	0

3.5 Other benefits – cost of future business and increased efficiency

In this section other potential benefits from peri-mortem information systems (Table 37) are discussed. Most of the value from these benefits can be summarised as:

- compliance to increased future animal information requirements,
- increased efficiency of inspection process,
- increased efficiency of animal health surveillance programs, or
- utilisation of disease/condition information together with other animal information (genetics, production performance, meat quality).

Table 37: Potential benefits arising from peri-mortem information systems

Benefit	Detail	Value
Satisfy future requirement for greater post-mortem information	• Increased requirement for information to satisfy country/region market access, customer and customer.	• Requirement of doing future business • Compliance with information requirements
Increase accuracy and efficiency in inspection process	• Targeted inspector training • Adoption of less invasive techniques • Utilisation of technologies	• Increased accuracy • Reduced contamination • Labour savings, increased accuracy
Integration with DAWR reporting	• Electronic capture of post-mortem and ante-mortem data with increased level of detail and suitability	• Full condemnation information more easily transferable and usable by production sector • Increased accuracy and suitability through knowledge of ante-mortem state • One data capture system used for both DAWR reporting and peri-mortem information system

Integration with surveillance programs (e.g. programs administered AHA)	• Ability to increase efficiency of information capture of current and future surveillance programs • Provision of data for evidence of disease absence	• Increased efficiency of current and future surveillance programs • Ability to immediately respond to new surveillance requirements. • Enhanced ability to satisfy market demands for evidence of disease absence
Integration with programs operated through industry bodies (e.g. MLA, APL) and state governments	• Ability to increase efficiency of programs through cost effective provision of information. • Relevant to programs such as feral animal management, endemic disease research.	• Increased efficiency of programs
Integration of disease/condition information with other information	• Post-mortem data captured by individual animal id	• Ability to satisfy future market requirements for complete animal information • Ability to analyse and understand connection of disease/condition to factors such as meat quality, genetics and production conditions

3.5.1 Importing country/region market access

Currently, apart from peri-mortem information transfer systems, other systems provide the requirements for market access into each and every country (including domestic) where Australian sheep, goats, pork and beef are exported. The market that is potentially requiring peri-mortem information the soonest, as a requirement of doing business, is the European Union.

There is scope to include relevant current mandatory requirements for market access into peri-mortem information systems (which may increase data capture and information transfer, and improve efficiencies, of current systems). However it is important that this is not viewed as the key driver behind setting up peri-mortem information systems, as this will stifle and confuse supply chain initiatives.

3.5.2 Customer requirements

Similar to country market access, individual customer requirements are currently fulfilled by other systems, apart from peri-mortem capture and transfer systems. However it is expected that within the next 5-10 years, the requirement for animal health, welfare and traceability information will increase to make the provision of peri-mortem (and ante-mortem) information part of standard operations. For example auditable documentation and systems to show incidence of animal disease/conditions and improvements in animal health and welfare (at an individual production or processing company level; and potentially at a whole of industry level) will probably become standard for certain customers. In light of this, there is significant incentive for each individual supply chain to have operative systems.

3.5.3 Consumer requirements

The increasing demand for information surrounding the origin and history of each product consumed, by individuals all over the world, is a key driver behind the changing customer and country/region requirements. It is expected that the demand to know that the animal that is being consumed had a safe and healthy existence, across the whole of its life (whole of supply chain), will only increase. In this context, the ability to provide messaging and documented improvements in animal health and welfare (at an individual production or processing company level; and potentially at a whole of industry level) will become increasingly valued, and in time will probably become standard requirement of consumers.

3.5.4 Changing inspection process

Apart from increasing accuracy and suitability of inspection process and information, there are two identified areas of saving, which are reducing labour and contamination that results from the current inspection process. The labour savings that could result from installing technology to undertake part (such as ultrasound analysis of offal) or all of the current inspection process are in the order of 2-3 inspectors per processing chain. Reduction of contamination as a result of a less invasive ('hands free') inspection approach is difficult to quantify, however the shift of the European pork industry to this process indicates the opportunity for the Australian pork industry. There is also scope to reduce the amount of 'hands on' inspection in process for sheep and beef. However given the large export focus and the many and varied export markets of the Australian sheep and beef industries, there may be significant challenges in getting changes in the 'hands on' components of current inspection standards (such as incising lymph nodes and bile ducts) accepted across the importing countries.

It is expected that changes in the inspection process will not be in isolation to changes in how other objective measurements are being undertaken and captured in plants. As a result technologies that are set up to quantify parameters such as lean meat yield, will probably play a future role in being able to (help) detect/identify relevant post mortem disease/condition information.

Another area of consideration, is the role of inspectors to reduce full condemnation of certain items (such as tongues because of grass seeds, arthritic joints rather than full condemnation, and removing pleural cavity in pleurisy rather than full condemnation) by either undertaking the trimming themselves or overseeing this trimming. Development and implementation of the best frameworks for standardising this practice, whilst ensuring safety and suitability for human consumption, is the aim of several current projects.

3.5.5 Data capture – assisting inspection training and validation

As data is increasingly captured in real time using electronic means, it is expected that providing animal information and targeted training to inspectors, and undertaking inspection performance review will become much easier to do. This will help to increase inspection accuracy and suitability, as well as providing the ability to more easily add in extra inspection criteria in the future (such as diseases included in surveillance programs or outbreaks). Examples of this include,

- The front screen of inspection touch screen being used to capture data could provide a brief summary of the history of the animals (such as grain-fed, species, breed, location) with relevant flags of what are the top disease/conditions usually present and anything that is unusual, rare or different to what the inspectors have been seeing recently.
- In built training modules are regularly uploaded to the touch screen and allow inspectors to do specific and targeted training 5-10 minutes prior to the commencement of their shift.

3.5.6 Integration with DAWR reporting and surveillance programs

Peri-mortem data capture and transfer systems could be extended to include information relating to ante-mortem inspection and post-mortem (full) carcase condemnation. This reporting is the jurisdiction of DAWR. The current annual loss from full carcase condemnation is $29.6 million, split by industry as:

- Sheep industry – $9.0 million
- Goat industry - $1.4 million
- Pork industry – $3.1 million
- Beef industry - $16.1 million.

Whilst not only aiding the transfer and the suitability of the current full carcase condemnation information (which is often low on detail and unusable by producers or vets for improving future animal health, and method of capture could be made more efficient using electronic systems), this would be a mechanism of capturing ante-mortem inspection information. This ante-mortem inspection information, could be utilised by:

- in-plant inspectors to aid their inspection process (improving accuracy and suitability)
- vets in understanding more about the specific animal's disease/condition status
- producers and processors in both marketing their products ("we care for our animals and we monitor their health and welfare at all points of the supply chain") and satisfying customer/consumer/market requirements for complete animal information, including animal welfare ("we have detailed and verified information for each and every animal, including ante-mortem and post-mortem inspection").

Peri-mortem data capture systems could also be utilised for surveillance programs. For example, it is recommended that the various programs administered by AHA could be run more efficiently through peri-mortem information capture systems.

It is recommended that propositions be developed and discussed with 1) DAWR and 2) AHA, to pursue the opportunities of better integrating with other reporting, inspection and surveillance programs.

3.5.7 Individual animal identification – connection to all other data

Although peri-mortem information is only a small package in the whole information for an animal (which includes genetics, production information, geographical location, carcase yield, meat quality) it is recommended that the peri-mortem information be viewed and collected in the context of the total data for an animal. The major areas of value that may be realised from this approach include:

- ability to understand how certain disease/conditions are related to meat quality indices
- providing customers, consumers and market regulators (domestic and export) with the complete information on each animal.

The beef industry has systems developed to currently operate this way and individual animal data is highly valued. Although the sheep, goat and pork industries do not currently have widespread individual animal identifiers, and treatment/management of disease/conditions is at a flock/herd level, the trend to move to individual animal identification systems, and connect individual data to this, is recommended.

It is also recommended that peri-mortem information transfer systems be setup to be easily integrated into other software packages and systems. This would allow for producers, vets and feedlots to be able to integrate peri-mortem information with the rest of the information they currently (and extra information in the future) capture, analyse and utilise.

Ideally, peri-mortem information would integrate into systems being utilised and developed to capture, transfer, analyse and utilise other data and information. This would maximise efficiency and reduce operating expenses for the capture, transfer and utilisation of peri-mortem information. In this context, there may be synergies with systems being developed in two other current Rural R&D for Profit projects,

- Advanced measurement technologies for globally competitive Australian meat
- Improved surveillance, preparedness and return to trade for emergency animal disease incursions using foot and mouth disease as a model.

3.5.8 Aggregated information – in context of realising total opportunity and other programs

Although aggregated data is helpful for production sector awareness it is not useful for making specific herd/flock management decisions. This is because the information received back for each lot of animals is individual and generally not transferable, disease/conditions are farm/production system-specific, and each farm/production system is unique. Therefore, aggregated information of disease/condition prevalence is not thought to be able to enable the core value proposition (section 3.1).

Aggregated information from peri-mortem transfer systems can be useful when being utilised for other programs and activities such as:

- state government management of feral animals (which may be carriers of certain disease [e.g. hydatids] or perpetrator of animal condition [e.g. wild dog bites])
- research into endemic disease (mapping and tracking prevalence; understanding costs; investigating potential risk factors)
- certifying absence of disease/condition (mapping presence and absence; tracking potential incursion; responding to market demand for disease-free status)
- specific disease surveillance/management (such as Johne’s disease).

In the future, it is recommended that surveillance projects and programs that currently utilise peri-mortem data provide funding to abattoirs in exchange for the supply of this data.

4 System component information and opportunities for increased system performance

4.1 Current performance summary

Table 38 summarises estimated system component performance and relevant information across each of the industries.

Table 38: Summary of current system component performance and related information

System component	Sheep	Goat	Pork	Beef
Inspection accuracy	90%	90%	95%	90%
Inspection information suitability	90%	90%	95%	80%
Data capture	• 10% • NSHMP: collected by third-party inspectors • EAS: collected by plant-based meat inspectors • Non-electronic capture • Captured by lot	• 0.5% • GPCP: collected by AHA inspectors • Non-electronic capture • Captured by lot	• 50% • Collected by: 1) meat inspectors 2) consultant vets • Some electronic data capture • Captured by lot	• 50% • Collected by meat inspectors • Electronic capture • Captured by individual animal id
Data analysis	• 80% • As prevalence by lot	0%	• 90% • As prevalence by lot • Prevalence by time graphed	• 50% • Mostly as prevalence by lot • Offal downgrade rate
Information transfer	• 60% • Prevalence information is posted to producer by state governments • Relevant information provided regarding disease/conditi ons	0%	• 100% • Various methods: 1) emailed to producers, 2) via PIGMON data base, 3) transfer from consultant vets to producers	• 10% • Information is sent directly from processor to livestock supplier • Often only in response to higher prevalence of disease/ condition • Often lacks suitably due to inconsistency in reporting

Adoption	25%	• Rangeland: 0% • Farmed: 25%	50%	25%

4.2 Sheep industry

4.2.1 Accuracy of inspection

As the current level of inspection accuracy is assumed to be 90%, there is little value in increasing the accuracy of the inspection apart from increasing performance in other system components. This is evidenced by an increase in net gain of 0.1% of total opportunity if only inspection accuracy and suitability of inspection are increased (from 90% to 95%). Short term mechanisms for increasing accuracy include inspector training and connecting post-mortem inspection with ante-mortem inspection[9]. Longer term mechanisms for increasing accuracy include the utilisation of technology to aid and/or undertake the inspection process with current projects trialling a range of technologies for their potential applicability (personal communication with MLA).

4.2.2 Suitability

Similar to inspection accuracy, the suitability of the inspection data is thought to be high (90%). This is because, as part of the NSHMP, the inspection data is directly connected to a specific disease/condition. There is little value in increasing the suitability apart from increasing performance in other system components.

Suitability could be increased by providing information on location (area of carcase or specific offal), timing (when was the disease/condition present or when did it begin) and severity of certain disease/conditions. Two examples of this are:

1) whether the evidence for liver fluke is suggestive of parasite in current season or historical scarring, and
2) severity of pleurisy.

Short term mechanisms for increasing suitability include inspector training, connecting to other information for the animal/herd (including ante-mortem inspection) and capture and transfer of digital images. Longer term, utilisation of technologies may increase suitability of information.

4.2.3 Data capture

Increasing data capture has the most potential of the system components for increased performance, from the current level of 10%. Increasing data capture alone, with the other components remaining at current performance, has an estimated value of $605,334 per 10% increase.

[9] The contribution of meat inspection to animal health surveillance in Sheep and Goats, European Food Safety Authority (2012)

The NSHMP is slowly transitioning to an updated model whereby inspection costs are expected to be 30-50% less. As a result, at the same level of funding there will be 2-3 times more data captured.

It is recommended that data capture be transferred from being undertaken by a NSHMP inspector to being part of the role of full time meat inspectors who are currently employed as part of day to day abattoir operations (as per the EAS). Electronic data capture is recommended (see section 4.6.1). In the short term, for supply chains and abattoirs where there is no or limited ability to be able to connect data capture to individual animal identifier, then data will be captured by lot. However, as systems become widespread for individual animal identification, it is recommended that capture of inspection data be undertaken according to individual animal identification.

It is recommended that the focus of data capture begin in export abattoirs. The reason for this is that due to current operational differences between export and domestic abattoirs (including differences in current inspection processes and requirements; plant infrastructure; product/market requirements) export plants can more easily and would presumably be more willing to transition to data capture. It appears that there would be no extra labour requirement, in export plants, to capture data by full time meat inspectors who are currently employed as part of day to day operations. However this will be dependent on chain speed and may require increased labour at higher speeds.

During the recommended transition from NSHMP to supply chain driven system, it will be vitally important for the process to be well managed to ensure that transparency and trust be maintained.

4.2.4 Data analysis

The analysis of the data that is currently undertaken is assumed to be sufficient to allow production and processing sector to realise the total opportunity for treating/managing. The analysis takes the raw inspection data (which is recorded by lot) and presents the information as a prevalence of each of the disease/conditions for that lot of animals to the producer whose property identification code matches that lot.

In the future as individual animal identification becomes increasingly wide spread it is recommended that data analysis be undertaken to report disease/condition according to individual animal id. Furthermore connection of disease/condition information with other captured data from processing (such as ante-mortem inspection, trimming and lean meat yield) is envisaged to become increasingly widespread. In a model in which processors collect the peri-mortem data (via the meat inspectors they employ through DAWR or private company), it is anticipated that this level of data analysis could become routine.

4.2.5 Information transfer

The plan for the NSHMP is to transition from having the information that is currently sent to producers by letter by state government departments (including lot, kill date, processor, disease/condition prevalence, information about the disease/conditions that were present and how to treat/manage them), to a system whereby producers access the information via LDL. Currently feedback is received between 2 weeks and 2 months (in Queensland, NSW, Victoria and SA). Being able to access the data via LDL would allow for these lag times to be reduced. Although the more rapid feedback isn't normally essential in regards to treating the disease/condition (as they are chronic disease/conditions) it would probably increase the connection the producer had between the information and their herd.

Another model of information transfer is for the information to be directly transferred from processor to livestock supplier. There is very limited information transfer that currently occurs. Current transfer consists of deductions being made for lots in which there is a significant presence of specific conditions, and photos are captured and provided as evidence. Approximately 25% of animals are currently supplied directly to processors (not through saleyards) and it is anticipated that the % of direct sales will increase in the future. Direct information transfer has the most potential for directly influencing adoption rates. However there is a risk that certain producers will view the information as hostile and subsequently disregard the information, and look to shift their future supply to another abattoir.

4.2.6 Adoption

Currently it is assumed that adoption rate is 25%.

Within the last few months, relevant information describing what each disease/condition is, how it impacts animals, and ways to manage/treat it, has been uploaded into LDL. This information is similar to that sent by state government departments to producers (as part of NSHMP/EAS). The provision of this information is deemed to be sufficiently equipping for producers to act on the majority of the information they receive. Producers are encouraged to follow up with veterinary advice and services to maximise the effectiveness of their actions.

Models for each disease/condition are currently being developed that will allow individual producers to input their information (prevalence rate, production system information, geographical and environmental information) and understand the specific cost benefit of undertaking treatment/management decisions. As part of these models, it is also envisaged that benchmarking information will be provided. It is understood that once these models are developed, they will be available for producers within LDL or as a separate web login. The provision of this type of information will increase adoption rate. Based on 'LDL 2018' scenario (4.2.7), these models would increase adoption rate by from 25% to 50%, and realise $757,076 increase in total net gain per annum (1.2% of total net gain opportunity). However, at data capture rates of 40% and 80% the value of these models (in increasing adoption from 25% to 50%) are estimated to be $3,760,681 and $7,521,362 per annum.

Further incentive for producers to adopt would be direct information from abattoirs including the actual lost value and potential to increase returns to processing (such as lost carcase weight due to trimming). Processors could embark on a two stage progression for communicating with producers who have not received this information before.

For example:

- In the first stage provision of information on pleurisy that details the $ value of loss in carcase yield and offal loss, from a specific lot, and $ value for treating/managing the herd into the future (from the models mentioned above).

- The second stage would then be to incorporate the prevalence/absence of conditions into pricing systems.

One of the keys to these systems will be for processors to provide this type of information appropriately. It is recommended that it be skilfully handled by trained liaison officers or veterinarians, and producers be very well engaged throughout the process of changing reporting and pricing. It is noted that certain producers will not be trusting or receptive of this type of information and if provided with information and/or penalties will look to send animals to another processor that does not transfer this information, or associated financial penalties/bonuses. However, it is predicted that the overall % of these producers will decrease in time.

Other mechanisms that potentially increase adoption rates include field day type activities. In regards to field days, it is recommended that these be as integrated and collaborative as possible. For example, the ability for a single processor-led field day, with their livestock suppliers, to incorporate valid and valuable input from veterinarian, state government, vaccine supplier, MLA and Livestock Biosecurity Network, has much more value than separate field days run by each party.

As more information begins to flow back to producers, it is increasingly important that information and tools be quick and easy to use by producers. Furthermore information and tools need to be reliable, trusted and show value for money for producer to take action.

Currently, ~25% of animals are sold directly to processors (not through saleyards). In the short term the suppliers of these animals, and the supply chains these animals pass through, should be the target of understanding how to maximise adoption rates. The recommendation is to work with these supply chains (producers and processors) to understand how best to develop and road test information systems and tools that maximise adoption rates and efficacious treatment/management.

4.2.7 Scenarios

In Table 39, various scenarios are contrasted with the total net gain opportunity, with reduced performance of the components to varying degrees. These general scenarios are summarised as follows:

- The ‘Current situation’ (NSHMP as it currently operates) scenario has been estimated to only realise 1% of the total opportunity.
  - Accuracy and suitability – 90%
  - Data capture – 10%
  - Data analysis – 100%
  - Information transfer - 60% (80% of information capture transferred by state departments x 75% direct lines)
  - Adoption - 25%.
- ‘Increased accuracy and suitability – training’ shows that if only the accuracy and suitability of the inspectors and their data was increased (to 95%), from the current situation (90%), through training, there would only be a $68,500 increase in the total net gain, which corresponds to 0.1% of the total opportunity.

- 'LDL 2018' is an estimation of the current NSHMP delivered via LDL, incorporating modelling tools designed to increase adoption by giving producers indicative $ value net gains of adopting treatment/management for their specific incidence information.
- '10% increase in data capture' assumes
  - data capture of 20% (increased by 10%)
  - same performance in all other system components as current situation.
- 'Incentivised supply chains – 10 years from now' scenario assumes that:
  - Accuracy and suitability of information are maximum (=100%, as a result of training, data integration and possibly technology),
  - Data capture is 80%, based on 100% of export plants (representing 80% of total animals processed) capturing all animal data
  - Information transfer is 100% transferred back to producers (based on 100% of direct lines, as a result of individual animal identification being adopted by all export supply chains)
  - Adoption increases to 50%, based on direct supply chain incentives for animal management practice adoption.

Table 39: Estimated system performance for various scenarios

System components	Current situation	Increased accuracy & suitability - training	LDL 2018	10% increase in data capture	Incentivised supply chains - 10 years from now
Accuracy of inspection	90%	95%	90%	90%	100%
Suitability	90%	95%	90%	90%	100%
Data capture	10%	10%	10%	20%	80%
Data analysis	80%	100%	100%	80%	100%
Information transfer	60%	60%	76%	60%	100%
Adoption	25%	25%	40%	25%	50%
Total net gain - $/year	605,334	843,076	1,533,512	1,210,667	24,910,844
% of total opportunity	1.0%	1.4%	2.5%	1.9%	40.0%

4.3 Goat industry

In general the commentary for the sheep industry is relevant to the goat industry. As the system components develop in the sheep industry it is expected that similar progress will be transitioned across to the goat industry. One of the key reasons for this is that all export goat abattoirs also process sheep.

The data from the GPCP has been obtained opportunistically through NSHMP inspectors who were on duty and inspected goats between sheep lines. The goat industry is aware that funding will be required for inspection to continue. No data analysis or information transfer has been undertaken as yet. The estimated inspection cost for the GPCP, based on the new funding model for NSHMP inspection, is $0.15/head.

4.4 Pork industry

4.4.1 Accuracy of inspection

In shifting the inspection from a role undertaken by a combination of third party inspectors, meat inspectors and consultant vets, there is an expectation that the accuracy of inspection would decrease. However, with training for meat inspectors it is expected that the level of accuracy would be high (90%). At this current level of inspection accuracy, there is little value in increasing the accuracy of the inspection if the performance in other system components are much lower.

Short term mechanisms for increasing accuracy include inspector training and connecting post-mortem inspection with ante-mortem inspection. Longer term mechanisms for increasing accuracy include the utilisation of technology to aid and/or undertake the inspection process.

4.4.2 Suitability

Similar to inspection accuracy, the suitability of the inspection data would be lower when moving from vet inspection to being the sole responsibility of meat inspectors. However, as with accuracy, the suitability is expected to be high (90%) once training is provided. As a legacy of the Pig Health Monitoring Scheme, inspection data is directly connected to a specific disease/condition. There is little value in increasing the suitability apart from increasing performance in other system components.

Suitability could be increased by providing information on location (area of carcase or specific offal where disease/condition was located), timing (when was the disease/condition present or when did it begin) and severity of certain disease/conditions. A key example is providing information on the location and severity of pleurisy. Short term mechanisms for increasing suitability include inspector training and connecting to other information for the animal/herd (including ante-mortem inspection). Longer term, utilisation of technologies may increase suitability of information.

4.4.3 Data capture

The results of APL 2015-2209 indicate that there is a significant opportunity to become more systematic with data capture as part of the inspection process. It is recommended that data be captured electronically. In abattoirs where there are no touch screens currently, it is recommended that touch screens by installed (see further details in 4.6.1).

Increasing data capture alone, with the other components remaining at current performance, has an estimated value of $493,641 per 10% increase in data captured.

Although not crucial in terms of the way herd health is managed, as individual animal identification systems are established it is recommended that data be captured according to this id. The two major reasons for this are:

1. ability to satisfy future traceability and market information requirements
2. ability to connect to other animal information (genetics, production information, meat quality).

It is recommended that the focus of data capture begin in export abattoirs. As with sheep, it appears that there would be no extra labour requirement, in export abattoirs, to capture data by full time meat inspectors. However this will be dependent on chain speed and may require increased labour at higher speeds.

4.4.4 Data analysis

Data analysis for a pig herd generally only requires prevalence information to be able to inform appropriate treatment/management decisions. However, increasing the level of information to include severity and location information (particularly for conditions such as pleurisy and arthritis) would help maximise the efficacy of treatment/management.

In the future as individual animal identification becomes increasingly wide spread it is recommended that data analysis be undertaken to report disease/condition according to individual animal id. Furthermore connection of disease/condition information with other captured data from processing (such as ante-mortem inspection, trimming and lean meat yield) is envisaged to become increasingly widespread. In a model in which abattoirs collect the peri-mortem data (via the meat inspectors they employ through DAWR or private company), it is anticipated that this level of data analysis could become routine.

4.4.5 Information transfer

The generally well-integrated, collaborative and direct supply nature of the pork industry make direct transfer of the majority of the information much more straight forward than in the sheep or beef industries. It is thus envisaged that direct transfer of information from processor to producer could occur for a very high percentage of the industry. Whether another system (e.g. LDL-like) is required to transfer information is unclear.

4.4.6 Adoption

The base line adoption rate will be higher in the pork industry than the extensive sheep or beef industries.

Models have been previously developed and utilised, in the pork industry, to calculate ROI for treating/managing specific disease/conditions. There is scope for new models to be developed to cover the peri-mortem disease/conditions. However, it is important to note that for the common diseases (which are mostly not part of peri-mortem information), vets will have a medication program in place, which will also control most of the peri-mortem conditions. Vets will be unlikely to implement a control program for a condition that affects 1% of the kill unless it is recognised as a serious disease.

4.5 Beef industry

4.5.1 Accuracy of inspection

Although there is little data to accurately grade current inspection accuracy in Australian beef abattoirs, for the proposed list of conditions, the accuracy is assumed to be high (90%) based on the relatively routine nature of the list of disease/conditions and assumed accuracy rates for the other species. Connection with ante-mortem inspection information, training, and, in time, the use of technology will all increase accuracy. However, as discussed with the other species, training should not be the focus of programs/projects to develop peri-mortem information transfer systems, but rather a small part of the overall program. Increasing accuracy from 90 to 100%, and not changing the other system components, would only realise 0.1% more of the total opportunity.

One approach for maximising vet and producer engagement and trust of the data, would be to run trials that determine accuracy at abattoirs, publicise this information, and then undertake particular training if required.

The slower chain speed of beef processing provides inspectors with more time per carcase/offal than in sheep or pork abattoirs.

4.5.2 Suitability (usability)

In general the suitability (and usability) of the inspection data, for the particular disease/conditions, is thought to be high (80%). However, consistency of how the data is recorded and reported is important. Specific feedback received from feedlots, production companies and both feedlot and extensive vets is that the level of suitability of the information is often low and nullifies the value of receiving the information. The lack of standardisation and high variability in the way information is transferred and reported from different abattoirs has been identified as a major issue that needs to be addressed.

4.5.3 Data capture

This is a system component where the beef industry is generally much better set up than sheep or pork. Many abattoirs capture data via touch screens according to individual animal identifier. This data capture has focussed on offal but should be increased to include conditions on the carcase (such as abscess, bruising, pleurisy, scarring). This would require touch screen capability at the retain rail. Capturing images of certain disease/conditions (such as adhesions) would aid vets/producers in their ability to suitably treat/manage in response to the peri-mortem information.

It is important to standardise the fields for the list of disease/conditions to make data capture and reporting uniform across the industry. The proposed system would include:

- disease/condition name (with standardised nomenclature and associated description)
- location of disease/condition on animal (multiple fields should be available for relevant disease/conditions)
- severity score or grading of disease/condition
- action taken (e.g. trimming, downgrading of offal)
- ability to capture and attach images to inspection records (particularly relevant for conditions such as adhesions).

As with sheep and pork, it is also recommended that ante-mortem inspection data be captured electronically and connected with the post-mortem inspection data.

The development of standardised reporting of disease/conditions will presumably be undertaken in conjunction with the current project, *Australian National Standard for Animal Health Data*.

4.5.4 Data analysis

Most of the current data analysis is undertaken by processors to determine their offal downgrade/condemn rates. For processors sending back information to livestock suppliers, analysis usually only consists of calculation of prevalence rates. However certain supply chains (both production companies and processors) have specific projects that are increasing the scope of data analysis to provide more meaningful information to the supply chain. There is also interest in better understanding the relationship between meat quality and animal health. The feedlot sector is particularly interested in the ability to include peri-mortem (and ante-mortem) information in the relatively complex data analysis systems currently used to monitor individual animal performance and health.

4.5.5 Information transfer

Most of the current peri-mortem information is solely retained by processors or only transferred when there is a significant increase in disease/condition incidence (either from processor with the view to reducing offal losses, or on request from feedlot/producer to determine what a specific problem is). However, information transfer is expected to rapidly increase over the next 18 months. Since many processors already electronically capture and analyse data, the transfer of information is not a difficult process to set up and undertake. Furthermore, several supply chains are undertaking projects to make direct peri-mortem information transfer and utilisation a routine process, within the next 6-12 months. As with the sheep industry, LDL is a potential mechanism of information transfer. This mechanism is of interest to some processors and of no interest to others (who only want to send information direct to their livestock producers).

It is thought that certain processors may be motivated to provide and increase information transfer, including provision of animal health liaison officer support, to ensuring livestock supply.

An important consideration for transfer of information to many feedlots, is the interest and ability of feedlots to handle and integrate peri-mortem information into their own systems that monitor live animal performance and health. Thus, transferring data in suitable formats that allow for easy integration into these data analysis systems would make for high utilisation of information by many feedlots.

As mentioned earlier, consistency of description of disease/condition (including location, severity, action), across abattoirs, is recommended. However, it is also recommended that a level of customisation of the information be provided. The size and type of the production operation, the ability to analyse and integrate information, nature of supply to processor (direct or indirect), and the connectedness to vets and nutritionists are expected to have the most impact on the level and type of information required. Four scenarios are presented in Table 40 that broadly summarise this.

Table 40: Expected requirements for peri-mortem information for different livestock suppliers

Livestock supplier	Prevalence	Individual animal information	Disease/condition information	Indication of $-value of treating/managing disease/condition	Information transfer
1) Extensive producer with small herd	yes	probably not	yes	yes	indirect/direct
2) Extensive producer with medium herd	yes	maybe	probably	yes	indirect/direct
3) Production company who process via service kill	yes	probably	no	no	direct
4) Large feedlot with vets and nutritionists who monitor animal performance and health	yes	yes	no	no	direct

4.5.6 Adoption

Relative adoption rates will also differ according to production size and type (Table 40). The level of adoption for feedlots extends to the way they influence other members of the supply chain. Examples of this include:

- Requesting for drenching for liver fluke, from livestock suppliers, and then checking on liver fluke incidence from peri-mortem information, and taking follow up action as required.
- Identifying patterns in high incidence of bruising and working with improving management of this both in the feedlot and in transportation.

A consistent system of reporting, yet a tailored approach to information provision and transfer is expected to maximise adoption rates. This is because too much information will disengage and potentially confuse individual producers with a small herd (and thus lower adoption rate), but individual animal information will be sought after by feedlots who will incorporate information into their data systems (and hence feedlots will be seeking suitable format that can be easily brought into their software).

For small to medium extensive producers, the provision of similar information and modelling tools, to those established and being developed for the NSHMP, will be crucial to raising adoption rates. It is anticipated that these tools (as long as they are suitably easy to use and rolled out to producers appropriately) would increase adoption rates from 25% to 40%.

4.5.7 Scenarios

A range of scenarios have been considered for the beef industry. It is estimated that only 0.45% of the total opportunity is currently being realised. However, it is also predicted that this could quickly increase to over 10% within the next 12-18 months. The reason for this is that much of the data (50%) is currently captured by processors and the systems to deliver this information back to producers are being set up by both supply chains and potentially within LDL.

- ‘Increased information transfer’ assumes that:
    - All abattoirs who currently capture data, begin to also analyse and transfer all information
    - Adoption rates are increased through provision of abattoir incentives, disease/condition treatment/management information, ROI calculator tools, and animal health liaison officers.
- ‘2019’ assumes that:
    - all export plants capture data and the information is transferred back to livestock suppliers (via direct information transfer or LDL)
    - information suitability is increased
    - there are suitable tools (information and ROI models for treatment/management) and pricing incentives to have adoption rates of 50%.

Table 41: Estimated system performance for various scenarios

	Total gain opportunity	Current situation	Increased information transfer	2019
Accuracy of inspection	100%	90%	90%	90%
Suitability	100%	80%	80%	90%
Data capture	100%	50%	50%	80%
Data analysis	100%	50%	100%	100%
Information transfer	100%	10%	50%	80%
Adoption	100%	25%	50%	50%
Total gain - $/year	8,516,968	38,326	766,527	2,207,598
% of total opportunity	100%	0.45%	9.00%	25.92%

4.6 Further consideration of system components and information context

4.6.1 Data capture and information transfer systems

For processing plants that do not have existing infrastructure to capture inspection data electronically it is suggested that mobile tough, touch screens are the best solution. Indicative set up and operating costs (per processing plant) are provided in Table 42 below. The costs and interests, in regards to data capture and information transfer, of abattoirs will vary widely. Examples of this include:

- Certain abattoirs are fully set up and operating whereas some abattoirs have no systems in place.
- Certain abattoirs will only want to have their own database whereas others would be interested in utilising a common, industry-wide database solution.
- Certain abattoirs will be employing specific animal health liaison officers to facilitate engagement and information transfer with their livestock suppliers.

For processing companies who have multiple sites and/or process multiple species there will obviously be faster pay back on certain system elements, which can be utilised across sites/species.

Table 42: Indicative set up and operating costs for data capture

Item	Cost ($)
3 x tough pads	15,000
software	20,000
system support (per annum)	15,000
database set-up	25,000
database maintenance (per annum)	10,000

4.6.2 Livestock Data Link

MLA is planning for LDL to be a mechanism for transferring NSHMP information to producers. Discussions are also underway with sheep and beef processors regarding their interest in uploading peri-mortem information into LDL. However, prior to embarking on trying to make LDL a major delivery mechanism for peri-mortem information, it is important to consider the following questions, statements and recommendations:

1) Is it better to support and co-fund direct supply chain-driven information transfer? In the short term, the answer appears to be yes.
2) In the sheep industry, adoption rates of LDL usage are incredibly low with producers. If LDL is to be a viable information transfer mechanism, suitable strategies need to be developed, funded and implemented to engage, convince and enable producers to utilise LDL.
3) In the beef industry, it is recommended that no work continue regarding animal health information via LDL until the outcomes of current projects being undertaken by Company 1 Australia and Company 2, have been reviewed, and consistent disease/condition reporting has been established. Rushing to get LDL up and going, without proper consideration will result in the loss of confidence of the production sector, and make any subsequent engagement attempts very difficult. Furthermore, it will be money and time miss-spent, when other specific supply chain projects should be co-funded.
4) In the beef industry, the target audience of the information, and their needs and requirements, needs to be determined. It is envisaged that small(er) extensive producers would be the main target of LDL. If this is the case, it is important to suitably tailor systems, communication strategy and extension programs.
5) Commitment of adequate resources is essential, in both short and longer term, to ensure that LDL is upgraded and maintained to consistently operate at a suitable level for users.

4.6.3 Information context – consideration of other disease/conditions and production factors

It is important to note that many of the most prevalent and economically costly disease/conditions (particularly for pork and beef) would not be part of a peri-mortem information transfer system. This is because these other disease/conditions 1) result in animals not reaching abattoir (mortality or culled in production); 2) can be routinely diagnosed in production systems; 3) there are no indicators to identify in peri-mortem inspection.

Furthermore, there are many other production factors that impact the profitability of a producer. In light of this, it is very important that peri-mortem information be as integrated as possible with other disease/condition management and general production programs. It is expected that in the pork and beef feedlot industries, the close connection with vets in managing animal health will mean that information will be able to be handled appropriately and in context. However, in the extensive sheep, goat and beef industries, where many producers are not well connected with a vet, tools that place peri-mortem information in context of the total production system would be very helpful. In this way, the information becomes more relevant to an individual producer.

5 Current and potential examples

In this chapter a few specific examples of current and potential operations within specific supply chains are discussed. The aim of this is to make the concept of specific supply chain driven peri-mortem systems tangible. For each example the system component diagram is shown with the specific foci or requirements and expected synergies.

5.1 Current projects

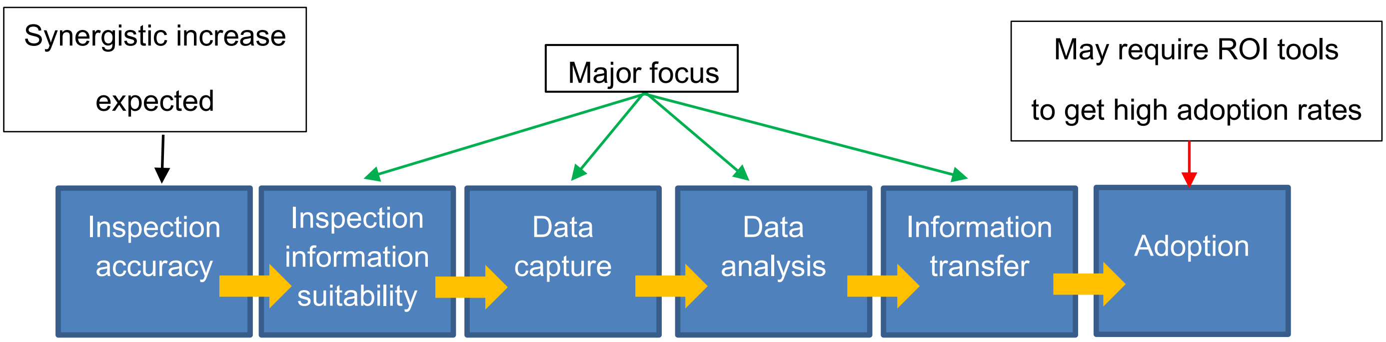
5.1.1 Beef abattoir

Company 1 are currently in the process of developing systems to capture data and transfer information to their livestock suppliers. They are setting up electronic data capture systems and are presumably going to be supplying peri-mortem information via their current information transfer systems. It is understood that they do not want to transfer information to their suppliers via LDL. It is also presumed that they will include animal health liaison officer roles as part of the overall communication strategy, operational transfer and client engagement.

The motivations behind Company 1's decision to invest in this are thought to include:

- Realization that they were behind their competitors (other beef abattoirs) in regards to data capture and potential to supply this information to their livestock suppliers.
- Ability to leverage peri-mortem information supply as a tool for ensuring suitable livestock supply.
- Increased offal and carcase yields as a result of livestock suppliers improving disease/condition treatment/management.
- Ability to satisfy potential future market requirements for auditable peri-mortem inspection information.
- Longer term potential benefits related to enhanced meat quality from healthier animals.

Although the system appears to have significant merit, one potential gap may be in the ability to provide producers with ROI investment of why they should treat/manage particular disease/conditions. Perhaps Company 1 will manage this by utilising vets who can develop suitable tools that provide this information for each livestock supplier.



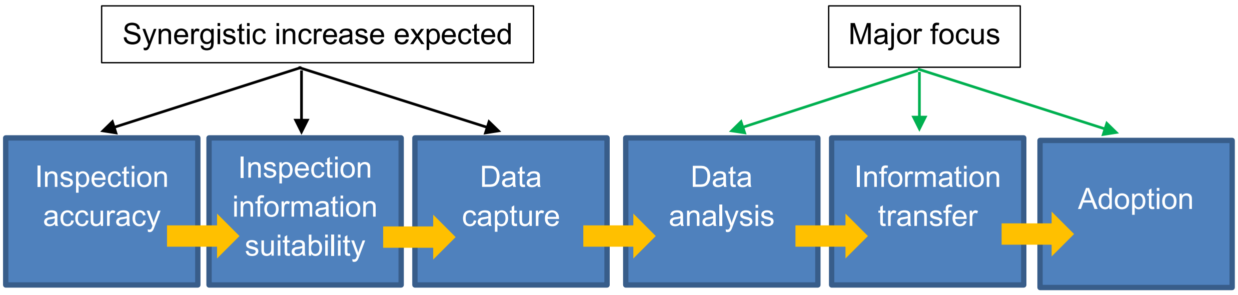
5.1.2 Extensive beef production company

Company 2 are currently undertaking a project which aims to utilise peri-mortem data for their livestock producers. In broad terms the system aspects are as follows:

- Pulling individual animal data from service kill abattoir (the abattoir capture data electronically and send data to Company 2)
- Data is analysed and converted to information by consultant vet
- Information is transferred to producers by consultant vet
- Information is utilised by producers in consultation with vet.

The motivations behind Company 2's decision to invest in this are thought to include:

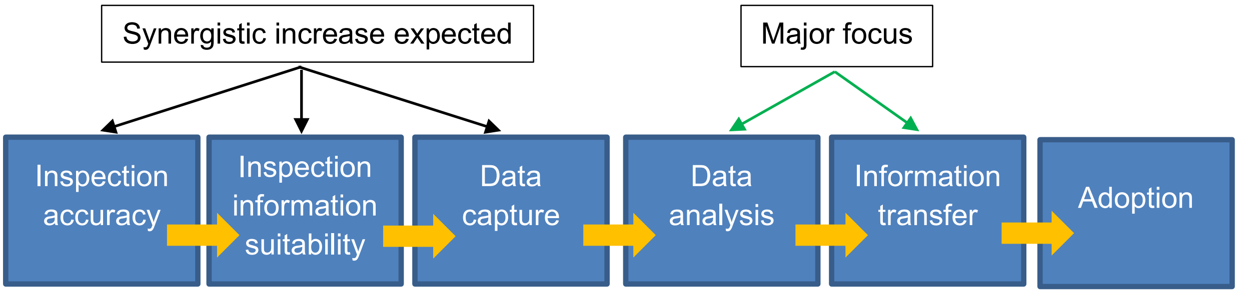
- Increased yields at processing
- Reduction of costs of disease/conditions in production
- Ability to validate overall high standard of animal welfare
- Further information that allows for defendable messaging concerning sustainable production.



5.2 Potential

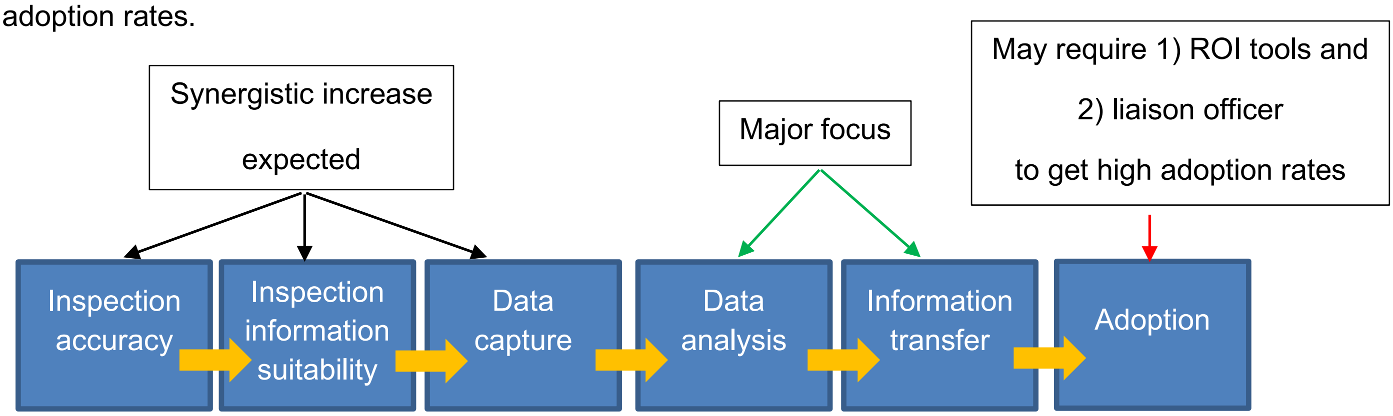
5.2.1 Beef abattoir - 1

Company 3 is a beef abattoir that exclusively processes feedlot animals, with the vast majority of animals being supplied from feedlots. They have all system components in place and information transfer and utilisation does occur (sporadically). It appears that only a short project would be necessary to increase information transfer and utilisation. The project could be a feedlot vet working with the relevant Company 3 staff to ensure data format and transfer is optimal, and then introduce systematic integration of the data into the feedlot live animal performance and health data analytics systems.



5.2.2 Beef abattoir - 2

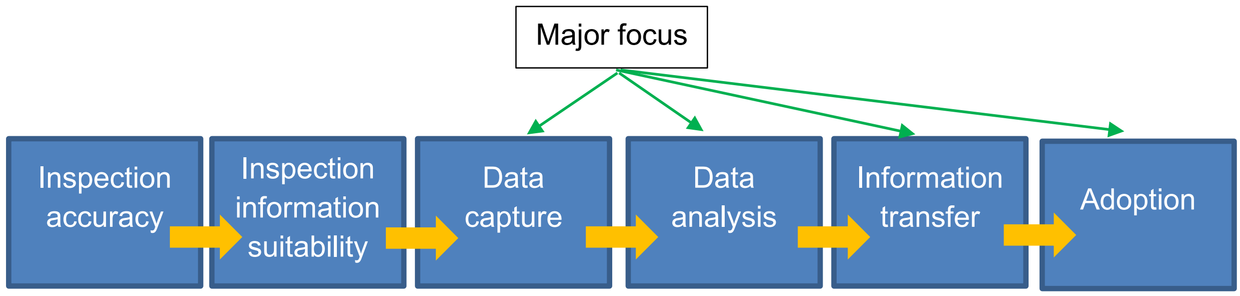
Company 4 abattoirs routinely capture peri-mortem data electronically. In discussions with MLA they have shown an interest in supplying this information back to their livestock suppliers. They are open to the principle of transferring this information via LDL. The largest requirements for this specific system to realise value are provision of information that enables animal health management decisions. Similar to the example of Company 1 (5.1.1) the utilisation of 1) ROI calculation tools and 2) animal health liaison officer, would increase adoption rates.



5.2.3 Sheep abattoir – 1

Company 5 has interest in providing peri-mortem information to their livestock suppliers, particularly producers who are part of their farm assurance program. The initial steps in setting up and operating a system are outlined as follows:

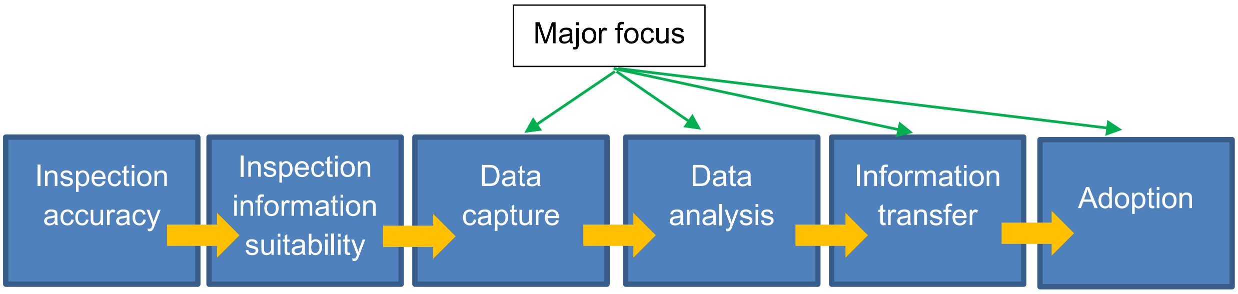
1. Adopt and install similar data capture systems to their beef abattoirs
2. Have meat inspectors capture data
3. Utilize current information transfer systems, and integrate with information and decision support tools (ROI calculator) from NSHMP/MLA, to send peri-mortem information back to producers
4. Incorporate animal health liaison officer role into system to manage communication and engagement with suppliers, and support information transfer and utilization
5. Understand requirements to supply information to producers who can't receive via current systems. Determine best mechanisms for supplying information to these producers.



5.2.4 Sheep abattoir – 2

Company 6 currently collect and transfer peri-mortem information back to their suppliers, in an ad-hoc fashion, when there is a high incidence of specific conditions. Company 6 have expressed interest in transferring information via LDL. The initial steps in setting up and operating a system are outlined as follows:

1. Adopt and install electronic data capture systems
2. Have meat inspectors capture data
3. Utilize current information transfer systems, and integrate with information and decision support tools (ROI calculator) from NSHMP/MLA, to routinely send peri-mortem information back to producers
4. Incorporate animal health liaison officer role into system to manage communication and engagement with suppliers, and support information transfer and utilization
5. Understand requirements to supply information to producers who can't receive via current systems. Determine best mechanisms for supplying information to these producers.



6 Recommendations and associated projects

Specific recommendations have been developed for each industry and are presented with details concerning how activities could be undertaken as industry-specific projects. There is significant overlap in the type of projects between industries, however it is recommended that most projects need to be undertaken within specific supply chains. This is due to:

- All system components need to be suitably operative within a supply chain for value to be realised (Figure 4).
- In specific supply chain systems there will be synergistic increases in all system components.

The projects and activities presented for each industry are viewed as the first phase from 2017-2019. From 2020 onwards it is anticipated there will be further work that either continues on in the supply chains involved in the first phase and/or involves new supply chains.

6.1 Sheep industry

The recommended approach for the sheep industry is to transition to a more supply chain driven model. The key changes to the existing framework would include:

- Inspection and electronic data capture being undertaken exclusively by fulltime meat inspectors who are part of the chain in processing plants
- Information transfer occurring by a combination of direct information transfer, from processors to producers, and potentially by indirect transfer via Livestock Data Link
- Increased direct supply chain incentives to treat/manage disease/condition to maximise returns for both producers and processors
- Utilisation of models by both producers and processors, which are currently being developed, to provide cost benefit analysis of treating/managing each disease/condition based on individual producer's information
- Transition to collecting peri-mortem data by individual animal identifier and connecting with other information such as ante-mortem inspection data.

In the first phase of transition, it is recommended that specific export abattoirs (2-4) be approached to determine their interest in installing and using electronic data capture systems, and undertaking data capture by meat inspectors. The best candidates are characterised by:

- high throughput
- have private company meat inspectors
- individual animal identification system
- already participate in ad hoc capture and transfer of peri-mortem information
- high % of animals directly supplied (not through saleyards)
- have current supply chain initiatives
- have been involved in discussion regarding potential utilisation of LDL for animal health information.

It is recommended that MLA, and potentially AMPC, funding (total funding pool of $200-400K; $100K per project) be used to co-fund, together with abattoir funds, an initial limited number of projects (2-4) that entail:

1. Establishment of routine inspection by abattoir meat inspectors.
2. Adaption of data capture systems from Australian pork/beef industries or New Zealand sheep industry.
3. Utilisation of current information transfer systems and, as required, establishment of new systems.
4. Roll out (including training and support) of disease/condition ROI models within each supply chain.
5. Potential salary cover of nominated animal health liaison officer.
6. Associated communication and change management strategy for each supply chain.

A broad outline of potential activities is described as follows:

6.1.1 Inspection

Aim	Establish inspection as part of role of plant-based inspectors.
Timing	2017-2018
Detail	• Transfer relevant learnings and training from NSHMP and EAS. • Establish routine inspection in these abattoirs.

6.1.2 Data capture

Aim	1) To set up and utilise electronic systems for data capture 2) To capture data by individual animal identifier
Timing	2017-2019
Detail	• Adopt software and hardware systems (from Australian beef or pork industry, or from NZ sheep industry) to specific abattoir requirements. • Test and refine systems. • Begin using systems for routine data capture. • Integrate with individual animal identification system where possible.

6.1.3 Information transfer

Aim	To include peri-mortem information in current information transfer
Timing	2017-2019
Detail	• Adapt current information transfer to include peri-mortem information. • Suitably combine with information tools developed in NSHMP. • Integrate with disease/condition ROI models (being developed). • Develop and integrate animal health liaison officer role into information transfer and relationship with producers.

6.1.4 Communication strategy

Aim	To suitably engage, educate, inform and enable producers
Timing	2017-2019

Detail	• Provide regular communication to producers on future changes to information transfer. • Provide training for using information and tools (e.g. ROI models). • Engage with producers via animal health liaison officer to provide ongoing support for understanding and utilising information and tools (e.g. ROI models).

The biggest barrier to increase supply chain value, is the capture of data. Activities 6.1.1 and 6.1.2 will remove this barrier and are expected to have the most significant direct capital and salary cost for abattoirs. Based on current performance of the other system components, an increase in 10% of data captured is estimated to be worth $764,000/annum. Incorporation of peri-mortem information into current transfer systems, together with associated tools and communication strategy are thought to require much smaller abattoir investment, due to what has been established as part of the NSHMP (disease/condition information) and what is being established through MLA (ROI models).

6.2 Goat industry

The recommendations for the sheep industry are relevant for the goat industry. Due to the goat industry being less than 10% of the size of the sheep industry, not having the history of the NSHMP/EAS, and 90% of the industry being rangeland animals, the scope and speed of uptake is expected to be much smaller and less rapid. The key recommendation would be to:

- Include the goat industry in the proposed projects for the sheep industry by including one suitable abattoir that processes both sheep and goats.

6.3 Pork industry

The key opportunities for the pork industry in the context of peri-mortem capture and transfer systems are as follows:

- Engage with veterinarians and abattoirs to develop suitable frameworks that support increased information utilisation rather than creating competition in regards to post-mortem inspection data (this is most relevant in NSW and Victoria)
- Transition to inspection and electronic data capture being undertaken exclusively by fulltime meat inspectors who are part of the chain in processing plants
- Increased direct supply chain incentives to treat/manage disease/condition to maximise returns for both producers and processors
- Determine production costs of relevant disease/conditions, to better understand net benefit of treating/managing each disease/condition
- Transition to collecting peri-mortem data by individual animal identifier and connecting with other information such as ante-mortem inspection data.

It is recommended that the six export abattoirs who don't have electronic data capture systems be approached to determine their interest in installing and using electronic data capture, and transfer to data capture by meat inspectors. It is recommended that APL funding be used to co-fund, together with abattoir funds, projects that entail:

1. Adaption of data capture systems from Australian pork/beef industries.
2. Utilisation of current information transfer systems for peri-mortem information.
3. Engagement with production vets.
4. Associated communication and change management strategy for each supply chain.

A broad outline of potential activities is described as follows:

6.3.1 Inspection

Aim	Establish inspection as part of role of plant-based inspectors.
Timing	2017-2018
Detail	• Transfer relevant learnings and training from PHMS. • Establish routine inspection in these abattoirs.

6.3.2 Data capture

Aim	1) To set up and utilise electronic systems for data capture 2) To investigate the potential for capturing data by individual animal id
Timing	2017-2019
Detail	• Adopt software and hardware systems (from Australian beef or pork industry) to specific abattoir requirements. • Test and refine systems. • Begin using systems for routine data capture. • Integrate with individual animal identification system where possible. • Undertake scoping for requirement and framework for collection of data by individual animal identifier.

6.3.3 Veterinarian, producer and abattoir engagement

Aim	Successfully manage change by suitably engaging vets, producers and abattoirs.
Timing	2017
Detail	• Workshop with vets, producers and abattoirs to develop frameworks and plan for establishing suitable systems, which transition from current practice. • Determine production costs for relevant disease/conditions and net benefit of treatment/management. • Continue ongoing communication within each supply chain.

Similar to the sheep and goat industry, the biggest barrier to increase supply chain value is the capture of data. Activities 6.3.1 and 0 will remove this barrier and are expected to have the most significant direct capital and salary cost for abattoirs. Based on current performance of the other system components, an increase in 10% of data captured is estimated to be worth $823,000/annum. Incorporation of peri-mortem information into current transfer systems, together with engagement and communication strategy are thought to require much smaller abattoir investment, due to highly integrated and collaborative connection with the production sector.

6.4 Beef industry

Peri-mortem capture and transfer systems in the beef industry are being supply chain driven. Thus, it is expected that there will be relatively rapid increases in the realisation of the total opportunity. Key dimensions of the system in the beef industry include:

- Development and use of consistent reporting across the industry, in regards to disease/condition 1) name/terminology/description, 2) location on animal (carcase and/or specific offal), 3) severity (where appropriate), 4) action (e.g. trim carcase; liver downgrade to pet food) and 5) photographic record (for conditions such as adhesions).
- Information transfer occurring by a combination of direct supply chain information transfer, from processors to producers and feedlots, and potentially by indirect transfer via LDL-type mechanism (if required).
- Tailored detail of information provided to different livestock suppliers/producers.
- Abattoirs employing staff who have a specific role as an animal health liaison officer, to help communicate and manage the relationship with livestock suppliers/producers. Production companies (feedlots and extensive) employing consultant vets to engage directly with abattoirs to request and manage information requirements.
- Increased direct supply chain incentives to treat/manage disease/condition to maximise returns for both producers and processors.
- Determine production costs of relevant disease/conditions, to better understand net benefit of treating/managing each disease/condition.
- Development of models, for utilisation by producers (similar to that being currently developed for sheep), to provide cost benefit analysis of treating/managing each disease/condition based on individual producer information.
- Connecting peri-mortem information with other information such as ante-mortem inspection data (at processing) and with other genetics, performance and live health data (particularly in the feedlot industry).

In the first phase, it is recommended that the beef abattoirs who currently capture data electronically be approached, and the following projects be articulated and then undertaken with willing participants in the order presented.

1. Standardisation of disease/condition reporting, including set up and utilisation of image capture system.

Beef abattoirs, together with feedlots who supply these abattoirs:

2. Development of systems and tools for tailored provision and transfer of information to feed lot sector.

Beef abattoirs, together with extensive producers who supply these abattoirs:

3. Development of systems and tools for tailored provision and transfer of information to extensive production sector.
4. Development and roll out (including training and support) of disease/condition ROI models within each supply chain.

It is recommended that MLA, and potentially AMPC and/or ALFA, co-fund each project, together with abattoir funds.

A broad outline of potential activities is described as follows:

6.4.1 Standardisation of reporting

Aim	Develop and implement framework and systems for consistent reporting
Timing	2017-2018
Detail	• Engage with beef abattoirs who currently have data capture systems to determine their interest in being involved in standardised reporting. • Engage with feedlot and extensive vets, and production companies to road test proposed reporting. • Implement standards being developed under Australian National Standard for Animal Health Data. • It is proposed that this reporting will include 5 data fields, o Name o Location on animal o Severity o Action taken o Photo.

6.4.2 Development of tailored information and transfer systems

Aim	Work with supply chains to develop suitably tailored information and transfer systems for different livestock suppliers
Timing	2017-2019
Detail	• Undertake projects that consider the information/data needs, requirements and wants of different production sectors o Feedlot o Large extensive production company o Small extensive producer • Key consideration includes the ability of data to be easily integrated into other systems that allow for connection to genetic and live animal information. • Develop and integrate animal health liaison officer role into information transfer and relationship with producers. • Develop and integrate veterinary consultant role (for feedlots, medium to large production companies) for information pull from processor.

6.4.3 Determination of disease/condition costs and development of ROI models

Aim	1) Determine costs of diseases 2) Develop and implement ROI models for extensive producers
Timing	2017-2019
Detail	• Undertake trials to determine costs of disease/conditions for which there is no data. • Develop models (similar to that being developed for sheep industry) and roll out in in specific supply chains with associated training and communication program.

The biggest barrier to increase supply chain value in the beef industry is the transfer of suitable information. It is envisioned that these project activities will remove this barrier, whilst also increasing adoption rate. Based on current performance, there is a potential 20-fold increase in the value realised, if data that is currently captured is transferred as suitable information (data analysis, information transfer and adoption rates all increase). As relevant, the feedlot sector has been recommended to be involved in projects prior to the extensive sector due to:

- Feedlots already receive some peri-mortem information, are familiar with handling and integrating data, there is some vertical integration, and have direct connection with vets and nutritionists.
- It is envisaged that problems could be more easily ironed out in trials with the feedlot sector and make transition to the extensive sector (less used to receiving and utilising peri-mortem information) much easier.

6.5 Cross-industry project

Separate to the supply chain specific projects, the recommended priority for a cross-industry (including each of the four species) project is:

Integration with DAWR reporting and jurisdiction

Industries	sheep, goat, pork, beef
Aims	1) Better utilise DAWR full condemnation reporting 2) Capture and utilise ante-mortem inspection information
Timing	2017-2019
Detail	• Develop framework for discussion with DAWR. • Present and discuss with DAWR. • Develop and undertake trial with DAWR to capture and utilise both full carcase condemnation information and ante-mortem inspection information, via peri-mortem system.

This is based on:

- Current loss from full carcase condemnations in export abattoirs is $29.6 million/annum.
- There is an expectation that auditable ante-mortem and peri-mortem information will become a future market requirement.

7 Appendix

7.1 List of Tables

7.2 List of Figures