final report

Developing RD&E priorities and investment plan for increasing compliance to specification including information flow in southern beef systems

Abstract

A research, development and extension plan for increasing compliance to specifications in southern beef systems was prepared. The development of the plan followed extensive consultation with producers, processors, consultants, R,D&E agencies and other industry personnel. The Plan foresees an indicative RD&E investment of approximately $6.8 million over four years across four key outcome areas: Understand the benefits of increased compliance; More accurate measures / predictions; Better decision tools for buying & selling animals; and Enhanced understanding & information flows. An economic evaluation estimates a benefit/cost ratio from the R,D&E described of almost 6.18:1 (over 30 years, using a 7% discount rate) with a net present value of $28.30 million.

Notes on the R,D&E Plan
The Plan includes the:
- Rationale;
- Situational analysis ;
- Vision & gap analysis;
- The RD&E plan;
- Economic evaluation;
- Alignment with other plans & priorities; and
- Appendices including a Bibliography.

The Plan was developed over a period of six months under the guidance of a Project Development Team (PDT) comprising representatives of the Red Meat Co-investment Partners. The membership of the group included:

- Alex Ball, MLA (Chair);
- Richard Apps, MLA;
- Hayley Robinson (WADA)
- Hugh Griffiths (Tas DPIPWE)
- Tim Hollier (Vic DPI)
- Michael Beer (NSW DPI)
- Wayne Pitchford (Adel Uni)
- Jen Jeffrey (Producer)

The PDT met twice in person, at the start of the project and again in Sydney on 26 March, 2012 as well as teleconferences. Numerous iterations of the Plan were circulated during the course of the project and on each occasion refinements / alterations to the plan were made.

A summary of the penultimate version of the plan was also presented to and discussed with the Southern Australian Meat Research Council (SAMRC) at its meeting of 28 March, 2012. The feedback on the Plan appeared to be positive.

In preparing the Plan, widespread consultation with industry was undertaken. Cooperation with the research team was excellent. However, as has been experienced in the preparation of other similar plans, potential investing agencies of the Red Meat Co-investment Committee (RMCiC) and industry organisations are reluctant to quantify their specific financial and other resource commitments to a program of work until that program has been specified in detail and the

willingness of other parties (notably MLA, AMPC and ALFA) to invest has been clarified.

For this reason, the budget put forward in this Plan should be seen as indicative only of the amount of funding required for the work recommended.

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Executive summary

Background to the Report

Meeting consumer expectations of meat quality is critical to developing the beef industry. Maximising compliance to consumers' preferred specifications depends on all sectors in the beef supply/value chain trying to meet the preferred requirements of each purchaser.

The aim of this report is to propose a national investment plan to increase compliance to specifications in the southern beef industry for at least the period from 2012 to 2015. This plan has been prepared for consideration by the Red Meat Co-investment Committee (RMCiC).

The overall outcome sought is to establish priorities and industry deliverables that will contribute to an increase in information flow and use of management tools that delivers an improvement in the compliance benchmark of no less than 5% over the next 5 years compared to levels benchmarked in 2010/11.

This plan presents a staged RD&E strategy to further increase compliance, especially in relation to weight, fat cover and meat quality characteristics of marbling, pH and maturity. It provides a balance of research, development and extension.

Some observations on compliance

A review of the literature combined with significant industry consultation suggests:

- Decades of RD&E investment means that much is known about the characteristics that are important to beef consumers and what factors influence those characteristics. The Australian industry is extremely well placed in that regard.
- Some studies have sought to quantify the level of non-compliance and the resultant financial impact, but these are limited.
- There are a large number of measurement and prediction systems, and knowledge to support these, either available or under development to assist supply/value chain participants improve compliance. However, many of these systems are still under development or have not yet been widely adopted.
- The penalties for non-compliance are generally not onerous for the common specifications, weight and fat, and other commercial imperatives must also be taken into account when making decisions to sell or buy animals.
- The structure of the production industry *viz.* a large number of small players, does not readily lend itself to an efficient supply/value chain.
- Some members of the Australian beef industry are happy to operate largely as a supply chain, where there remains a lack of preparedness to share information and build long term relationships. Others however (from all segments of the industry) have or are keen to enter into "value chain relationships".

The plan

The RD&E plan presented below lists four key Themes (outcome areas) and a range of potential projects within each. It should be noted that:

- The Plan has been developed to allow a continuous improvement process to be implemented. This involves establishing initial benchmarks (Theme 1) and then measuring progress over time as the plan is implemented (suggested every 2 years).
- An indication of the priority for each project is given (High (H), Medium (M) and Low (L)).
- Some projects are covered by existing work (e.g. improved EBV's via the industry Animal Genetics and Genomics strategy and breed societies; release of Beef Specs and LDL). While such projects are listed in this Plan, they are shown in red so as to clearly identify them as being directly linked to or part of other programs. As such they do not form part of the proposed budget for this RD&E plan.
- The plan has direct linkages with a range of other relevant MLA and industry plans (see below).
- An ex-ante economic evaluation of this proposed RD&E plan has been undertaken (see below). It considered on farm benefits only and did not include benefits to processors, consumers or the Australian community.

Four investment pillars (called Themes) are suggested:

1. **Benefits of increased compliance** - gain a better understanding of the scope and cost of the problem, providing a sound basis for investments – current and future.
2. **More accurate measures / predictions** - ensure the industry has access to accurate predictive tools and measurement systems for key traits / specifications, especially on live animals.
3. **Better decision tools for buying & selling animals** - develop and demonstrate expert systems (decision support tools) to easily allow the conversion of prediction and measurement technologies of key characteristics into buying / selling mechanisms and make feedback from processors / feedlots more useful for producers.
4. **Enhanced understanding & information flows** - increase the understanding of the beef value chain and enhance information flows along it.

The Plan is shown pictorially below:

Compliance to specifications – RD&E Plan
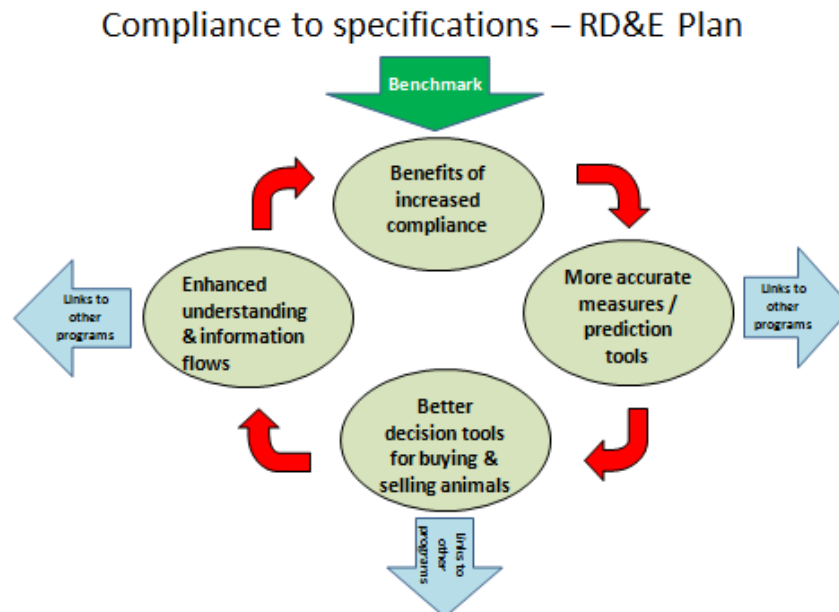
Other relevant plans

- MLA Strategic Plan 2010-2015
- Australian Government's National Research Priorities and Rural Research and Development Priorities
- Meat Industry Strategic Plan 2010-2015
- National Beef Production RD&E Strategy 2010
- ALFA RD&E Strategic Plan 2011-2016
- AMPC Research, Development and Extension (RD&E) - Priorities and projects for tender
- Various MLA Program Plans e.g. Animal Genetics and Genomics Strategy, Feedbase R&D Plan, More Beef from Pastures

Estimated ROI

An ex-ante economic evaluation[1] of this proposed RD&E plan has estimated that a total investment of $5.47 million (in present value terms) may produce gross benefits of $33.77 million (present value terms) providing a net present value of $28.30 million and a benefit cost ratio of almost 6.18:1 (over 30 years, using a 7% discount rate). Return on investment is estimated at 25.6%. Sensitivity tests (using pessimistic and optimistic assumptions) on the increase in cattle profitability attributable to improved compliance was also undertaken. The ex-ante evaluation considered on farm benefits only and did not include benefits to processors, consumers or the Australian community.

The plan – at a glance

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[1] MLA (2012), Alford A. Southern Beef Compliance to Specification RD&E Plan Economics (see Appendix 1)

Current Situation	The Gaps	The Possible Solutions	The Cost & Benefits
• About 5 million cattle are slaughtered in Australia each year in the target market (2½ y.o. or less) • Large number of small producers in southern Australia - many of which focus on weight and price only • Specifications vary depending on markets • Specifications are publicly available and market reporting relates to some of these • Levels of compliance are not well known and depends on trait and market segment (estimated to be 75% to 95%) • Much R&D work has been done to improve compliance, especially by the Beef CRC • There is an array of measurement and predictive systems & tools available or under development - but they are not well used as yet • The impact of genetics and environment on important characteristics are reasonably well known, but EBV use not universal • The penalties for non-compliance for producers (and lot feeders) for some markets are not high • Other commercial factors are taken into account when buying or selling • There is a reluctance by some to share information along the value chain • For some, there remains a heavy reliance on the auction system	• Unknown level of industry compliance and at what cost? • There is a reluctance by many producers to use EBVs and measure / assess key traits • Reluctance to build long term relationships - by all sectors • Difficult to predict potential carcase characteristics in young store/feeder cattle and heifers • The role of animal temperament and handling in processing performance is not well understood by some producers • Some producers are not clear on what market they are targeting - many are mainly weaner breeders • A lot of data is not captured and not shared • Some measurement and tracking systems in abattoirs are not yet good enough • Key tools are not yet available (e.g. LDL, BeefSpecs) • There is a lack of tools to compare non-compliance costs versus other commercial costs	**Theme 1: Benefits of increased compliance** • Quantify the level of compliance, costs and benefits, and the reasons for non-compliance • Clarify where RDE investments will give best returns **Theme 2 More accurate measures / prediction tools** • Refine EBVs • Continue genomics work • Improve fat / muscle assessment on live animal • Improve measurement system on carcases for marbling **Theme 3 Better decisions tools for buying & selling animals** • Develop better decision support tools (BeefSpecs and other) • Finalise and roll out LDL **Theme 4 Enhanced understanding and information flows** • Standardise specification formats • Market research to identify social / cultural barriers to value based marketing • Comprehensive extension program for producers / agents on meeting the market • Build the RD&E capacity of the industry	• Approx. $6.8 million over 4 years including 'in-kind' • MLA, AMPC, ALFA will be main providers of cash investments • State agencies & Universities- cash and in-kind • Commercial players need to contribute / partner for specific projects • Estimated benefits - NPV of $28.30 million at a benefit cost ratio of almost 6.18:1 ROI is estimated at 25.6%.

Abbreviations used in this document

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ALFA	Australian Lot Feeders Association
ALPA	Australian Livestock & Property Agents
AMPC	Australian Meat Processor Corporation
BCA	Benefit/cost analysis
CRC	Cooperative Research Centre
DAFWA	Department of Agriculture and Food Western Australia
DEEDI	Department of Employment, Economic Development and Innovation (QLD)
DPIV	Department of Primary Industries Victoria
DPIPWE	Department of Primary Industries, Parks, Water and Environment (Tas)
EMA	Eye muscle area
FCE	Feed conversion efficiency
H(S)CW	Hot (standard) carcase weight
IMF	Intramuscular fat (or marbling)
LDL	Livestock Data Link
LMY	Lean meat yield
LPA	Livestock Production Assurance
MLA	Meat & Livestock Australia
MSA	Meat Standards Australia
NLIS	National Livestock Identification Scheme
NLRS	National Livestock Reporting Service
NSWDPI	New South Wales Department of Primary industries
NVD	National Vendor Declaration
OTH	Over-the-hooks
PIC	Property Identification Code
PIMC	Primary Industries Ministerial Council
PISC	Primary Industries Standing Committee
PIRSA	Department of Primary Industries and Regions South Australia
RFID	Radio frequency identification
RD&E	Research, development & extension
RMCiC	Red Meat Co-investment Committee
SAMRC	Southern Australian Meat Research Council
SARDI	South Australia Research & Development Institute
SG	Sheep Genetics
TIA	Tasmanian Institute of Agriculture
UNE	University of New England

1.   Rationale

1.1   Planning context

This Plan has been prepared for the Red Meat Co-investment Committee (RMCiC), representing the major players in red meat research, development and extension (RD&E): Meat & Livestock Australia (MLA); State Departments of Primary Industries; CSIRO; CRCs for Beef Genetic Technologies and Sheep Industry Innovation; Department of Agriculture, Fisheries & Forestry; and member faculties of the Australian Council of Deans of Agriculture.

In 2010, the Primary Industries Ministerial Council (PIMC) called for the development of a National Beef Production Research, Development and Extension Strategy (the Strategy). DEEDI (Qld) was allocated the lead role in this process with MLA the supporting Research and Development Corporation. One of the 7 strategic imperatives covered by the RD&E plan, from which this project arose was:

- **Enhancing integration and value adding in supply chains (including cost efficiency).**

There are a range of other plans that both relate to and are referred to in this plan, including:

- MLA Strategic Plan 2010-2015
- Australian Government's National Research Priorities and Rural Research and Development Priorities
- Meat Industry Strategic Plan 2010-2015
- National Beef Production RD&E Strategy 2010
- Australian Lot Feeders' Association (ALFA) RD&E Strategic Plan 2011-2016
- Australian Meat Processor Corporation (AMPC) Research, Development and Extension (RD&E) - Priorities and projects for tender
- Various MLA Program Plans e.g. Animal Genetics and Genomics Strategy, Feedbase R&D Plan, More Beef from Pastures

1.2   Objective

By March 2012:

1. Develop a national investment plan to increase compliance to specifications in the southern beef industry for at least the period from 2012 to 2015, for consideration by the Red Meat Co-investment Committee (RMCiC) with a particular focus on the strategic & applied research and the identification of delivery priorities and opportunities for extension.

2. To document the priorities and industry deliverables that will contribute to the increase in information flow, management and utilisation that delivers an improvement in the compliance benchmark of no less than 5% over the next 5 years compared to levels benchmarked in 2010/11.

3. Provide recommendations for governance, management and coordination of such investment across the national RD&E framework.

4. Suggest appropriate mechanisms for linkage to the lamb and sheep meat RD&E plan.

1.3 Problem definition

Cattle breeders raise animals on pasture and then have a range of options for subsequent sale:

- Continue to grow and fatten animals on pasture for subsequent sale to processors;

- Sell or transfer 'feeder cattle' to a feedlot for finishing on a grain-based diet;

- Sell or transfer as 'store cattle' to grass finishers and / or backgrounders for further growth and fattening.

Backgrounders purchase feeder cattle to be further grown and fattened on pasture and then usually sell them to either feedlot operators for further growth and fattening on grain or sell to processors.

Feedlots purchase feeder cattle either from breeders or backgrounders to fatten them on grain-based feed until they meet the desired weight specifications and other characteristics. In feedlots, cattle can be fed from 60 to over 300 days depending on market requirements.

In Australia at any one time, approximately 800,000 cattle are 'on feed' (in feedlots), against a capacity of over 1 million. Of the 8 million (approximate) cattle slaughtered annually in Australia, about 35% (2.5 million) are finished on grain (or approximately 50% when excluding cull cows and bulls). Up to 80% of all beef retailed in supermarkets in Australia is grain fed beef[2].

Currently, there are tools and knowledge available or under development to better predict and provide feedback on the performance of store and feeder stock (to backgrounder / finisher or feedlot), including Beef Specs, Livestock Data Link (LDL) and Meat Standards Australia (MSA). However, information flows up and down the supply/value chain are currently limited.

Previous studies have shown that non-compliance to specifications can lead to significant financial impacts on producers and other supply/value chain participants. The application of reliable tools, knowledge and enhanced information flows should lead to store or feedlot buyers applying price premiums / discounts through value based trading at feedlot or finisher entry, with a preference for cattle that are positive for these predictive characteristics and allow finishers managing cattle to achieve high compliance with processor specifications.

This Plan focuses on southern Australian beef cattle of age 24 months (max two tooth) or less which should meet domestic and / or short-fed and mid-fed market needs and cattle of 2 or 4 tooth (30 months or less) which may enter feedlots for long-fed markets. It does not cover cows and bullocks, live export cattle or northern Australian cattle.

The key characteristics (specifications) that are considered in this report are:

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[2] ALFA (2010) Lot Feeding – Where are we now?? Beef CRC Feeder Steer School, Armidale course papers

- 'Feeder / store' specifications - fat and muscle score, maturity
- 'End point specifications' - fat, weight, marbling (IMF), meat colour / pH and ossification

1.4 Methodology

The methodology employed to develop this Plan was:

1. Review the literature on beef production that documents past research, development and extension to increase compliance to market specifications.

2. Develop a scenario (straw man) of "what might be" in relation to compliance to specifications in the southern beef industry.

3. Consult with industry and agencies to:

   a. Gauge the current level of compliance.

   b. Clarify the reasons for and implications of non-compliance.

   c. Identify and assess current and prospective investments in RD&E that may lead to better compliance outcomes.

4. Identify the capacity (both public and private - and for personnel and financial) and priorities of RMCiC and other industry participants for investments in this area.

5. Develop an investment plan and recommend governance / management arrangements to enable effective implementation of the plan.

6. Provide input to a benefit/cost analysis of what effective prediction would do for improving compliance.

2. Situation analysis

2.1 Overview of the beef value chain

2.1.1 Production

The Australian cattle herd in 2010/11 was estimated[3] to total 28.8 m of which 26.2m were beef cattle. The number of cattle is forecast to rise in 2011/12 to 30.2 million head, before increasing to 31.4 million head in 2012/13 and reaching 31.8 million head by 2013/14[4].

Nationally, the largest beef properties, mostly in northern Australia, carry the majority of the herd, with 82% of the total beef herd being carried by the largest 29% of beef properties. In southern beef production systems 22% of properties (more than 400 head) carry 63% of production.

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[3] ABARES (2011) Agricultural Commodities December Quarter 2011
4 ABARES (2012) Agricultural Commodities March Quarter 2012

The prevailing trend at the end of the last decade was an increasing number of larger, specialist beef properties and a decreasing number of smaller beef properties, both for specialist and mixed enterprise beef properties - see figures below.

Figure 1:   Number of properties, herd size >400 beef cattle head[5]
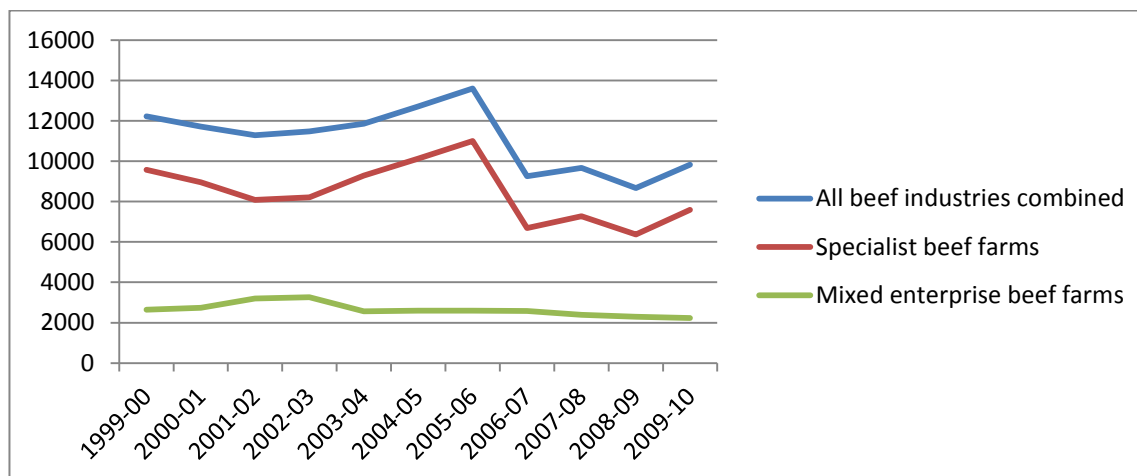
Figure 2:   Number of properties, herd size 100-200 beef cattle head[6]
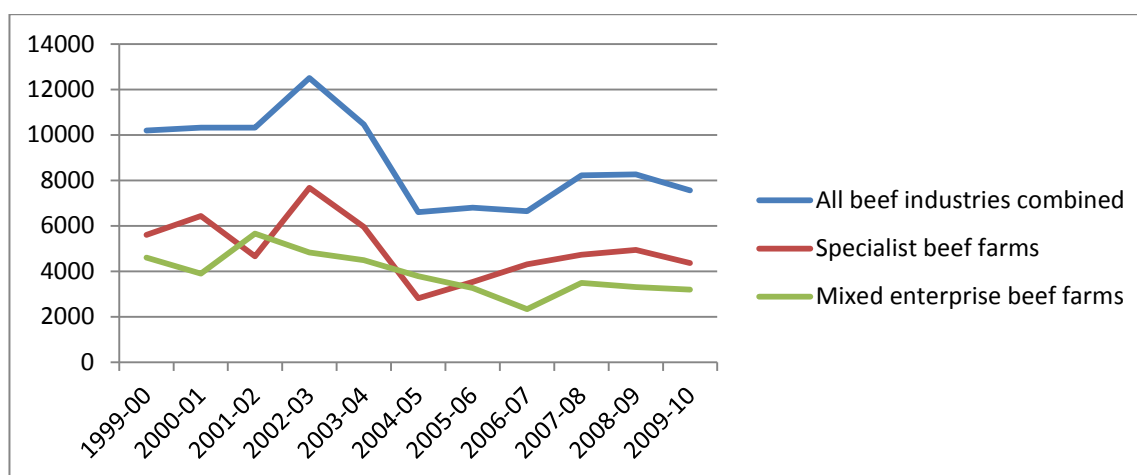
According to the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), there are approximately 22,000 commercial beef properties in Australia[7]. Data also shows that over the past five years, almost 1 in 3 of these properties had less than 100 head of beef cattle. This figure however, excludes many of the smallest properties of less than 100 head and engaged in enterprises other than beef, due to the survey excluding the smallest farm units which in aggregate contribute less than 2 per cent to the total value of agricultural production.

It can therefore be surmised that there is an unknown, but significant number of small beef producers (<100 head) than the current ABARES beef properties figures indicate.

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5 http://www.abareconomics.com/ame/mla/mla.asp, Interactive farm survey data for the beef, slaughter lambs and sheep industries
6 Ibid.
7 ABARES (2011) Financial performance of beef cattle producing farms 2008-09 to 2010-11

This is important as scale of enterprise is seen as an important factor in relation to compliance to specifications.

There are considerable differences between breeds, markets and structure of the northern and southern Australian beef systems. Depending on geographic definition, southern Australia is home to approximately 40% of the Australian beef herd.

The Australian processing industry is continuing to rationalise, which has led to increased market concentration. The top five processors account for over 50% of red meat production in Australia. Further to this concentration, the four largest processors in the country are either owned by or in joint ventures with foreign companies[8].

The beef value chain is complex and fragmented. Typical flows through the chain are depicted in the following diagram:

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[8] PWC (2011) The Australian Beef Industry

Figure 3: Beef value chain[9].
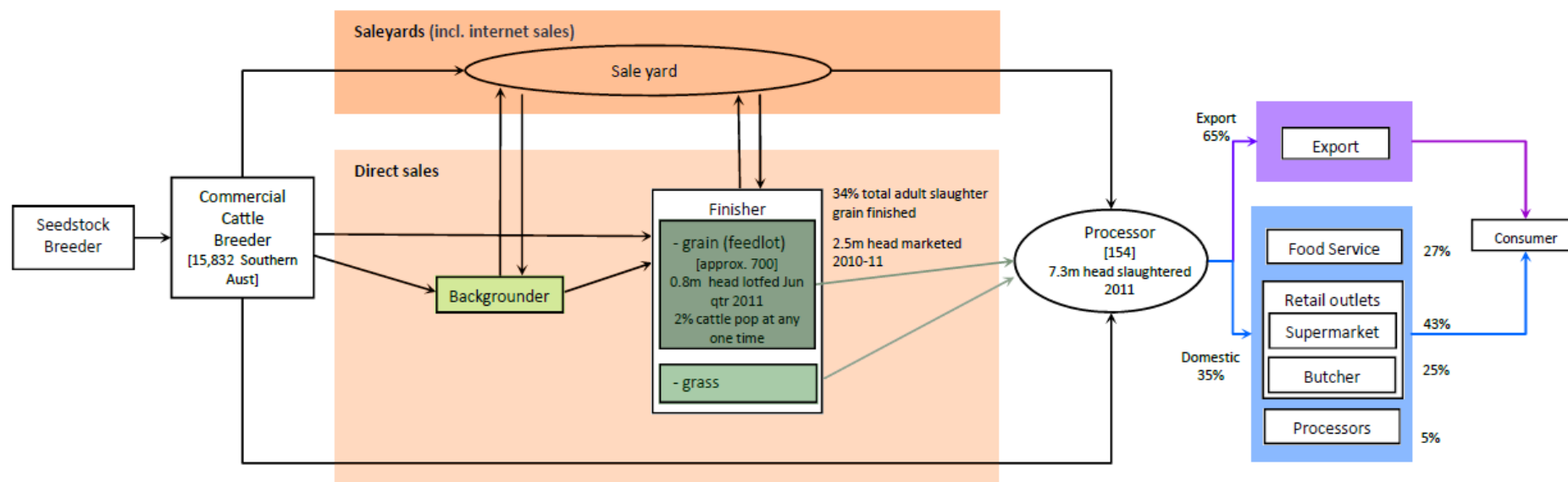
[9]Adapted from Moreland, H. E., 2012 "Innovation fit and innovation adoption in supply chains: An exploratory study within the Australian beef industry"

2.1.2 Selling methods

Selling methods in southern Australia are approximately 20% over the hooks (OTH), 20% from paddock and 60% by auction, although this varies over years, depending in part on sale prices.

By contrast, in northern Australia, OTH selling dominates at over 40% of sales with paddock sales accounting for 20% and auction 40%.

More recently, cattle sales on Auction Plus has been growing with 226,000 listed in 20010/11, up from 151,000 in 2009/10[10]

Figure 4: Method of selling beef cattle, southern Australia[11]

p Preliminary estimates.

Note: Because of changes in the data collected, consistent results cannot be provided for the period 2002–03 to 2004–05.
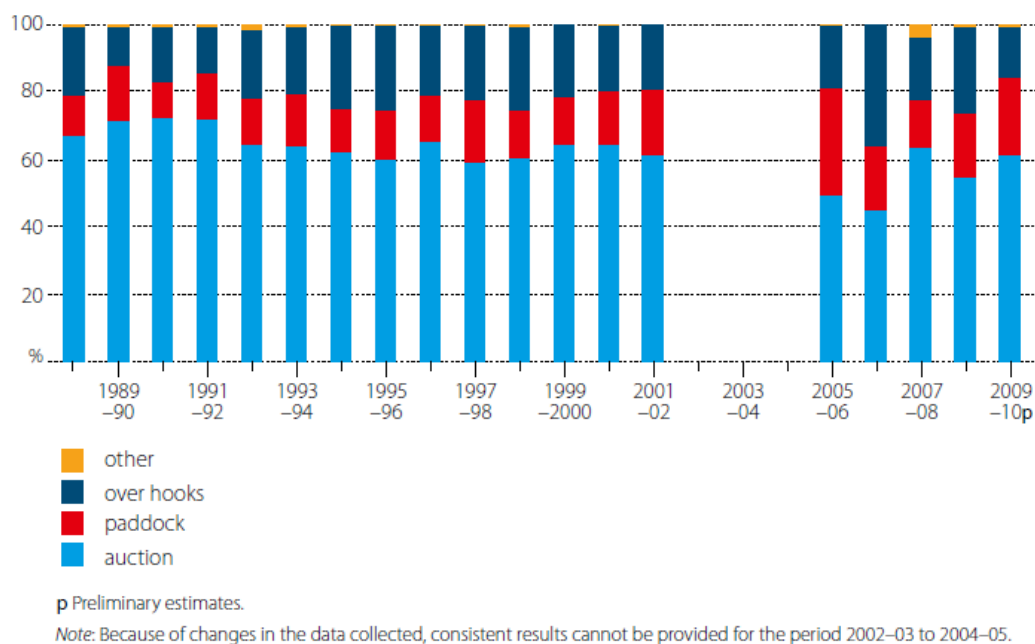
2.1.3 Specifications in the beef industry

The beef industry can and does target a wide range of carcase specifications and market outlets as shown in the chart below. These specifications are used in market reporting.

Specifications vary depending on markets, but usually involve the following:

- Major - weight (live or carcase), fat (P8 fat depth or score), sex, age (teeth)
- Other - breed, meat/carcase pH (meat colour), ossification, fat colour, marbling (measure or score), retail meat yield, accreditation or other eligibility requirements (e.g. EU, supermarkets, MSA), lifetime traceability, HGP status.

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[10] Auction Plus, Personal communication (2012)

[11] ABARES (2011). Financial performance of beef cattle producing farms 2008-09 to 2010-11

Figure 5: Beef market specifications for slaughter cattle[12].
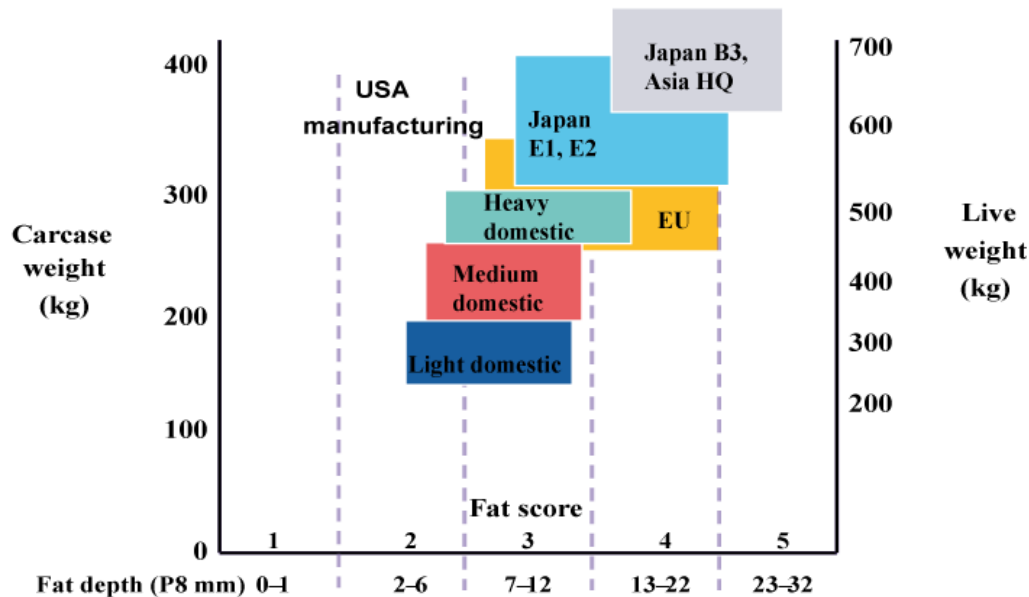
2.1.4 Some observations on compliance to specifications

There has been some, but not extensive, work on compliance to specifications in the beef value chain and there is some uncertainty as to what levels exist.

A general statement from the Beef CRC[13] on genetic improvement notes that "up to 25% of Australian (feedlot) cattle fail to meet targets for particular market specifications .... for weight or fatness alone, depending on the target market". Another study showed that animals fed in a feedlot from a number of producers resulted in greater than 85% compliance rates to domestic eating quality standards[14].

On the other hand, compliance to specifications from grass fed cattle is largely unknown[15], although anecdotal evidence suggests that there may be more non-complying animals finished on pasture than feedlots. While a recent survey[16] of producers found that compliance at slaughter for one producer was over 95% when finished on grass, this was only achieved by close animal management, supplementation and sending only those animals deemed to meet specifications (probably not normal practice for small producers).

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[12]PISC (2010) National Beef Production RD&E Strategy

[13] Beef CRC (2010) Beef Genetics Discussion Paper

[14] Beer, M et al (2000) Producing Beef Products to Eating Quality Standards

[15]Oddy, H (2010) Prediction of carcass attributes in beef cattle

[16]Littler, Brett (2012)Personal communication

A report by Deland[17] showed results for eight groups of steers (total 162) slaughtered from the same property between March 2010 and October 2011 where the failure rate due to dark cutters declined from 28% for the first group in 2010 to zero after February 2011

However, industry participants sometimes have a different perspective. When asked about how many animals meet required specifications a response of 'over 95%' is common, as is 'they all do'. This latter response is because processors usually have a market for overfat / low fat and over and under-weight animals.

The price penalties for producers (which for many characteristics are not onerous, e.g. 5 to 10 cents / kilogram for non-compliance within a relatively wide fat spec) needs to be weighed up against other commercial realities (such as the cost of partially filling transports; the availability of feed or needing to secure additional fodder for retained animals; small 'left over' mobs needing to be isolated from the rest of the herd / bulls etc).

The same 'commercial realities' are equally important for feedlots who require maximum utilisation of their infrastructure. The lack of supply of quality animals year round (and at the right price to be commercially viable) often leads to the need to purchase cattle that may not be ideally suited to meeting future specifications (increased risk).

Processors face similar challenges in balancing demand / supply and utilisation of infrastructure. Smaller processors are more vulnerable to costs associated with non-compliance while larger processors have the advantage of having a range of markets they supply into and can manage carcase allocation better.

Often, the reasons for non-performing cattle are known – but some are not. As expected, there is a range of opinions on the importance of genetics versus nutrition and management and the relative importance of genetics or environment depends on whether the key specification is weight, fat or eating quality measures such as marbling and tenderness. Animal temperament is another factor where, in general, cattle with poorer temperaments (as assessed by flight speed) had consistently less feed intake and slower growth rates, which resulted in smaller carcases with less fat cover and poorer objective meat quality characteristics[18].

Other observations of note included:

- *If marbling is OK, then being overweight is not a problem as cut size is not important. In fact being overweight returns significantly more money per beast.*
- *Feedlot grids are tight so that producers will target the 'sweet spot'. If the grid was looser, then the feedlot would end up with some animals well out of 'preferred' specs which could result in significant penalties for them.*
- *The specifications of incoming animals to feedlots is not a big issue as they adjust management to ensure markets are met and price maximised. They pay less for animals*

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[17] Deland, M (2012) Progress report on dark cutters

[18] Cafe et al (2011) Cattle temperament: Persistence of assessments and associations with productivity, efficiency, carcass and meat quality traits. *J Anim Sci* 2011.89:1452-1465

if they are less likely to meet their carcase grid (e.g. for particular breeds and / or lighter animals).

- *Processors sell to different markets based on maximising their return. Whilst often there will be discounts for overweight carcases, often 'final' out of spec animals will have cost less to purchase or feed so the net return may not be affected as much.*

- *One major processor supplies feedback to producers and includes their national compliance data for key specifications for feedlot cattle, but not for grass fed.*

Notwithstanding the above observations, there is no doubt that at the processor level, there are many carcasses that do not meet the specifications that will maximise the processors' financial return.

It is also anticipated that in the future, the payment for quality will be enhanced as MSA has an increasing influence. Thus meeting preferred weight, fat and meat quality will become more important.

Overall, in 2010/11 some 1.4m cattle were MSA graded of which 94.3% complied to MSA specifications. The major reasons for non-compliance are shown in the chart below.

Figure 6: MSA non-compliance reasons[19]
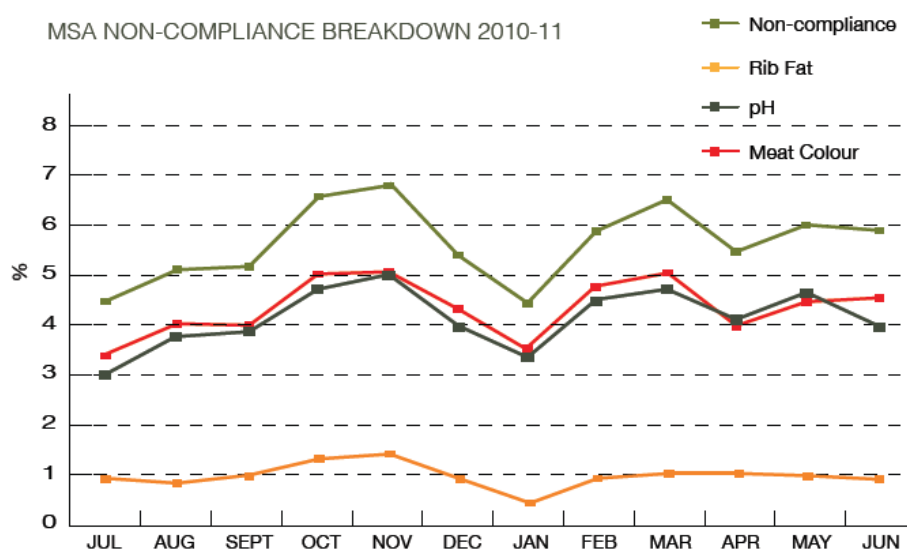
NB: A carcase may fail for more than one reason. Dark meat colour and high pH levels remain the most common reasons for non-compliances.

The average OTH premium for MSA yearling cattle across all weight ranges in 2010-11 was $0.15 /kg.

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[19] MSA (2011). 2010-2011 Annual Outcomes Report

2.1.5 The estimated cost of non-compliance

The key research report into the cost of non-compliance, which many other analyses use as the benchmark, was conducted by Slack-Smith et al[20]. This study examined data from two feedlots and showed that 28% of carcases were outside the weight specification in the short fed export market (300kg - 400kg), 29% were outside the carcass weight specification (385 - 450 kg) in the long-fed export market, and 16% were outside the P8 fat depth specification of 10mm-26mm specification for the short-fed market. For the average short-fed animal out of specification for both weight and fat score, the loss was estimated at $23 / head while for long fed animals out of weight specification the average cost was $11 / head. More significantly, at the nominated marbling score specification (3+) in the long-fed market, 70% were outside of specification resulting in a loss of $105/head. Across all 40,000 animals in the two datasets, the estimated total cost of non-compliance was around $1,628,000, or around $40/head. Factors contributing to out-of-specification in both the short and long-fed export markets were primarily pre-feedlot induction weight and "producer" effects (yard weaning etc).

Other analyses include:

- An economic assessment of the value of the Livestock Data Link (LDL)[21] showed a total net present value (NPV) of between $20 and $150 million to the Australian beef industry over ten years (when examining the heavy steer sector alone).

- A more recent study by Pollock[22] assessed that the economic benefit to the Australian beef industry of increased specification compliance rates from use of the Livestock Data Link technology would result in a total NPV of up to $89.0 million to the Australian beef industry over the 10 years, 2012–2021 (assuming baseline compliance rates of 75% with 25%). This analysis did not deduct the extra cost of management and varying purchase costs to comply. The analysis needs further review.

- An economic analysis[23] of using the BeefSpecs tool to optimise inputs in a feedlot situation showed that its application to predict optimal days on feed *after the animals have been assigned to pens*, has the potential to lift profitability by around 25 to 30+% (in the range of $20 to $25 per head).

- Davies et al.[24] found that the highest gross margins in the pre-feedlot phase were produced by the fastest growth groups, whereas the slow growth treatments performed better in the feedlot. However, the magnitude of the economic advantage

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[20]Slack-Smith, A et al (2009) The Cost of Non-Compliance to Beef Market Specifications, Australasian Agribusiness Review - Vol.17 - 2009, Paper 9, ISSN 1442-6951

[21] McKiernan, B (2011) Solutions to Feedback - Livestock Data Link, Final Report, V.LDL.1004

[22] Pollock (Pers. Comm. 2011) The economic impact of Livestock Data Link for increasing compliance rates within the Australian beef industry

[23] Mayer (2010) Beef CRC Report October, Appendix 10 in McKiernan, B (2011) Solutions to Feedback - Livestock Data Link

[24] Davies, L et al (2009) The Economic Effects of Alternate Growth Path and Breed Type Combinations to Meet Beef Market Specifications across Southern Australia, NSW DPI Economic Research Report No. 39

pre-feedlot, combined with the improvements in carcase traits reported above, certainly favour the fast growth option overall.

- A study by Dodd et al (2011)[25] found that stress pre slaughter (exposed holding yards and handler treatment) could result in a loss of up to $77 per head due to dark cutting.

- Other reports suggest that dark cutting carcases are often heavily discounted (up to $0.45/kg hot carcase weight)[26] and the incidence of dark cutting in Australia is estimated at almost 10%. That equates to a potential loss for the industry of almost $35 million per year. As noted above, MSA (2011) found 4.2% of carcasses had pH above 5.70.

- Feedback on steers slaughtered in 2010 by Deland[27] *et al.* (2011) indicated that a premium equivalent to $0.05 per mm of fat was applied. Results also showed that using a carcase price grid with maximum price of $3.75/kg hot standard carcase weight (HSCW) for a 300-340 kg steer with 0-2 permanent incisor teeth the discount of $0.25/kg or $75/ carcase would apply for steers with 4 permanent incisors and $0.45/kg ($135) for 6 teeth.

- In the vastly different US market and production system, the beef audits reported that 'using 2000 Logic/Prices, there was a 22.8 percent improvement ($US30.96) from 1995 to 2000 in value-losses due to waste, taste, management and weight concerns'[28].

- There is also a 'hidden' cost of compliance - processors need to have a range of markets / customers available so as to 'place' product that does not meet specification. Maintaining such a range of markets is likely to be expensive.

Overall, until the industry has a better idea of what percentage of carcases fall out of specification and by how much it is hard to determine the losses reasonably precisely.

However, below are some indicative costs based on current information. Some of this information has been used in the BCAs.

- 7.5 to 8 million cattle slaughtered annually in Australia.
- 5 million cattle slaughtered in target market - age 24 months (max two tooth) or less for domestic and / or short-fed and mid-fed market needs and cattle of 2 or 4 tooth (30 months or less) for long-fed markets.
- Cost of non-compliance - assume 5 million cattle x 250kg (carcase average) = 1,250,000,000 kg
  - Outside weight specified - 1,250,000,000 kg (carcase) x 0.28 (%) x $0.10 = $35 million.
  - Outside fat specified - 1,250,000,000 kg (carcase) x 0.16 (%) x $0.10 = $20 million

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[25] Dodd, C. et al (2011) Risk factors causing high ultimate pH of beef at a South Australian abattoir

[26] MLA (2010), The effect of pH on beef eating quality, Tips & Tools

[27] Deland, M et al (2011). Proc. Assoc .Advt. Anim. Breed. Genet 19, 434.

[28] NCBA (2005). Staying on Track. Executive Summary, 2005 National Beef Quality Audit.

- o Outside IMF specified - (40%[29] of OTH sales (1m) = 400,000) x $62.5/head = $25m
- o Dark cutters - $35 million.

2.1.6 Factors affecting compliance to specifications

The factors impacting on an animal's ability to meet specifications are complex, with individual factors and interactions between them all playing a part. The following table seeks to summarise some of the key ones, but it is acknowledged that these are somewhat subjective.

Table 1. Factors impacting on an animal's ability to meet specifications (minor, intermediate and major affects)

Specification	Factors affecting					Heritability (Angus)*
	Breed (e.g. Angus, Hereford)	Genetics (within breed)	Nutrition	Sex	Mgmt, handling & temperament	
Weight (live / carcase)	Major	Major	Major	Inter	Inter	0.37
Fat depth (rib)	Major	Major	Major	Inter	Inter	0.40
pH	Inter	Minor	Inter	Minor	Major	
Ossification	Minor	Minor	Major	Minor	Minor	
IMF / Marbling	Major	Major	Inter	Minor	Minor	0.34
Eye muscle area	Inter	Major	Inter	Minor	Minor	0.37
Retail beef yield	Inter	Major	Major	Inter	Minor	0.50

* Recent estimates of heritability are not easy to obtain from BREEDPLAN. These are from the Angus Society website. Other cattle should be similar to this.

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[29] MLA (Alford, A) 2012 Southern Beef Compliance to Specification RD&E Plan Economics

2.1.7 Measurement systems of important characteristics

On live animals, measurement systems are currently possible for weight, rib and rump fat, eye muscle area, marbling and frame size, but most (except for weight on many properties) are visually assessed. More objective measures and assessment are available on carcases.

The following table provides a summary of current measurement systems:

Table 2: Measurement / assessment systems for key specifications

Specification	Measures used		Comments
	Live	**Carcase**	
Weight	Scales Assessed	Scales	Limited use of scales on small properties
Fat depth (rib)	Visual Palpation Ultrasound	Assessed Objective measure - Viascan	Ultrasound mainly in stud bulls for EBV purposes (and some females) Possible as enter grass or grain finishing, but rarely done because of time and questionable value
pH	Not done	Objective measure	
Ossification	Age (dentition)	Assessed	
IMF / Marbling	Ultrasound	Objective measure / assessment	Rare on live animal - use of IMF% EBVs limited Ultrasound only in stud bulls for EBV purposes (negligible on heifers for selection)
Eye muscle area	Ultrasound	Objective measure	Ultrasound for EMA only in stud bulls for EBV purposes
Retail beef yield	Can be estimated from other measures	Can be estimated from other measures, or by	

		weighing all retail cuts	

2.1.8 Tools & processes to aid compliance to specifications

The Australian beef industry is or will be well served by the large investment made into better understanding the factors that impact on meat quality traits and tools to assist their monitoring and enhancement (note: further information on these tools can be found in Appendix 1)

These include:

- National Livestock Identification System (NLIS) - radio frequency identification (RFID) tags provide lifetime traceability and the ability to monitor and record the performance of individual animals. Despite the use of RFID tags for several years, few producers or processors use them to enhance management. However there are examples of integrated value chains in beef that capitalise on individual animal traceability. One such example is meat processor Greenham Tasmania Pty Ltd which has established several premium beef brands (including Cape Grim, Pure South and Greenham Tasmania). Producers are paid according to MSA and other quality gradings (such as organic certification) achieved by their cattle.

- Livestock Data Link (LDL) - a pilot project being run by MLA, NSW DPI and Victorian DPI to use the NLIS database to deliver carcase feedback to beef and sheepmeat producers. Industry release may occur in the short term.

- Meat Standards Australia (MSA) - MSA provides an endorsement of quality for graded cuts of red meat indicating product has met quality standards for tenderness, juiciness and flavour. Effectively, it guarantees tenderness providing that the consumer cooks the meat using the method or methods recommended on the label. For beef, a range of three gradings is available: 3 Star (Tenderness Guaranteed), 4 Star (Premium Tenderness) and 5 Star (Supreme Tenderness).

- BeefSpecs - a calculator that predicts carcase weight and P8 fat in live animals to assist cattle producers and feedlots to make more accurate management decisions that could increase carcase compliance rates for fatness and weight targets for specific beef markets. Currently being re-validated and soon to be re-released.

- BREEDPLAN - is the Australian beef industry's genetic evaluation program that generates Estimated Breeding Values (EBVs) i.e. provides the best available estimate of an animal's breeding potential in comparison with other animals of the same breed. EBVs are available for a large number of traits relating to weight (birth weight, 200-day weight etc), carcase (eye muscle area, meat yield etc), and temperament. EBVs are expressed as absolute units of measurement e.g. kilograms.

- BreedObject - a tool for formalising breeding objectives and $Indexes that can help producers breed more profitable cattle. It uses BREEDPLAN EBVs. It helps the producer target the type of commercial herd performance they need from animals for a given market production system including specifications and also helps identify seedstock that will be best suited to this. BreedObject $Indexes are intended for use by both stud and commercial beef producers.

- Genomics - much recent R&D has been directed towards the development of direct genetic tests for desirable traits. A major commercial player in this market is Pfizer Animal Health. Pfizer's product GeneSTAR® Molecular Value Predictions[TM] (MVPs) includes markers for feed efficiency, marbling and tenderness. Some of these have arisen from Beef CRC research and are incorporated into BREEDPLAN EBVs. Other prediction equations for growth, feed efficiency, carcase and beef quality attributes are under development. Besides Pfizer, DNA tests for production, disease traits as well as pedigree are available from other companies and institutions (see http://www.brahman.com.au/technical_information/selection/knowYourGenes.html)

- Other tools / knowledge - commercial players and agencies have developed or are developing an array of "tools" (e.g. software, scanners, drafters etc) to assist producers, feedlots and processors to capture and manage data on individual animals or at the mob level. There have also been many derivative tools developed such as the Feedlot Steer Prediction Tool, Decision Optimisation Tool and the Maternal production tool.

2.1.9 Current research on new measurement systems

Currently, there would appear to be relatively limited research for new measurement systems for weight, fat, and carcase traits on live animals.

A laser capture system is being evaluated by NSW DPI to automatically record hip heights and thus estimate frame scores[30]. The laser system at present has a correlation of 0.85 to 0.90 between laser estimate and actual height of hip (this correlation assumes the tape measurement of hip height is accurate). Laser technology was also thought to be a possibility to measure condition score which is a combination of muscularity and subcutaneous fat.

An alternative to the laser technology is to use RGB-D cameras to obtain 3D images and estimate frame height, muscle score, and P8 fat. Some very preliminary work has been done but there is a need for further major development with a range of breeds, ages and condition along with developing the relationship with carcase traits. This potential research by NSW DPI and the UTS Robotics and Mechatronics Unit has exciting potential as it could record information automatically and be used for developing EBVs and management tools for producers including feedlots as well as to help estimate carcase yield on the live animal. This opens up possibilities to value live animals on estimated meat yield at various points in the

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[30] Wilkins et al., (2008; 2009)) 'Automatic capture of live conformation in cattle using laser technology', and 'Laser technology to enhance live cattle assessment'

supply chain. With automatic recording of data and linking to the RFID tag and databases, this could lead to electronic trading of estimated meat yield for breeders, backgrounders and both pasture and grain cattle finishers.

2.2 Beef compliance in other countries (NZ, US, Canada)

From a brief review of the situation in other key beef producing countries, it appears that Australia is a market leader in the field of tools and knowledge related to this area.

New Zealand - launched a Red Meat Sector Strategy Report that identifies the opportunity to increase information flow and exchange along the chain. Some participants in the value chain are already adopting this approach. Silver Fern™ Farms, a vertically integrated company has adopted a 'Market Value Traceability System'. New Zealand's National Animal Identification and Tracing (NAIT) scheme is scheduled to commence for cattle on 1 July 2012, requiring cattle producers to, amongst other things tag their cattle with NAIT-approved radio frequency identification device (RFID) ear tags.

United States and Canada - differ from Australia in that they are both highly oriented towards the domestic rather than export markets, especially following the discovery of BSE in the US in December 2003 (note that, although about 38% of Canadian production is exported, most of this is to the United States). Both industries are also much more heavily based on grain finishing.

In the US, beef is graded by USDA graders inspecting carcases 18-48 hours after chilling. Having carcases graded is optional for 'packers' (abattoirs) who must request and pay the USDA for the service, but one source quotes that 'more than 95% of beef cattle harvested receive USDA grades'[31].

Two forms of grading are used: Quality and Yield, with the Quality Grading appearing to be a version of MSA using fewer variables but a broader range of gradings that includes the poorer quality cuts excluded by MSA.

Individual identification of cattle is much less advanced in the US than it is in Australia with around 79% of cows carrying some form of individual identification (plastic ear tag being the most common type (57% of all cows)) and only 1.2% of cows carrying electronic ID or microchip responders. Canada, on the other hand, has since July 2010 required all cattle leaving their current location or farm of origin to be tagged with radio frequency identification (RFID) tags.

The US Beef industry conducted beef quality audits in 1991, 1995, 2000, 2005 and 2011-12. The audits include questionnaires, telephone interviews and personal contacts with all segments of the beef industry, the collection of quantitative data and finally a 'Strategy Workshop' to identify tactics needed to reduce or eliminate specific defects, and to identify quality challenges on which beef quality audits could be focused.

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[31]Mississippi State University Extension Service (2009) Beef grades and carcass information, http://www.thebeefsite.com/articles/1961/beef-grades-and-carcass-information

The most recent results were reported in April 2012.Whilst there are good messages from the US audits (such as industry involvement, the range of audits done e.g. fed and non-fed cattle, old cows and bulls, dairy beef, international market audit, value of wastage, animal health etc) there are other deficiencies such as sampling, limited information on the cost of overcoming non-compliance, the dilemma of what grade to target. LDL and MSA seem to be more objective and have far larger data sets which will be much more valuable to the Australia beef industry than the US audits are to the US beef industry.

Canada also has a national voluntary web-based database (recently released) called the Beef InfoXchange System (BIXS) which is 'designed to capture and exchange data linked to an individual animal's unique electronic ID [CCIA] tag number'. Users will be able to 'use BIXS to capture and exchange information on a wide range of production, performance, health management, genetics and carcass data'[32].

2.3 Capacity and interest of organisations in the beef value chain

During the industry consultation phases of this project, the majority of key organisations with an interest in compliance to specifications in the southern beef industry were consulted.

The following provides a brief summary of their interest and capacity

The **Beef CRC** has been the lead organisation within the area but it draws to a close in mid 2012. This will leave a substantial gap in both capacity and funding which will need to be filled by other players (who by and large make up the CRC).

State agencies in NSW, Victoria and WA have been very active in this area from a research, demonstration and extension perspective, often as part of the CRC. They have significant human capacity to add to the work proposed by this plan and are likely to co-fund projects of interest. The priority of compliance RD&E would not appear to be as high in **SARDI / PIRSA and Tasmanian DPIPWE.**

The **AMPC** does not list compliance to specifications as a specific priority within its most recent RD&E Plan[33] however there are project areas listed of direct relevance, viz:

- *To support further investment in Objective Carcase Measurement (OCM) and CT, this project will quantify the benefits of developing a CT marbling solution;*
- *A review of sensing and scanning technologies in the context of a future automation strategy (e.g. roles and applications for CT, Ultrasound, Infrared, X-ray)*

Universities, specifically Murdoch, UNE and Adelaide have been key drivers of research, often as part of the Beef CRC. The capacity they bring to future work will be critical.

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[32] http://bixs.cattle.ca/bixs-overview

[33] The Australian Meat Processor Corporation (2011) Research, Development and Extension (RD&E) - Priorities an Projects for Tender

ALFA's[34] most recent RD&E plan refers to priorities which are also priorities within this plan including:

1. Animals of superior genetic potential - Mechanisms for measuring and identifying animals with superior genetic potential developed.
2. Education, Extension, Awareness - Industry access to current MLA information and research reports.
3. Training - Maintenance of research capacity to service industry requirements.

Breed societies and BreedPlan in general will continue to play a key role in the development of genetic (and genomic?) advances (EBVs etc).

Private companies (producers, feedlots and processors) have expressed a desire to cooperate with future RD&E but primarily in areas where they can capture the benefits privately, a completely understandable commercial response. Similarly, **organisations developing and selling software and hardware** to support measurement systems will remain key resources where private benefits can be captured.

Finally, the hole left by the conclusion of the **Beef CRC** will place greater responsibility on **MLA** to help coordinate future compliance RD&E. Given that this plan holds considerable focus on benefits to producers, this is not unreasonable.

3. Vision, opportunities & gaps

3.1 Gap analysis (including SWOT)

The following is a summary of a SWOT analysis undertaken during the project. A more detailed version can be found in Appendix 2

Strengths

- Larger processors can find a market for non compliant bodies - because of the range of markets available

- Larger producers have greater options in relation to complying to specifications (not so hampered by mob size, transportation etc)

- The Australian industry appears to be a world leader in regard to specifications - numerous tools (Beefspecs, LDL etc) and information sources are available to producers or are under development

- Processor grids (specifications) are readily available - enabling value based marketing

- MSA is gaining momentum

- BREEDPLAN provides genetic data to help producers target preferred specifications

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[34] ALFA / MLA (2011), Feedlot Program - Research, Development & Extension Strategic Plan 2011-2016

- There are major public extension services and commercial organisations that are applying the major research outcomes of the last 10-20 years

Weaknesses

- Smaller producers find it difficult to economically meet market or feedlot / backgrounder specifications

- Producers and lot feeders are not paid for what they produce / what consumers desire

- Market signals are often of small magnitude and there is a reluctance to provide feedback to previous owner (s) of animals

- There is often a lack of information on the background of cattle for sale - genetics, nutrition, weaning, handling, animal health history and treatments

- Accurate measurement systems for use on live animals for many traits is limited (or under-utilised)

- Some prediction tools either not routinely used or are insufficiently accurate

- Many producers are not sure of what market they are chasing (or don't see the need to know)

- Processor grids vary in structure etc so are confusing for some participants. They are not continuous for many characteristics

- Access to the NLIS data-base is quite restrictive

- BREEDPLAN is not used enough

Opportunities

- Much is already known (but not always well adopted)

- Improvement of growth and carcase traits is possible using genetics / genomics

- New technologies become available that better reflect yield and eating quality (not just weight and fat)

- Enhancements to current developments (e.g. LDL, BeefSpecs)

- Greater use of MSA and expansion of factors it covers

- Capture and application of data becomes easier with ongoing advancement in information technology

- Development of specific markets using all available information for "store cattle" and payments based on same

- Analysis of economic benefits of meeting specifications, improved data and information flow

- Further refinement of grids to be based on customer / consumer needs

- Objective assessment of temperament and impacts of "handling" on performance

Threats

- Commercial realities lead to continuation of current situation

- Moderate beef industry profitability is threatening technological advances - making change more difficult

- The supply chain continues to be poorly integrated and is slow to develop into a true value chain

- The significant number of small producers who are not engaged (often with saleyard reliance)

- Domination of key players (processors / retailers) may limit competition

- Lack of successors for established world class researchers working in growth and carcase areas

- The Beef CRC will be discontinued from mid 2012

3.2 A future scenario for compliance to beef specifications (and investment opportunities)

In developing an RD&E plan to enhance compliance to beef specifications for the feedlot / backgrounder sector, a "forecast" of what might be possible was prepared (or in other words what an ideal outcome may look like).

The summary below describes this possible future and highlights the gaps between it and the system as it currently exists.

Scenario	Potential gaps & responses
All beef cattle are electronically identified (using RFID) soon after birth	• Available today
RFID tags facilitate the capture of data on growth rates (via regular weighing, much of it remotely done), phenotypic characteristics (such as conformational defects) and management history (birth date, health treatments, supplementary feeding etc)	• Available today but not well used. Large extension campaign to producers **(see Theme 4)**
Producers are very clear on what market they are targeting and the costs and benefits of each	• Information is available from many buyers, if producers look for it • Large extension campaign to producers **(see**

	Theme 4) • Clearly establish and demonstrate costs and benefits of compliance **(see Theme 1)**
Producers routinely use EBVs and have online access to EBVs for all males and females, with these EBVs being continuously updated as phenotypic and genomic data is uploaded from seedstock and commercial producers, aided by a rapid DNA parentage test applied to all newborn calves	• EBVs are available but they are under-utilised and there are gaps • Large extension campaign to producers **(see Theme 4)** • Enhanced EBVs including improvements for meat quality traits, **(see Theme 2)** • Increased use of genomics **(see Theme 2)**
Producers can accurately measure / assess cattle for trading into market segments Data is used on-farm to guide decision-making in input purchases (e.g. fertiliser, supplementary feeds), management practices (eg. how much, what and when to feed, when to turn cattle off), breeding, marketing and price risk management (e.g. futures contracts)	• Some measurement tools are available • New measurement systems **(see Theme 2)** • Enhanced Beefspecs **(see Theme 3)** • New decision support tools **(see Theme 3)**
Data is also shared up and down the value chain: • Producers receive and use feedback on the performance of their cattle at finishing, processing and retail stages; • Lot feeders / backgrounders use information from the vendor on an individual animal (or mob) basis to purchase and manage	• Enhanced and widely used LDL **(see Theme 3)** • Enhanced BeefSpecs **(see Theme 3)**

animals based on their predicted performance and carcase specifications to increase compliance rates for their target market (s);	• Better flows of information **(see Theme 4)**
• Processors use information from finishers and feedlots to predict and manage the quality of their purchases as well as match supply against demand; and information from customers (retailers) to optimise their purchases; • Retailers use information from all parts of the chain to ensure high eating quality; and • Consumers provide regular feedback through simple routes	• Easier feedback loops from consumers and customers up the chain
Key technology breakthroughs include : • Ability to predict potential carcase characteristics in young store/feeder cattle; • Autodraft facilities (at producer and feedlot) based on predictive and measured characteristics to draft cattle into mobs to reduce pen performance variation, improve pen management and timing to achieve better market compliance; and • Behind these tools, expert systems that enable producers (and others in the value chain) to continuously improve by converting data into information for decision making	• New measurement / assessment techniques **(see Theme 2)** • Greater use of EBVs and enhanced BeefSpecs **(see Themes 2 & 3)** • Tools that allow producers the ability to calculate costs and benefits of compliance **(see Theme 3)**
There is an effective and fully utilised central national database available which allows performance benchmarking against specifications (at regional, seasonal, other levels) to be monitored and non-compliance to be both quantified (in $ terms) and explained through the data captured along the chain. As a result, remedial measures can be implemented and non-compliance to market specifications falls to approximately less than 5% (down from an estimated 10%)	• Enhanced and well utilised LDL **(see Theme 3)** • Clear understanding of costs of non-compliance and ways to remedy **(see Themes 1 & 4)**
The above 'system' leads to increased compliance to market specifications, a clear understanding of the cost of non-compliance, the	• Large extension campaign to

removal of the seasonality of compliance, and participants along the value chain better meeting customer requirements.	producers, agents and other service providers **(see Theme 4)**
As a result, consumers are happy and beef consumption is increasing.	

4. Beef compliance RD&E Plan

This draft RD&E plan presented below, lists four key Themes (outcome areas) and a range of potential projects within each. It should be noted that:

- Prioritisation of themes and a more refine budget will be developed once a benefit cost analysis has been performed at the Theme level
- An indication of the priority for each project is given (High (H), Medium (M) and Low (L))
- Some projects are likely to be covered by existing work (e.g. improved EBV's via the industry Animal Genetics and Genomics strategy and BreedPlan) and these linkages are explained
- The list of projects is likely to be altered following further consideration and feedback
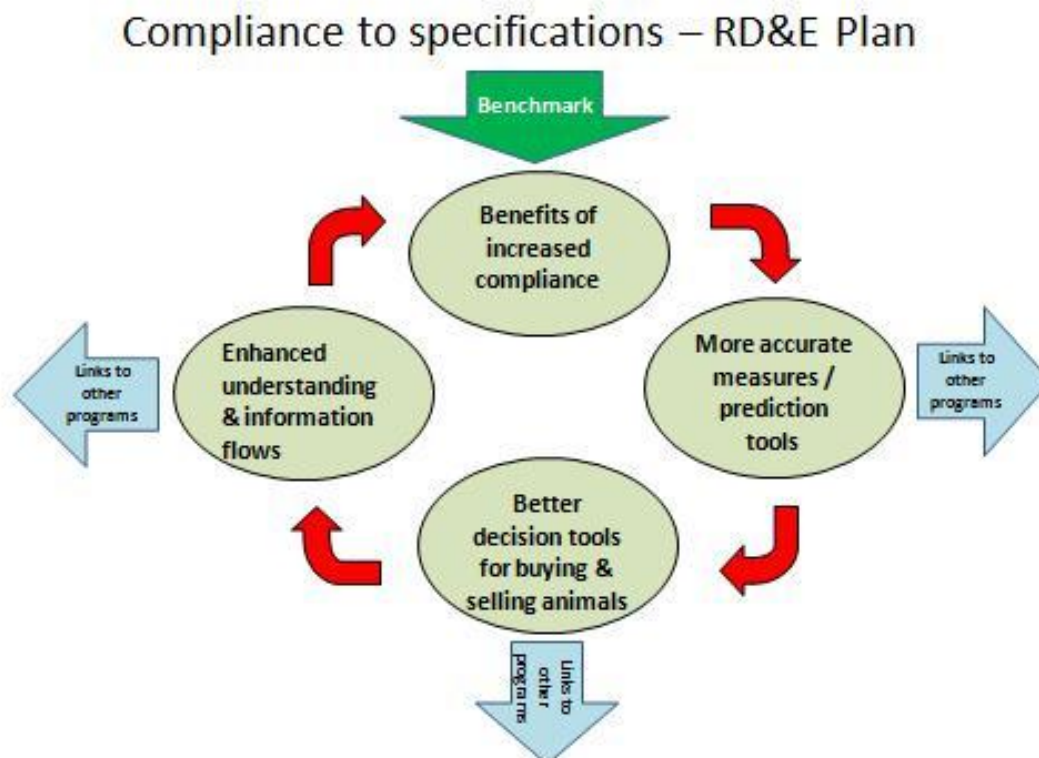
4.1 Theme areas

Four themes are proposed:

1. **Benefits of increased compliance** - gain a better understanding of the scope and cost of the problem, providing a sound basis for investments – current and future.
2. **More accurate measures / predictions** - ensure the industry has access to accurate predictive tools and measurement systems for key traits / specifications, especially on live animals.
3. **Better decision tools for buying & selling animals** - develop and demonstrate expert systems (decision support tools) to easily allow the conversion of prediction and measurement technologies of key characteristics into buying / selling mechanisms and make feedback from processors / feedlots more useful for producers.
4. **Enhanced understanding & information flows** - increase the understanding of the beef value chain and enhance information flows along it.

It is suggested that such an approach can lead to a continuous improvement ethos within the industry as depicted below:

Figure 7: Pictorial representation of Beef Compliance RD&E Plan

Theme 1: Benefits of increased compliance - gain a better understanding of the scope and cost of the problem, across different market segments, enabling both the measurement of the impact of investments and providing a sound basis for investments – current and future

1.	**Benefits of increased compliance**
Rationale:	There are a limited number of public reports / assessments available that define the scope of non-compliance to weight, fat (subcutaneous and marbling), pH, EMA and age preferred specifications and thus the true financial impact. There are some public reports and several "privately" held sources of information which are not easily accessible. There are also MSA reports but these would not necessarily be representative of the whole industry. Furthermore, most analyses on new developments (e.g. LDL, Beefspecs) tend to refer back to one detailed economic analysis from two feedlots and data is needed from pasture finished animals and more feedlots. There is also limited understanding of the value that is added (or lost) along the value chain and thus at what points intervention would be most valuable. An 'audit' of the chain is required, although it is noted that this is outside the scope of the current project and is not budgeted within this plan. A scoping study should be started immediately (along with other investments into compliance in the beef value chain). Such a study would: • provide an initial benchmark from which progress can be measured and value for investments better assessed; and • assist with determining future investments
Timeframe	2012/13
Estimated funding:	• $250,000 over 1 year (50% cash and 50% in kind from partners) • $100,000 at year 2 and year 4 for benchmarking (until such time as LDL can assume that function)
Return on investment	Benefit : Cost Ratio 5.77

Likely funding sources	MLA, ALFA and AMPC with in kind input from state agencies and private companies		
Possible projects:	Outputs	Outcome	Linkages to other programs
	a. Clarification of the true level and costs of non-compliance for different market segments - High	• Defined opportunities (and clarified extent of the problem) of greater numbers of beef carcasses meeting specifications for each key market • A benchmarking system in place for ongoing monitoring of industry progress	➢ ALFA RD&E Plan ➢ AMPC RDE Project Priorities Funding Round 2012-2013 ➢ LDL (over time) ➢ Private companies (Note: a plan in line with this suggestion has already been received by MLA)
	b. A benefit / cost audit of the entire beef value chain and understanding of where best to make investments - Medium	• Best intervention points determined through BCA and priorities ranked	➢ Separate to this plan ➢ Coordinated via MLAs CIS Group
Risks	• Preparedness of feedlots and processors to provide information on levels of compliance • Preparedness of all pipeline players to provide commercial information on costs of production and value added for value chain audit		

Theme 2: More accurate measures / prediction tools - ensure the industry has access to accurate predictive tools and measurement systems for key traits / specifications, especially on live animals.

2.	More accurate measures / prediction tools		
Rationale:	Store stock are sold / purchased largely on the basis of breed, weight (measured or estimated), fat (estimated) and age and biosecurity information (on NVD). However, at the processor level carcasses must meet a broader range of specifications that relate to processor profitability and market preference. There is a need to develop improved measurement / prediction of these key traits, especially at the live animal stage.		
Timeframe	2012/13 to 2015/16		
Estimated funding:	$800,000 per year for 4 years (50% cash and 50% in kind from partners) - $3.2 m		
Return on investment	Benefit : Cost Ratio 6.77		
Likely funding sources	MLA, AMPC, ALFA, State agencies (NSW, Vic, WA), Breed societies		
Potential projects	Outputs	Outcomes	Linkages
	a. Enhanced EBVs for meat eating quality, meat yield and marbling (IMF) - High	• Animals of superior genetics • Genetic potential to be incorporated into value-based marketing	➤ Separate to this plan, funded from linkages below ➤ Breed societies / BreedPlan ➤ ALFA Strategic Plan ➤ MLA Animal Genetics / Genomics Plan
	b. Genomics - identifying markers at competitive price to predict performance traits, including for replacement commercial heifers - High	• Animals of superior genetics	➤ Separate to this plan, funded from linkages below ➤ MLA Animal Genetics / Genomics Plan ➤ Commercial partners

	c. Improved fat / muscle assessment on live animal (non invasive scanning or camera etc) to form the basis of trading on estimated meat yield - High	• Improved objective live animal tools & skills which are used by producers, buyers and finishers • Opportunities for better "value based marketing" e.g. ability to trade on predicted retail beef yield for specific markets • Improved animal management to meet specifications	➢ MLA Strategic Plan ➢ ALFA RD&E Plan ➢ State departments (Note: a plan in line with this suggestion is understood to be under-development)
	d. Further develop across breed EBVs / standardisation of indexes - Medium	• Animals of superior genetics •	➢ Separate to this plan, funded from linkage below ➢ Breed societies / BreedPlan
	e. Improved measurement systems on carcase for marbling - High	• More objective measures of marbling • Potential to lead to improved definition of key traits (Including RBY)	➢ AMPC RDE Project Priorities Funding Round 2012-2013
	f. Further identify reasons for individual animal performance differences in feedlots, especially transition feeding - Medium/Low	• Better feedlot performance and reduced wastage	➢ Separate to this plan, funded from linkage below ➢ ALFA Strategic Plan
Risks	• Industry may not see the need for aids to visually assess animals • Logistics of "scanning" animals, transforming data to be useful and transferring information may be too complex • Reasons for differences in animal performance in feedlots is complex and much has already been done - is more required?		

Theme 3 - Better decision tools for buying and selling animals - develop expert systems (decision support) to easily allow the conversion of prediction and measurement technologies of key characteristics into buying / selling mechanisms and make feedback from processors / feedlots more useful for producers and facilitate improved management.

3.	Better decision tools for buying and selling animals		
Rationale:	There is a large (and growing) amount of information available about important animal and carcase characteristics and what impacts them. But the development of technologies for prediction / measurement of key characteristics and research information is of limited use unless they can be turned into easy to use tools to aid decision making (for buying, selling and managing animals). Considerable progress has been made with BeefSpecs and this is expected to be re-released soon. LDL is also under development. Once these tools are "in market", ongoing refinements will be necessary as will their application within various sectors of the industry. The application of a tool such as BeefSpecs is required across a range of different environments and different segments of markets to demonstrate its robustness and value.		
Timeframe	2012/13 to 2014/15		
Estimated funding:	$400,000 per year for 3 years (40% cash and 60% in kind from partners) - $1.2 m		
Return on investment	Benefit : Cost Ratio 6.20		
Likely funding sources	MLA, State agencies, ALFA, AMPC		
Potential projects	Outputs	Outcome	Linkages
	a. Further development of BeefSpecs and application / demonstration across a broad range of environments and sections of the value chain - High	• Opportunities for better "value based marketing" • Increased compliance to specifications • Producers better understand feedbase, animal growth rates etc • Producers / feedlots better manage animals to meet purchaser's grid • Wider application of BeefSpecs	➢ MLA Strategic Plan ➢ State Departments ➢ ALFA RD&E Plan
	b. Demonstration of functioning LDL with open flow of information and identification of benefits to value chain participants (including future national	• Beef industry recognises value of LDL • Benchmarking of compliance data	➢ *Decision on LDL funding soon - already being progressed by MLA, NSW*

	benchmarking program for compliance and quality) - High	• Feedback and advice on increasing compliance to producers	*Dept and Beef CRC*
Risks	• Decision support tool may prove too complex to handle all combinations for selling options • Processors don't engage with LDL		

Theme 4: Enhanced understanding and information flows - by increasing understanding about the importance of compliance to specifications, and the impacts on chain partners, a greater level of information should flow. Maintaining an RDE capacity into the future will also be critical

4.	Enhanced understanding and information flows		
Rationale:	Value chain drivers (at each point) are not well understood by all participants. A greater understanding of the value chain and enhanced information flows should lead to greater opportunities for value based marketing. Additionally, grids are not consistent and thus hard for producers to make optimum selling decisions Much valuable information is captured (or could be captured) along the supply/value chain but it is not widely analysed and often not shared freely with participants. Information that is currently generated and could be shared includes: • Producer – management information in excess of that currently required on NVDs • Backgrounder / feedlot – growth rates, benchmarks across animals / breeds, management history, nutrition regime etc • Processor – yield, compliance to weight and carcase specifications, condemned carcases (part), animal health performance issues • Retailers /wholesalers – customer feedback • Consumers – feedback to retailers and the supply/value chain		
Timeframe	2013/14 to 2015/6		
Estimated funding:	$500,000 per year for 3 years (40% cash and 60% in kind from partners)		
Return on investment	Benefit : Cost Ratio 6.06		
Likely funding sources	MLA, AMPC, State Departments, ALFA, ALPA		
Potential projects	Outputs	Outcome	Linkages
	a. A standardised format for specifications – at both the processor and feedlot level – Medium	• Easier grid interpretation • Greater engagement of producers • Consistently defined measurements on live animals	➤ ALFA RD&E Plan ➤ AMPC RDE Plan
	b. Market research to identify social / cultural and other barriers to the establishment of value based marketing - Medium	• Greater understanding of opportunities and costs • Information to help inform extension project (see d. below)	➤ MLA Strategic Plan ➤ ALFA RD&E Plan

			➢ AMPC RDE Plan
	c. Development of a comprehensive national awareness and training program for producers and livestock agents - 'meeting the market', including the development of a beef compliance 'trading game'. Include consideration of agricultural students (secondary / tertiary) - High	• Improved live animal assessment skills • Improved understanding of value chain • Increased compliance to market specifications	➢ More Beef from Pastures ➢ Better Beef programs ➢ State Departments extension efforts ➢ ALPA ➢ Schools / colleges
	d. Build the capacity of industry for an ongoing commitment to compliance and meat quality RD&E (including by building post graduate opportunities and commercial secondments in above projects) - High	• Availability for long term of skilled researchers and extension people	➢ MLA Strategic Plan ➢ ALFA RD&E Plan ➢ AMPC RDE Plan
Risks	• Processors and feedlots may not be prepared to adopt a standard format for specifications • Lack of resolution on definitions		

4.2   RD&E timeframe

A staged implementation is suggested for this area of work. While a priority is to initially clearly identifying the scope of the problem (benefits of increased compliance), there is no reason why Themes 2 and 3 should not commence / continue at the same time.

 The following chart shows the suggested stages by theme:

Timeframe for Compliance to Beef Specifications RD&E Plan				
Themes	**2012/13**	**2013/14**	**2014/15**	**2015/16**
Theme 1: Benefits of increased compliance	■			
Theme 2: More accurate measures / prediction tools	■	■	■	■
Theme 3: Better decision tools for buying and selling animals	■	■	■	
Theme 4: Enhanced understanding and information flows		■	■	■

4.3   Portfolio characteristics & who pays

As a large body of work has already been done in this area, this R,D&E plan has elements of research, development / demonstration and extension.

In discussions with industry organisations and agencies it is evident that joint contributions to specific projects would be likely, provided MLA / AMPC / ALFA saw the projects as priorities and were also prepared to invest.

While section 4.1 lists out the various linkages, the following table identifies who will be the major beneficiaries of the work and thus who should be the primary investors.

Note that while the Beef CRC is not listed, it is expected to be a key player via its partner organisations until its ceases operations.

Table 3: Potential Investors in RD&E Plan

Theme	Projects	Primary investor(s)
1.	Clarification of the true level and costs of non-compliance for different market segments	MLA, AMPC, ALFA
	A benefit / cost audit of the beef value chain and understanding of where best to make investments	MLA
2.	Enhanced EBVs for meat eating quality, meat yield, feed conversion and marbling (IMF)	Breed societies, MLA
	Genomics - identifying markers at competitive price to predict performance traits	MLA
	Improved fat / muscle assessment on live animal (non invasive scanning or camera) to form the	MLA, ALFA

	basis of trading on estimated meat yield	
	Further develop across breed EBVs / standardisation of indexes	Breed societies, MLA
	Improved measurement systems on carcase for IMF%	AMPC
	Further identify reasons for individual animal performance differences in feedlots, especially transition feeding	ALFA
3.	Refinement and release of an improved BeefSpecs to estimate potential processing performance (at a mob level)	MLA, State Depts
	Demonstration of functioning LDL with open flow of information and identification of benefits to value chain participants (including future national benchmarking program for compliance and quality)	MLA, AMPC, ALFA, State Depts
4.	A standardised format for specifications – at both the processor level and the feedlot level	AMPC, ALFA
	Market research to identify social / cultural and other barriers to the establishment of value based marketing	MLA, AMPC
	A comprehensive national awareness and training program for producers and livestock agents – "meeting the market", including the development of a beef compliance "trading game"	State Depts, MLA, private consultants, ALPA
	Build the capacity of industry for an ongoing commitment to compliance and meat quality RD&E (including by building post graduate opportunities and commercial secondments in above projects)	MLA, AMPC, ALFA, State Depts

4.4   Portfolio management

This draft Plan does not propose a substantial new Program area. Rather it is a continuation of several existing programs with some new initiatives, especially from an extension perspective.

A totally separate and new reporting structure may not be required but the importance of the area and monitoring and management of progress indicates the value of a dedicated resource for the program.

It is recommended that a member of MLA's Livestock Production Assurance (LPA) team should be given the responsibility to oversee the body of work and to provide regular updates to an industry working group (Beef Compliance) who represent the interests of the funders. This 'Beef Compliance' working group should report directly to the RMCiC (or SAMRC). The MLA person may also act as Executive Officer for the group or that role outsourced.

Membership of the Working Group should include:

- Producer (Chair)
- Additional producer
- MLA
- AMPC
- ALFA
- State Department reps (2)
- Beef CRC (or University researcher)
- ALPA or agent rep
- Executive officer

Representatives from the commercial hardware / software sector should be invited 'ex-officio' on a regular basis.

There are two other pertinent points in relation to such a working group

1. Final governance structures will be greatly influenced by the outcomes of similar considerations currently taking place for the Feedbase program.
2. Regardless of the structure adopted, because the of the strong linkages between this RD&E plan and other related plans (Feedbase, Genetics and Genomics, LDL, MSA, extension (More Beef from Pastures etc)) it will be critical that there are strong and clear inter-connections between them all.

4.5   Summary of indicative budget

The following table provides a summary of the suggested investment for this RD&E plan. The level of investment has been estimated from indicative proposals that are under preparation by potential partners, industry consultation and experience of the team in other similar projects. Funds are listed in millions of dollars. An allocation has been made for project management which would allow for the operations of the working group (estimated 2 meetings per annum) described in 4.4 above, plus a contingency allowance should sub-contracting of the project management role be required (e.g. in the (likely) event that this role could not be subsumed by existing MLA staff).

Table 4: Indicative budget - Beef Compliance RD&E Plan

Theme	Funding period	Cash ($m)	In-kind ($m)	Total ($m)
1.	2012/13	$0.25	$0.25	$0.5
2	2012/13 to 2015/16	$1.6	$1.6	$3.2
3.	2012/13 to 2014/15	$0.48	$0.72	$1.2
4.	2013/14 to 2015/16	$0.6	$0.9	$1.5
Project Mgmt	2012/13 to 2015/16	$0.3	$0.1	$0.4
Total		**$3.23**	**$3.57**	**$6.8**

5. Economic evaluation of the Plan

An ex-ante economic evaluation of this proposed RD&E plan is shown in Appendix 1.

That evaluation estimated that a total investment of $5.47 million (in present value terms) may produce gross benefits of $33.77 million (present value terms) providing a net present value of $28.30 million and a benefit cost ratio of almost 6.18:1 (over 30 years, using a 7% discount rate). Return on investment is estimated at 25.6%. Sensitivity tests (using pessimistic and optimistic assumptions) on the increase in cattle profitability attributable to improved compliance was also undertaken. The ex-ante evaluation considered on farm benefits only and did not include benefits to processors, consumers or the Australian community.

6. Alignment with other priorities

As noted throughout this report (Section 4.1, 4.3 and 4.4) there are strong linkages between this RD&E plan and several other programs and plans. These include:

- MLA Strategic Plan 2010-2015
- Australian Government's National Research Priorities and Rural Research and Development Priorities
- Meat Industry Strategic Plan 2010-2015
- National Beef Production RD&E Strategy 2010
- ALFA RD&E Strategic Plan 2011-2016
- AMPC Research, Development and Extension (RD&E) - Priorities and projects for tender
- Various MLA / meat industry plans e.g. Animal Genetics and Genomics Strategy, Feedbase R&D Plan, More Beef from Pastures, LDL, MSA

Appendix1: Ex-ante economic evaluation

Southern Beef Compliance to Specification RD&E Plan Economics

Alford A (2012)

Economic Evaluation Purpose

Ex ante economic evaluation provides insight into the likely performance of Plan investments and guides data collection to facilitate monitoring and ex post evaluation. Economic evaluation was completed in a standard benefit cost framework (see CRRDC Guidelines 2009[35]) and a real discount rate of 7% was applied. Sensitivity analysis was completed on major assumptions driving each case study / representative benefit cost analysis (BCA).

Plan Themes

The Southern Beef Compliance to Specification RD&E Plan has four investment pillars (called Themes):

1. **Benefits of increased compliance** - gain a better understanding of the scope and cost of the problem, providing a sound basis for investments – current and future.

2. **More accurate measures / prediction tools** - ensure the industry has access to accurate predictive tools and measurement systems for key traits / specifications, especially on live animals.

3. **Better decision tools for buying & selling animals**- develop and demonstrate expert systems (decision support tools) to easily allow the conversion of prediction and measurement technologies of key characteristics into buying / selling mechanisms and make feedback from processors / feedlots more useful for producers.

4. **Enhanced understanding & information flows** - increase the understanding of the beef value chain and enhance information flows along it.

A representative BCA was completed for each of the Plan's four key themes and on the Plan in its entirety.

Costs Incurred to Realise Themes

To deliver the Southern Beef Compliance to Specification RD&E Plan cash investment will be required by Meat & Livestock Australia (MLA), Australian Meat Processor Corporation (AMPC) and the Australian Lot Feeders Association (ALFA) along with in-kind contributions from state agencies and universities. Commercial players will need to contribute / partner for specific projects.

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[35] Council of Rural Research & Development Corporations 'Guidelines for Economic Evaluation' updated 2009

Industry cash investments are anticipated to total approximately $6.8 million over four years including in-kind contributions (Plan page 9). Plan investment profile is shown in the table below.

Table 1 – MLA and Co-investor Budget to Deliver Outcome 1

Theme	Funding Source	2012-13	2013-14	2014-15	2015-16	Total
1. Benefits of increased compliance	MLA, AMPC, ALFA	125,000	50,000	25,000	50,000	**250,000**
	Other co-investors	125,000	50,000	25,000	50,000	**250,000**
2. More accurate measures / prediction tools	MLA, AMPC, ALFA	400,000	400,000	400,000	400,000	**1,600,000**
	Other co-investors	400,000	400,000	400,000	400,000	**1,600,000**
3. Better decision tools for buying & selling animals	MLA, state agencies, ALFA	160,000	160,000	160,000	0	**480,000**
	Other co-investors	240,000	240,000	240,000	0	**720,000**
4.Enhanced understanding and information flows	MLA, AMPC, ALFA	200,000	200,000	200,000	0	**600,000**
	Other co-investors	300,000	300,000	300,000	0	**900,000**
Project Management		100,000	100,000	100,000	100,000	**400,000**
Total		**2,050,000**	**1,900,000**	**1,850,000**	**1,000,000**	**6,800,000**

Source: Miracle Dog *et al* June 2012

Benefits from Theme Investment

Investment in each Theme will result in a number of outcomes and these outcomes are listed in the Plan. In turn outcomes, when delivered, are expected to produce industry benefits. Potential industry benefits associated with Plan investment are described in the table below.

Table 2 –Benefits for Industry from Theme Delivery

Theme	Outcomes	Potential Industry Benefits
1. Benefits of increased compliance	• Defined opportunities for a greater number of southern beef carcases • Best intervention points determined using BCA and priorities ranked	Improved information delivering increased productivity and efficiency • Additional sales at premium prices • Production cost savings • Improved consumer satisfaction • Processor OH&S improvements Improved market access • Economic benefit realised by southern beef producers, processors and those further along the supply chain Increased biosecurity – endemic and exotic disease management • Economic benefit realised by cattle producers and processors (e.g. less condemned slaughter stock) • Environmental benefit – exotic disease prevention may benefit indigenous biodiversity • Social benefit – less risk of human health impacts associated with both endemic and exotic diseases
2. More accurate measures / prediction tools	• Cattle of superior genetics • Genetic potential to be incorporated into value-based marketing • Improved objective live cattle tools & skills which are used by producers, buyers and finishers • Opportunities for better 'value based marketing' • Improved cattle management	Potential industry benefits are of the same type as Theme 1 i.e. industry productivity and efficiency; improved market access and increased biosecurity.

	to meet specifications • More objective measures of marbling • Potential to lead to improved definition of key traits • Better feedlot performance and reduced wastage	
3. Better decision tools for buying & selling animals	• Opportunities for better 'value based marketing' • Increased compliance to specifications • Producers better understand feedbase, animal growth rates, etc. • Producers / feedlots better manage animals to meet purchaser's 'grid' • Wider application of BeefSpecs • Beef industry recognises value of LDL • Benchmarking of compliance data • Feedback and advice on increasing compliance to producers	Potential industry benefits are of the same type as Theme 1 and 2 i.e. industry productivity and efficiency; improved market access and increased biosecurity. Themes 1 and 2 provide the foundations through which benefits are realised by industry in Theme 3 and 4.
4.Enhanced understanding and information flows	• Easier grid interpretation • Greater engagement of producers • Consistently defined measurements on live animals • Greater understanding of opportunities and costs • Information to help inform extension • Improved live animal	Themes 1 and 2 provide the foundations through which benefits are realised by industry in Theme 3 and 4.

	assessment skills
	• Improved understanding of value chain
	• Increased compliance to market specifications
	• Availability of long term of skilled researchers and extension people

Key: Text of this colour indicates investment to realise this outcome is separate to this Plan

From the above table it can be seen that delivery of the Plan is about meeting consumer expectations of beef quality and maximising compliance with consumers' preferred specifications.

Additional southern beef sales at premium prices dominate expected industry impacts and this benefit, measured as improved producer profitability for cattle currently sold out of specifications, is quantified in the economic analysis. This on farm benefit is estimated using the literature referenced in the Plan (see Section 2.15).

It is noted that the analysis does not include benefits to processors, consumers or the Australian community. Data used to quantify on farm benefits is summarised in Table 3.

Table 3 – Summary of Assumptions

Variable	Assumption	Source and Comment
Increase in beef cattle profitability attributable to improved compliance with specifications	$25/head	Slack-Smith *et al* (2009)[36] established a per head loss for short-fed feedlot cattle of $23/head; long fed of $11 /head; and $105 / head for cattle outside required marbling score. Using this data as a guide and with knowledge that improved compliance will also benefit grass finished beasts a conservative estimate of $25/head for all Southern slaughter cattle was selected.
Australian southern cattle kill	5 million head	5 million cattle slaughtered in target market – age 24 months (max) two tooth or less for domestic and / or short fed and mid fed market needs and cattle of 2 or 4 tooth (30 months or less) for long fed markets.

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[36] Slack-Smith, A et al (2009) The Cost of Non-Compliance to Beef Market Specifications, Australasian Agribusiness Review – Vol.17 – 2009, Paper 9, ISSN 1442-6951

Cattle out of specification with the potential to benefit from Plan outcomes	25%	NSW DPI LDL analysis March 2012 also consistent with Slack-Smith 2009.
Adoption rate – of the cattle that are out of specification % that adopt plan outcomes	25%	NSW DPI LDL analysis March 2012
Year in which improved information flows and some adoption of plan outcomes first occurs	2018	Consultant assumption based on review of the RD&E Plan
Year in which maximum adoption occurs	2023	Consultant assumption based on review of the RD&E Plan
Year when profitability improvement begins to decay	2031	Consultant assumption based on review of the RD&E Plan
Probability of research success delivering industry profitability improvement.	80%	Consultant estimate based on plan quality and low risk profile of MLA investments

Table 3 data enables the estimation of total forecast on farm returns from investment in the Plan. To estimate returns from each of the four Plan Themes it is necessary to 'unbundle' the total benefit pool and allocate it to each of the Themes. This is not a straightforward exercise as each theme is interdependent and Themes 1 and 2 are really about providing a foundation for delivery of Themes 3 and 4 (see Table 2). Given the interdependence of themes the only sound way to unbundle the benefit pool is to allocate it on a relative inputs basis i.e. industry benefits are assigned to each theme as a proportion of the cost of delivering each pillar.

Benefit Cost Analysis Results and Discussion

Benefit cost analysis results for each of the four Plan Themes and the whole Plan (including project management costs) is summarised in Table 4.

Table 4 – Benefit Cost Analysis Results (Discount rate 7%, 30 years)

Theme	Present Value of Benefits ($/million)	Present Value of Costs ($/million)	Net Present Value ($/million)	Benefit Cost Ratio	Internal Rate of Return (%)
Theme 1: Benefit of increased compliance	2.36	0.41	1.95	5.77	24.2
Theme 2: More accurate measures / prediction tools	15.87	2.53	13.34	6.27	26.2
Theme 3: Better decision tools for buying and selling animals	6.08	0.98	5.10	6.20	25.2
Theme 4: Enhanced understanding and information flows	7.43	1.23	6.20	6.06	24.9
Plan total#	**33.77**	**5.47**	**28.30**	**6.18**	**25.6**

(includes project management costs not allocated to individual themes)

Results show an acceptable return on investment using a conservative set of assumptions. For example the analysis has assumed that the increase in beef cattle profitability attributable to improved compliance with specifications is $25/head. This assumption is based on grids that take into account only weight and fat. Grids that include marbling which may make up to 40% of cattle sold over the hooks are not accounted for and may increase compliance opportunity costs by up to $0.25/kg carcase weight (approximately $62.50/head).

Furthermore there are other efficiencies that are obtained through greater carcase compliance through the supply chain that have not been included in the analysis. ProAnd Associates (2012)[37] found that while improved compliance with carcase specifications would benefit the beef production sector to the tune of $51 million annually, there is a further $64 million lost annually through carcase condemnations and between $12 million and $49 million in offal and meat condemnations, largely due to animal disease. The compliance to specification RD&E plan would also have a role in addressing current carcase condemnation rates.

On the other hand, there currently appears to be relatively high industry costs of non-compliance despite the current price signals provided by the grids. This would suggest that cost of non-compliance for some producer segments is not as high as the industry averages. Reasons may include:

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[37] ProAnd Associates (2012) Livestock Data Link – Analysis of the Benefits for the Processing Sector prepared for MLA

- For small cattle lots drafting and retaining some stock on farm is likely to be problematic leading to higher labour costs and management time that is not readily captured in farm budgets;

- Higher transport charges for incomplete loads;

- Increased market risk with producers foregoing sales in the expectation of achieving a premium at a later time by retaining and growing out under specification cattle; and

- Opportunity cost of feed fed to retained stock which might alternatively be fed to a younger cohort of stock that will have more efficient conversion to feed to live weight.

Similarly in feedlots there are limitations on harvesting stock out of pens and the mixing of pens.

Sensitivity Testing

Given that valid arguments have been made for both a higher and lower profit per head estimate to be used in the benefit cost analysis, it is important that evaluation results are reviewed using sensitivity testing. The 'core' assumption of a $25/head increase in beef cattle profitability is tested at $8/head and $60/head. Results are shown in Table 5.

Table 5 – Sensitivity Test on the Increase in Cattle Profitability Attributable to Improved Compliance

Criterion	Pessimistic Assumption ($8/head)	Core Assumption ($25/head)	Optimistic Assumption ($60/head)
Present value of benefits ($/million)	10.81	33.77	81.05
Present value of benefits ($/million)	5.47	5.47	5.47
Present value of benefits ($/million)	5.34	28.30	75.58
Benefit cost ratio	1.98	6.18	14.83
Internal Rate of return (%)	12.9	25.6	38.2

An $8/head profit increase will generate a benefit cost ratio of approximately 2:1 with other analysis assumptions held constant.

Economic Evaluation Conclusion

Investment in the Southern Beef Compliance to Specification RD&E Plan has been assumed to produce a number of benefits, one of which has been valued (i.e. improved profitability for cattle that currently fall outside market specification). A total investment in the Plan of $5.47 million (in present value terms) has been estimated to produce gross benefits of $33.77 million

(present value terms) providing a net present value of $28.30 million and a benefit cost ratio of almost 6.18:1 (over 30 years, using a 7% discount rate). Return on investment is estimated at 25.6%. This is an on farm benefit only and does not include benefits to processors, consumers or the Australian community.

Appendix 2: Listing of organisations consulted

Group	Organisation	Name	Title	Location	State
Agency	NSW DPI	Todd Andrews	Beef cattle officer	Scone	NSW
Agency	PIRSA	Ben Hebart	Project Manager, Value Chain Development	Adelaide	SA
Agency	DAFWA	Hayley Robinson	Beef Supply Chain Development Officer	South Perth	WA
Agency	Vic DPI	Dougal Purcell	Beef Extension Officer	Ballarat	Vic
Agency	NSW DPI	Malcolm McPhee	SnrLivestock Research Officer (Livestock Production / Modeller)	Armidale	NSW
Agency	NSW DPI	Hutton Oddy	Principal Research Scientist)	Armidale	NSW
Agency	NSW DPI	Kirrily Pollock	Research Economist	Armidale	NSW
Agency	NSW DPI	Robin Dobos	Research Scientist	Armidale	NSW
Agency	NSW DPI	Robert Herd	Principal Research Scientist	Armidale	NSW
Agency	NSW DPI	John Wilkins	Senior Livestock Research Officer	Wagga Wagga	NSW
Agency	NSW DPI	Brett Littler	Livestock Officer Beef Cattle	Mudgee	NSW
Agency	NSW DPI	Linda Cafe	Livestock Research Officer	Armidale	NSW
Agency	Beef CRC	Bill McKiernan	Researcher / part developer Beef specs	Armidale	NSW
Agency	MLA	Jo Quigley	LDL (initial)	Sydney	NSW
Agency	MLA	Michael Crowley	MSA	Brisbane	Qld
Agency	MLA	David Jones	MSA	Brisbane	Qld
Breed Societies	Charolais	Terence Farrell	CEO	Armidale	NSW
Breed Societies	Limousin	Alex McDonald	General Manager	Armidale	NSW
Breed Societies	Angus	Peter Parnell	CEO	Armidale	NSW
Breed Societies	Hereford	John McKew	CEO	Armidale	NSW
Commercial	Graham Lean & Assoc.	Graham Lean	Director/Consultant	Hamilton	Vic
Commercial	Holmes &Sackett	Sandy McEachern	Consultant	Wagga Wagga	NSW
CRC	Beef CRC	Heather Burrow	CEO	Armidale	NSW
CRC	Beef CRC	Brad Walmsley	Researcher / modeller Beef specs	Armidale	NSW
Industry Groups	SAMRC	Kevin Smith	Executive Chair	Byaduk	Vic
Industry Groups/ Producer	WA Beef Council	Tony Hiscock	Chairman	Waroona	WA
Industry Groups/Feedlot	WALFA	Ivan Rogers	Chairman	Tammin	WA
Industry Groups	Cattle Council Aust	Paul Fry	Industry& Policy Analyst	Canberra	ACT
Feedlots	ICM Agribusiness	Will Cowley	Operations Manager Peechelba feedlot	Wangaratta	Vic
Feedlots	JBS	James Palfreeman, Michael Doyle	Manager Feedlots	Brisbane	QLD
Feedlots	JBS	Richard Nichols	Manager Caroona Feedlot and Farm	Caroona	NSW
Processors	JBS	Mark Inglis	On farm Market Assurance Manager	Melbourne	Vic
Processors	Greenham Tasmania	Peter Greeham Jr	Managing Director	Smithton	Tas
Feedlots	Rangers Valley	Richard Eldershaw	Livestock Manager	Wagga Wagga	NSW
Feedlots	Rangers Valley	Don Mackay	CEO Rangers Valley, Feedlot Manager	Glen Innes	NSW
Producer	Coorong Angus Beef	Perry Gunner	Producer	Meningie	SA
Producer/Feedlot	S Kidman & Co	Greg Campbell	Managing Director	North Adelaide	SA
Producer/Feedlot	Producer	John Fry	Producer	Donnybrook	WA
Producer	Producer	Bruce Mitchelhill	Producer	Muswellbrook	NSW
Producer	Producer	Graham Moore	Producer	Glen Innes	NSW

Producer	Producer	Douglas Hall	Producer	Barraba	NSW
Producer	Producer	Brian Duddy	Producer	Goondiwindi	NSW
Producer	Producer	Stephen & Jodie Peake	Producers	Barraba	NSW
Producer	Te Mania	Hamish McFarlane	Co-principal	Mortlake	Vic
Retailer	Coles	Guy Hooper (initial)	Business Category Manager, Meat	Melbourne	Vic
University	UNE	Gary Griffith	Adjunct Professor (co-author Slack-Smith paper)	Armidale	NSW
University	UNE/AGBU	Stephen Barwick	Principal Research Scientist	Armidale	NSW
University	UQ	Don Cameron	Senior Lecturer/Post Grad Coordinator	Gatton	QLD
University	U Adelaide	Wayne Pitchford	Associate Professor	Roseworthy	SA
University	U Adelaide	Dave Rutley	Research Scientist	Roseworthy	SA
University	U Adelaide	Stephen Lee	Research Scientist	Roseworthy	SA
University	Murdoch Uni	Peter McGilchrist	Post Doctoral Fellow	Perth	WA

Appendix 3: Documents reviewed in the preparation of this plan

Author(s)	Date	Title
ABARE	2004	Australian Beef Industry 04.3 Production and Sale of Beef Cattle December 2004
ABARE	2005	Australian Beef Industry 05.1 Farm financial performance to 2004-05
ABARE	2006	Australian Beef Industry 06.1 Farm financial performance to 2005-06
ABARE	2007	Australian Beef 07.2 Financial performance and production to 2006-07
ABARE	2008	Australian Beef 08.1 Financial performance of beef farms 2005-06 to 2007-08
ABARE	2009	Australian Beef 09.1 Financial performance of beef farms 2006-07 to 2008-09
ABARE	2010	Australian Beef 10.1 Financial performance of beef cattle producing farms 2007-08 to 2009-10
ABARES	2011	Agricultural Commodities December Quarter 2011
ABARES	2011	Agricultural Commodities September Quarter 2011
ABARES	2011	Australian Beef 10.1 Financial performance of beef cattle producing farms 2008-09 to 2010-11
ABARES	2012	Agricultural Commodities March Quarter 2012
ACC	2010	Statement of Issues - Swift Australia Pty Ltd - proposed acquisition of Rockdale Beef Pty Ltd
Agtrans	2008	Economic Evaluation of MLA Feedlot Investment 2001-2006
ALFA	2011	Grain fed cattle numbers fall, Media release
ALFA/MLA	2011	Feedlot Program – Research, Development & Extension Strategic Plan 2011-2016
AMPC	2010	AMPC 2010 Annual Operating Plan 2010-2011
AMPC	2012	AMPC RDE Project Priorities Funding Round 2012-2013 (3) final draft
APHIS	2011	Animal disease traceability: A guide to identifying cattle and bison for interstate movement, Factsheet, August
Andrews T & Littler B	2007	Market specifications for beef cattle, NSW DPI, Primefact 621
Beef CRC	2010	Beef Genetics Discussion Paper (Draft 12 October 2010)
Beef CRC	2010	Feeder Steer School, Armidale - Course papers
Beef CRC	2011	CRC (extension bid) 14th selection round - Response to Selection Criteria Form (final)
Beef CRC	2011	Progress Report Sub-Program 1.2 Prediction of Phenotype (as at March 2011)
Beef CRC	2012	Muscularity reduces dark cutting, Media release
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Appendix 4: Other pertinent RD&E issues

While outside of the scope of this Plan, the review team were asked to identify any other issues that may be of importance from an RD&E perspective in relation to the southern beef industry that were identified during industry consultation.

A brief summary of such issues is provided below.

They must be taken as observations / anecdotes rather than being of a substantive nature. They are not recommendations and are included for advisory purposes only.

1. The 'divide' between the northern and southern beef industry (while extremely blurred) needs to be broken down. While the difficulties are clearly understood, there were repeated calls for greater alignment between the two sectors - across all production aspects - breeds, genetics (especially greater use of EBVs in the north), compliance, management, welfare etc.

2. With recent advances in technology transformational research is needed to reduce labour inputs and increase efficiency. Compliance and thus improved market access can also include animal welfare on farm and at slaughter, resource use efficiency (land, grain, water, carbon footprint) and 'ethical farming' more generally

3. One of the biggest reasons for inconsistent animals is long calving period - this should be identified more in extension

4. Producers would like much more information on feed efficiency for growth particularly so that stocking rates can be adjusted in feed deficit periods or so they can sell beforehand. There is a lack of information on FCE growth data for pasture fed animals.

5. Weeds need more research – those mentioned included Parramatta grass, Coolatai grass (from South Africa) Giant African Love Grass and Fleabane weed

6. There is support for more extension of present research – e.g. 'beef feeder schools' were regarded as valuable (and 'More Beef from Pastures'). There were also some queries as to whether extension methodology was right (by implication, why progress is not greater)

7. Producers need RD&E that can lead to greater farming system flexibility, especially with the likelihood of increased climate variability

8. Scenario planning / forecasting - need major improvements in overall productivity if Australian beef is to remain competitive. The beef industry in 20 years will require fundamental research now. What might the industry be like - what markets, prices, farming and finishing systems, restraints (land, water, carbon etc)?

Appendix 5: Distribution of broadacre beef cattle farms by size[38]

	number of farms	share of farms	share of beef cattle	share of value of cattle sales
	no.	%	%	%
Northern Australia				
< 100	1 169	19.5	1	2
100–200 head	841	14.1	2	2
200–400 head	1 042	17.4	4	5
400–800 head	956	16.0	7	7
800–1 600 head	877	14.7	13	14
1 600–5 400 head	845	14.1	30	29
> 5 400 head	250	4.2	44	40
Total	5 981	100	100	100
Southern Australia				
< 100	4 956	31.3	5	7
100–200 head	3 845	24.3	11	11
200–400 head	3 593	22.7	20	21
400–800 head	2 247	14.2	25	23
800–1 600 head	855	5.4	18	17
1 600–5 400 head	310	2.0	16	17
> 5 400 head	27	0.2	4	3
Total	15 832	100	100	100
Australia				
< 100	6 125	28.1	2	5
100–200 head	4 686	21.5	5	7
200–400 head	4 635	21.2	10	13
400–800 head	3 203	14.7	14	15
800–1 600 head	1 732	7.9	15	15
1 600–5 400 head	1 155	5.3	24	23
> 5 400 head	276	1.3	29	22
Total	21 813	100	100	100

Note: Excludes major feedlots.

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[38]ABARES (2011).Financial performance of beef cattle producing farms 2008-09 to 2010-11, ABARES, Canberra.