REPORT

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Red meat eating quality

Recent program performance

Prepared for

Meat and Livestock Australia

Centre for International Economics
Canberra & Sydney

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The CIE's professional staff arrange, undertake and publish commissioned economic research and analysis for industry, corporations, governments, international agencies and individuals.

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Summary

The Centre for International Economics (CIE) has been commissioned to assist MLA with an ex-post analysis of the eating quality program. The purpose of this evaluation is to quantify the performance of the program during the period from 1999-2000 to 2010-11 (this involves estimating the benefits out to 2019-20).

The red meat eating quality program comprises a R&D portfolio, the Meat Standards Australia (MSA) grading system and the adoption of electrical stimulation technology in the processing sector. Over the evaluation period MLA expenditure on the MSA system has been heavily weighted towards the cattle and beef industry ($75.4 million, versus $5.9 million for the sheep and sheepmeat industry in nominal terms). By contrast, approximately 75 per cent of expenditure ($10.9 million) on electrical stimulation has been allocated to sheepmeat, versus $3.6 million to beef.

Overall the program can be identified as a success story with 1.4 million beef carcasses and approximately 0.8 million lamb carcasses MSA graded in 2010-11 and significant premiums being achieved for MSA cattle and beef.

- In 2011-12, over 2 million cattle and 3.3 million sheep were graded.

In summary: taking a whole of chain approach, and including the investments by the CRCs under a low and high scenario and the investment by MLA in electrical stimulation, the net benefit of the beef eating quality program is between approximately $1 059.0 and $1 135.4 million in present value terms representing a benefit cost ratio between **3.7** and **4.5** to 1 out to 2019-20. These benefits can be broken down along the supply chain as follows:

- the anticipated net benefits at the beef producer level were found to be $545.0 million in present value terms resulting in a benefit cost ratio of 6.2 to 1 over the evaluation period.
- the net benefit to processors that adopted MSA was estimated to be approximately $605.6 million, resulting in a benefit cost ratio of 1.7to 1.
- The net benefit at the retail level was estimated at $12.8 million and a benefit cost ratio of just over one.
  - The actual payoff to retail, in terms of improving the attractiveness of their offer relative to their competitors, is likely to be substantially larger because the analysis does not reflect the benefits of the improved red meat offer on overall store turnover.

- Benefits were not able to be quantified for the sheepmeat eating quality program. The main reason for this is the inherent differences between the MSA beef and sheep systems. MSA beef is a cuts-based grading system which involves predicting the eating quality outcome of individual cuts in a carcass by individually grading each carcase. Individual carcase grading enables a price signal to flow to members of the supply chain when they adopt practices which enhance eating quality outcomes. By contrast, MSA sheep is a process control system, so it does not generate strong price signals when, for example, a processor adopts an intervention like electrical stimulation which has a positive impact on eating quality. Instead, the benefits are more widely dissipated and harder to quantify in a cost-benefit analysis.
- The benefits of participating in the MSA sheep program are captured by processors and their suppliers when they gain access to key customers who now require it as part of their supply contracts. The pricing associated with these supply contracts are highly confidential. Outside of these integrated supply chains, the tight supply conditions for lamb have made it extremely challenging to extract consistent price premiums for MSA eligible sheep.
- While MSA Sheepmeat is in its early stages, relative to beef, it has made a contribution through an improvement in process control and overall quality levels and consistency of the lamb industry. Also, the knowledge gained through the R&D portfolio is ensuring that the positive eating quality attributes of lamb are protected when pursing productivity objectives. At the processing level we recognise that the benefits of adopting MSA must be at least equal to, or greater than, the additional costs of those who have adopted it.
- In terms of the internal rate of return for the program, the breakeven point for the discount rate, where the present value of benefits equals costs, was found to be between 74.1 and 78.6 per cent.

The Eating Quality program

The eating quality program is a unique MLA program because it integrates research and development (R&D) with marketing activities and involves participation along the entire Australian red meat value chain.

Four MLA business units (Industry Systems, Livestock Production Innovation, Client Innovation Services and Global Marketing) collaborate to deliver the outcomes of the eating quality program.

The Eating Quality program reflects the themes and imperatives outlined in the Meat Industry Strategic Plan (MISP) 2010–2015 and are consistent with the MLA Strategic Plan 2010–2015.

The eating quality program can be subdivided into four pillars which form the structure for implementation:

- Research and Development;
- Integrity;
- Adoption; and
- Marketing and Promotion.

MISP Strategic Theme 5: Innovation

Increase competitiveness and profitability through innovation

5.1. **Capacity to innovate:** Build capacity to research and innovate.

5.2. **Production efficiencies:** Enhance production efficiencies through innovation.

5.3. **Innovative products:** Place consumers first in developing innovative products.

5.4. **Speed and adoption:** Increase the speed and adoption of innovation.

5.5. **Innovative communication:** Implement innovative, rapid and effective communication with all stakeholders.

MISP Strategic Theme 6: Marketing and Promotion

Focus on the consumer to continue to achieve profitable growth in demand for Australian red-meat and livestock products.

6.1. **Positive attributes:** Promote the positive attributes of red meat to engender consumer trust so red meat becomes the product of choice.

6.2. **Promote versatility:** Promote the versatility of red meat products to meet the demands of changing consumer eating patterns.

6.3. **Branded products:** Assist with the development and utilisation of appropriately branded products in selected markets to enhance consumer confidence and increase profitability.

6.4. **Market diversification:** Seek opportunities for commercial expansion into a greater range of markets, and further penetration of existing markets, to broaden marketing choices and more evenly distribute risks associated with market downturns.

6.5. **Marketing techniques:** Adopt new marketing techniques and encourage retail innovation to maximise efficiency and effectiveness in growing demand for red meat and livestock.

Strategic themes 5 and 6 of the MISP contain the elements that determine the strategic direction of the eating quality program. The eating quality program encompasses an innovation component (strategic imperatives 5.1 and 5.3) which

forms the first **'research and development'** *pillar* in the eating quality program, a framework to drive adoption of these innovations (strategic imperatives 5.4 and 5.5) that relies on a rigorous integrity program which forms the second **'adoption'** and third **'integrity programs'** *pillars* of the eating quality strategy and finally a marketing and promotion component (in particular strategic imperative 6.1, but also 6.2 to 6.5) which forms the fourth **'marketing and promotion** *pillar* of the eating quality plan.

The objective

A high level of consumer confidence in product performance is necessary for food-industry category success. MLA's goal is for the Australian industry to provide customers with beef and sheepmeat of consistent and predictable eating quality in both domestic and export markets via adoption of the Meat Standards Australia (MSA) system.

Over the evaluation period, the focus of MSA has been driving participation and ensuring adherence to the standards. Now that a 'critical mass' of product is flowing through the system, the focus is shifting to initiatives which extract greater value from the MSA system. Reducing eating quality variation within brands, increasing the volume of MSA-graded product per carcass and strengthening MSA's integrity are three key initiatives.

Investments

Since 1998 the industry, through MLA, has spent around $105.4 million ($89.7 million on beef and $15.7 million on sheep), an average of $7.1 million a year. A small part of this investment has been recovered through fees paid by processors to become MSA accredited, approximately 6 per cent of the total expenditure by MLA or some $4.5 million.

The outcomes

Overall the program can now be identified as a success story with 1.422 million beef carcasses and approximately 0.833 million lamb carcasses being graded in 2010-11 with significant premiums being achieved at the retail level for beef, especially for higher value cuts.

- This includes involvement with all parts of the chain including approximately 19 000 producers and 46 processors accredited, 55 underpinned brands, 1 550 end users licensed.

The penetration of red meat, produced by MSA accredited and licensed processors, into the domestic market is estimated at 19.3 per cent of the total volume of domestic disappearance in 2010–11 for beef and 8.3 per cent for lamb.

- To this point, MSA is almost exclusively used for beef sold to the domestic market, with very little reach into export markets.
- For sheepmeat, the potential widespread use of MSA process controls by processors, who may not be fully licensed, makes this contribution substantially larger for both domestic and export markets.

Beef retail premiums in 2010-11 were, as a simple average across graded primals and cuts, 114 cents per kilogram when compared to equivalent ungraded product.

Consumption figures, using domestic disappearance, are consistent with expenditure trends observed in the retail channel; suggesting an annual average decline of 0.3 per cent over time. Despite the fact that consumption and demand are not growing, it does not mean the program has necessarily been unsuccessful.

- There are several factors affecting demand, besides eating quality, and it may well be that the integrated approach by MLA is actually off setting the even greater decrease in demand due to adverse market effects. However, there is not sufficient information available to this evaluation to isolate the contributing effect of each demand driver, eating quality among them.

While the program has achieved significant benefits as identified above, a current issue is that MSA accredited processors appear not to be using the grading system to its full potential. This may ultimately be limiting the total value that can be extracted from participation in the scheme. Opportunities exist to capture more value by segregating higher eating quality cuts (4 and 5 star) and marketing more cuts in the carcass as MSA. Further, there may be the opportunity to further strengthen the performance of enterprise brands by decreasing eating quality variation.

- For example, a recent pilot study conducted at a medium sized abattoir demonstrated that premiums could be obtained, at least in the short term, from the recovery and marketing 4 and 5 star products.
- It is important that MLA works closely with supply chains to develop these opportunities because a company's cost structures must be taken into account when determining which opportunities to pursue.

There is no routine data collection for premiums on retail lamb sold in the domestic market. This reflects the fact that MSA Sheepmeat has evolved as a process control system that improves quality and product consistency.

- For some supermarket customers, MSA Sheepmeat has been incorporated directly into the minimum specifications of supply, so that a premium cannot be readily observed because of confidentiality of commercial contracts.
- Processor compliance costs with MSA Sheepmeat are not fully understood. While the direct costs including auditing and the requirement for certain equipment are likely to be very small on a per kilogram basis, other in-kind costs or constraints on implementing MSA Sheepmeat may be substantial.

- Given the current strong market conditions for lamb at retail and through saleyards, consistent price premiums are difficult to observe.

Electrical stimulation (MQST)

The adoption of electrical stimulation (ES) has supported improved eating quality outcomes and is fundamental to the MSA program. Currently it is estimated that ES has been installed in 40 Australia plants with 16 in beef operations and 24 in sheepmeat operations. In terms of production, the impact is significant.

- It is estimated that ES as a process intervention for lamb accounts for between 75 and 89 per cent of total lamb produced for the domestic market in either MSA accredited operations or those with installed ES capacity.
  - Currently, around half of lambs stimulated in MSA accredited plants are presented for MSA grading.
  - ES is used in the production of between 58 and 85 per cent of total lamb production, which includes exported product.
- Currently, all beef graded MSA is stimulated except for heavy grain fed carcasses (120 days or more on feed). These heavy carcasses are likely to comprise less than 15 per cent of all graded carcasses.
  - Therefore around 1.2 million beef carcasses were likely to benefit from ES-based interventions as part of the MSA program in 2010-11.

The payoffs of the program

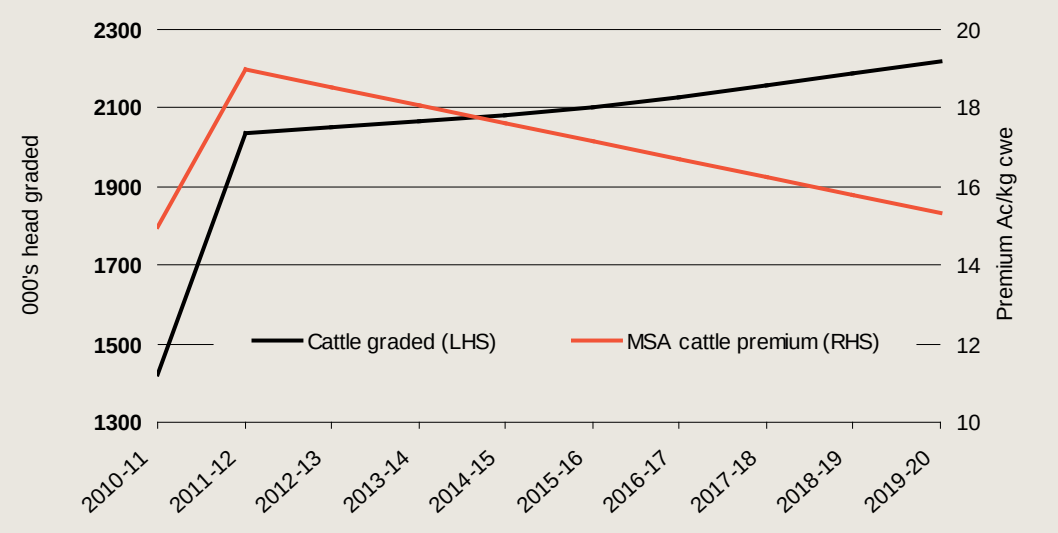
The assumed benefit profile also reflects that many of the MSA benefits should persist even if the R&D and marketing activities undertaken by the program were not (theoretically) funded beyond the end of the evaluation period (2010–11). For this evaluation we have assumed that MSA would continue to conduct auditing and compliance activities that would be required to maintain the integrity of the MSA system and brand. Therefore benefits were estimated out to 2019-20.

Key assumptions in these baselines include:

- total beef carcasses 'graded' MSA reaches 2.0 million in 2011–12 and, following the anticipated growth in the herd, reaches 2.1 million by 2015–16;
- price premiums paid at all levels of the chain are expected to peak in 2011-12 and then fall back to those levels observed in 2010-11 by 2019-20.

As a result, price premiums are assumed to fall from current levels (19 cents per kilogram in 2011–12) to around 15 cents per kilogram (a 15 per cent fall) back to the level of premiums observed in 2010–11.

1 **Baseline MSA number of cattle graded and premiums**



Data source: CIE.

Table 2 summarises the estimates of aggregated costs and benefits only for the beef industry at various levels in the value chain and the corresponding benefit cost ratios.

- It should be noted that estimates should not be added across each level of the value chain to avoid double counting.
- In addition, comparing the costs to producers with the benefits at retail should be avoided, unless the benefits at retail flow back to producers, who fund the program, at saleyard equivalent terms.

In present value terms, the MSA program has invested $99.3 million on behalf of levy payers up to 2010–11.

Under the baseline assumptions, another $3.6 million in present value terms of expenditure would be required to run MSA compliance and auditing tasks up to 2019-20. In addition, a further $3.9 million in present value terms should be included as a result of MLA's investment in electrical stimulation that can be attributable to beef.

There has been limited analysis of benefits and compliance costs of the MSA sheepmeat program. The main reason for this is the inherent differences between the MSA beef and sheep systems as discussed earlier.

- While MSA Sheepmeat is in its early stages, relative to beef, it has made a contribution through an improvement in process control and overall quality levels and consistency of the lamb industry.
- Also, the knowledge gained through the R&D portfolio is ensuring that the positive eating quality attributes of lamb are protected when pursing productivity objectives.

2 **Benefits and costs at various levels in the beef value chain[a]**

	Costs	*Benefits*	*Net benefits*	*B:C ratio*
	$m	$m	$m	
Beef Producers				
Levy funds	105.1			
On-farm compliance	0.0			
MSA premiums for cattle	0.0	650.9		
Total	105.1	650.9	545.8	6.2
Processors/wholesale				
MSA premiums on cattle	650.9			
Processing compliance	185.9			
MSA wholesale premiums	0.0	1 442.5		
Total	836.8	1 442.5	605.6	1.7
End users				
MSA premiums on beef	1 442.5			
Retail premiums	0.0	1 455.3		
Total	1 442.5	1 455.3	12.8	1.0
CRC investments				
Low – beef	24.9			
High – beef	101.1			
Electrical stimulation (MQST)				
Total - beef	3.9			
All sectors including CRC and MQST[b]				
Total – low CRC	319.9	1 455.3	1 135.4	4.5
Total – high CRC	396.3	1 455.3	1 059.0	3.7

[a] Net present value basis in 2008-09 dollars over the period 1999-00 to 2019-20 using a real discount rate of 7 per cent. [b] Total costs and benefits of the beef chain exclude costs passed between segments of the value chain.

Source: CIE.

Therefore, for this evaluation, we are unable to put a value on the benefit from MSA Sheepmeat, even though at processing level we recognise that the benefits of adopting MSA must be at least equal to, or greater than, the additional costs of those who have adopted it.

In terms of the internal rate of return for the beef program, the breakeven point for the discount rate, where the present value of benefits equals costs, was found to be between 74.1 and 78.6 per cent.

- While no benefits were identified for improved eating quality in sheepmeat at this point in time, MSA sheep will likely deliver increasing market opportunities as large domestic end-users place more importance on process control.

Attribution of benefits between the contributors — MLA, the CRCs and industry — proved to be problematic due to the limited amount of data available.

- A key issue was the treatment of the substantial investments made by the Beef CRC in eating quality prior to the evaluation period and the also inclusion of non-staff in-kind costs.

- Other factors included the capacity of each of the contributors to obtain leverage from others to improve the overall eating quality outcome. It should be noted that this analysis probably underestimates the contribution of industry due to the difficulty in identifying and measuring in-kind costs.

In the end, the CRRDCC Evaluation guidelines were consulted and the standard approach for attribution of benefits between the three contributors was made in proportion to the relative levels of investments made over the evaluation period — with the result that each of the contributors achieved the same benefit cost ratio.

Glossary

ABARE	Australian Bureau of Agriculture and Research Economics
AMPC	Australian Meat and Processor Corporation
AMILSC	Australian Meat Industry Language and Standards Committee
AOP	Annual Operating Plan
CIE	Centre for International Economics
CRC	Cooperative Research Centres
EBV	Estimated Breeding value
EYCI	Eastern Young Cattle Indicator
HGP	Hormonal Growth Promotant
HVES	High voltage electrical stimulation
ICA	Industry Collaborative Agreement
IF	Integrated Framework
LVES	Low voltage electrical stimulation
MISP	Meat Industry Strategic Plan
MLA	Meat and Livestock Australia
MSA	Meat Standards Australia
MQST	Meat Quality Science and Technology
MVES	Medium voltage electrical stimulation
OTH	Over the hooks
PIP	Plant Initiated Project
SMEQ	Sheepmeat Eating Quality
QA	Quality Assurance
TBC	Tropical breed content
USMEF	United States Meat Exporters Federation

1 This evaluation

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The eating quality program can be subdivided into four pillars which form the structure for implementation:

- Research and Development;
- Integrity;
- Adoption; and
- Marketing and Promotion.

The Centre for International Economics (CIE) is pleased to assist and recognises that this review complements a concurrent evaluation on MLA's domestic marketing program.

- This may provide an opportunity to better identify the separate impacts of two of the five pillars of demand for the domestic red meat market.

Previous evaluations

In **1996**, CIE conducted an ex-ante analysis on the implementation of a national eating quality assurance scheme, on behalf of the Meat Research Corporation. The study estimated the net benefits and costs of implementing the system for beef and for lamb over a period of 14 years, from 1997 to 2010.

- The benefits consisted of price premiums and increased sales (throughput) for producers, processors and wholesalers and of greater eating quality available for consumers.

The assumptions used in 1996 to estimate the benefits that were to progressively occur from year 1 to year 5 reaching the following maximums:

- 2 per cent increase in the beef retail price and 3 per cent in the wholesale price of lamb;
- 10 per cent increase in consumption of beef and 3 per cent in that of lamb;
- 1 per cent reduction in production costs a year for participating cattle producers; and
- adoption up to 50 per cent of the kill for both beef and lamb.

- Costs were assessed in terms of licensing/accreditation and changes to production technology to meet the scheme standards for producers, processors and wholesalers and of increased prices for consumers.

  The underlying assumptions for estimating the costs of the scheme were:

  - costs were split between:
    - set up costs; and
    - ongoing costs: research and operating costs (administration, grading and promotion);
  - a fundamental assumption was the cost of a grader:
    - for beef it was assumed that a grader could grade 200 carcasses a day for 200 days a year, with the cost of a grader at around $100 000 a year increasing at 3 per cent a year; and
    - for lamb it was assumed that a grader could grade 600 carcasses a day for 250 days a year and the average annual cost of a grader was approximately $80 000 a year increasing at a 3 per cent a year.

- The ex-ante study estimated that the benefit cost ratio for the scheme could vary from 4 to 12 for beef and between 1.3 and 2.6 for lamb.

In **2004**, Hassall & Associates Pty Ltd reviewed the MSA program using a triple bottom line approach. The analysis estimated the industry wide benefit cost ratio at 1.15 over 10 years.

In **2005**, CIE on behalf of MLA completed what was effectively an ex-ante or before-the-fact evaluation of the Improving Eating Quality program. The program had been running for eight years (from 1996 to 2005) but the benefits and costs were estimated for a period of 30 years to 2026.

This was one of the first programs covered by the MLA evaluation process. At the time the input numbers used in that evaluation did not undergo the same level of stakeholder consultation and scrutiny which is now the norm for all MLA ex-post evaluations. Nor did the final evaluation report go through the current process of verification with key industry stakeholders, peak industry councils, MLA Executive Committee and final approval by the MLA Board — although, some verification did take place with the relevant MLA program managers at the time.

The underlying assumptions for this analysis in 2005 for BOTH beef and sheepmeat were as follows.

- The benefits consisted of:
  - assumed price premiums for MSA graded product of up to 20 per cent for beef;
  - assumed adoption by the largest retailers, Coles and Woolworths and graded carcasses corresponding to 60 per cent of the cattle and 80 per cent of the sheep national kill by 2010;
  - assumed increase in domestic demand for beef of 6.7 per cent by 2010 and increase in demand for exports of 0.3 per cent by 2010;
  - assumed spillover of social benefits to consumers in the supply chain arising from significantly more consistent and higher quality product at only a marginal increase in retail price.
- The 2005 analysis estimated that costs consisted of:
  - an MLA investment in the eating quality program, estimated to total $87 million through to 2011; and
  - processor compliance costs increasing by 3 per cent each year.
- A combined benefit cost ratio of 8.7 for the three subprograms evaluated (MSA, SMEQ and MQST1).

It is now recognised that many of the assumptions used for projecting the benefits and costs going forward were quite ambitious and key metrics such as carcasses graded and premiums received have since been found to be overly optimistic.

Furthermore, when the relevant expenditure by the then Beef CRC I and II had also been included in this original analysis, the final combined benefit cost ratio was reduced to 5.0 to 1.

The approach to this evaluation

To better inform decisions to be made as a consequence of the Achieving Consistent Eating Quality five year business plan, two distinct but inter-related stages are proposed:

- a review of the performance of the MSA program since 1999–2000; and
- the development of a strategy for the Achieving Consistent Eating Quality program for the next five years.

This report focuses on the ex-post evaluation of the program. In a separate report, an ex-ante evaluation looks forward over the MLA business planning period to 2015–16. The ex-post component builds on previous work (the ex-ante) conducted on implementation of a national eating quality assurance scheme in 1996 and the 2005 analysis. This includes:

- updating with most recent data on carcasses and retail premiums collected as part of the data tracking for the MSA programs' current KPIs;
- consulting with the MLA program managers and other industry stakeholders;
- identifying and describing the program key strengths and weaknesses; and
- quantifying the benefits of the program using the standard approach based on the MLA's Integrated Framework.

There are a number of areas of the ex-post review that required special examination:

- the spillover effects of eating quality for participants in the value chain that are not MSA accredited or do not utilise MSA branding;
- taking a more detailed approach to quantification of impact by improving or adjusting the measure of the number of carcasses graded:
  - this recognises that a graded carcass is likely to contain meat sold as both graded and ungraded cuts;
- an evolving market that has become more concentrated in the processing and boning room sector but also where the development of new products based on beef and lamb are becoming more important; and
- the recognition of implementation and compliance costs borne by industry including the initial investment in eating quality systems and of course licensing for the MSA brand.

The remainder of this report consists of some background about MSA, a description of the activities conducted under the MLA eating quality programs since 1998–99 until 2010–11, an assessment of the impact of the program and a summary of the issues that remain relevant for the second component of this evaluation, this is, for the development of a strategy for the Achieving Consistent Eating Quality program for the next five years.

2 The MSA system

The eating quality program is consumer focused. The original rationale for the eating quality program was simple: to improve the performance of beef. A 1998 survey of 200 000 consumers found that:

- 40 per cent have difficultly buying beef of the quality they seek;
- 60 per cent have difficulty knowing which piece of uncooked beef is more tender;
- 80 per cent say price is a poor indicator of beef quality;
- there was no relationship between beef's appearance and eating quality; and
- 90 per cent believe fat indicates poor eating quality.

The national eating quality assurance scheme began in 1996 after research identified the following drivers of the decline in consumption of beef:

- changes in relative prices;
- consumer's lack of knowledge on cuts quality and cooking; and
- the variability in the quality of beef cuts.

MSA is focused on influencing the last two drivers to ultimately maintain and increase the consumption of beef.

The grading system

Perception of the relative importance of key attributes of good eating quality may vary from consumer to consumer. However, MSA research has identified that there is strong agreement on beef eating quality among beef consumers.

- It includes attributes such as tenderness, juiciness, flavour and overall liking.
- Consumers participating in tasting exercises are required to score the beef sample they have tried in each of the attributes mentioned above.

Hundreds of thousands of these scores are the basis for the MSA grading system and they relate back to product information in a large database:

- the animal's breed, sex, hormone growth promotant (HGP) status, physiological age and growth history;
- processing and chiller data by cut and muscle; and

- days of ageing and cooking method tested.

All these factors are combined through a statistical analysis that predicts the eating quality outcome of individual cuts. Feedback is provided to the cattle supplier and the abattoir for each carcass that is graded.

The MSA grading variables and eating quality attributes

Table 2.1 presents the variables used in the MSA beef grading system, the eating quality attributes they relate to, and the stage in the value chain where these attributes can be controlled.

- There are six variables included in the MSA grading system: pH, marbling, ossification, breed (specifically for cattle, tropical breed content, TBC), meat colour, and rib fat content.
- There are five attributes to control for to achieve best eating quality outcome: meat colour, tenderness, appearance before and after cooking, juiciness after cooking, and product shelf life.

2.1 MSA grading variables and eating quality attributes

MSA variables	*Eating quality attribute*	*Management*					
		Process control points					*Genetics*
		Pre-slaughter			*Post-slaughter*		
		Breeding	*Nutrition/ growth*	*Stress control*	*Processing*	*Handling at retail*	
pH	Colour, tenderness, appearance before and after cooking, juiciness after cooking, product life		✓	✓	✓	✓	
Marbling	Tenderness and juiciness		✓	✓			✓
Ossification	Tenderness		✓				
TBC	Tenderness	✓	✓				✓
Colour	Colour, appearance			✓	✓	✓	
Rib fat	Appearance, preservation		✓				
Total		1	5	3	2	2	2

Source: CIE based on MSA material.

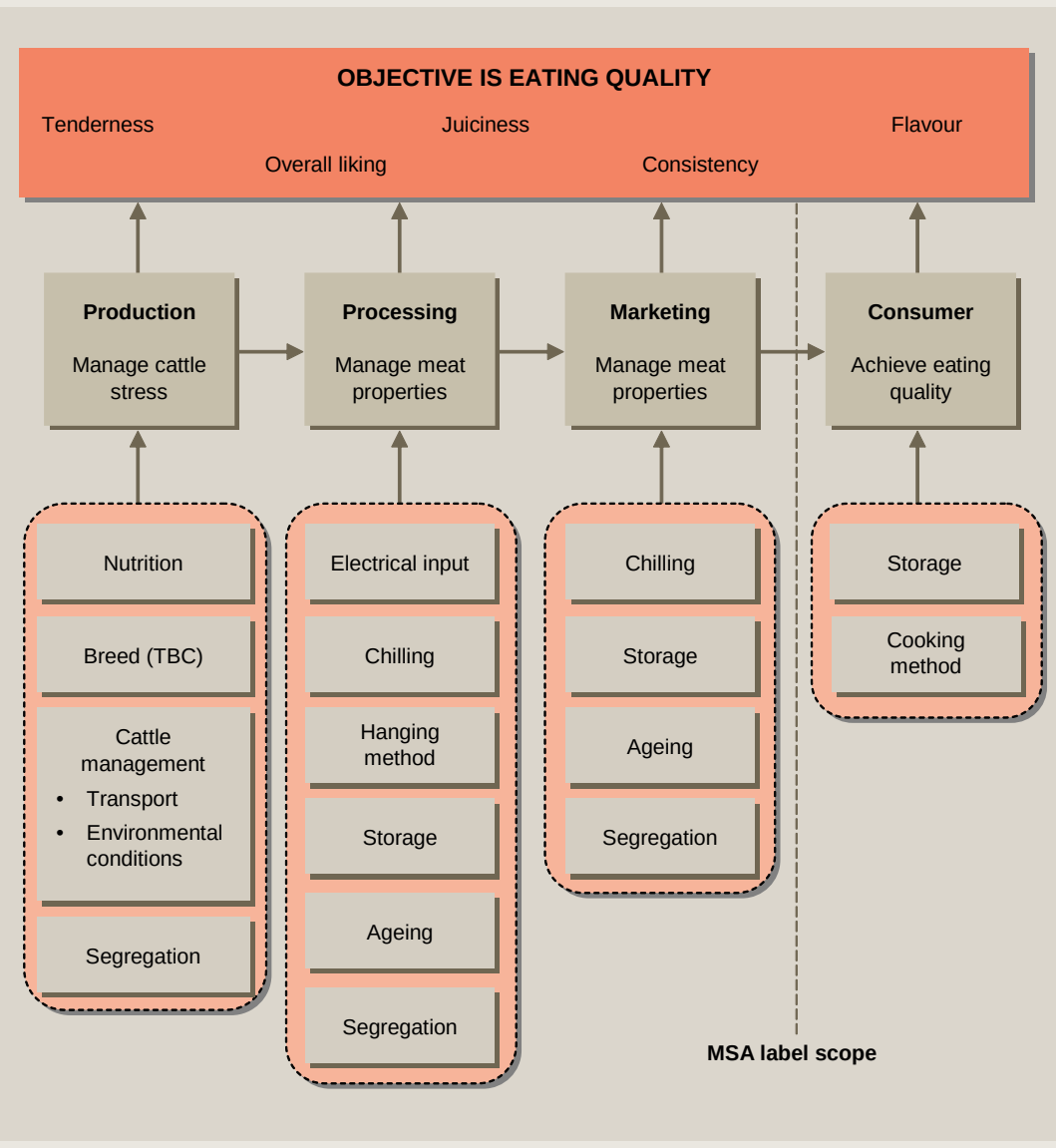
- All variables and attributes can be managed through best practices and process control along the value chain.
  - All variables and attributes require good management at the pre-slaughter stages.
  - Control of pH and colour require appropriate management when processing and handling at retail.
  - The potential impact of all the care taken at pre-slaughter stages can still be negated if the product is not appropriately handled at later stages.
- Genetics research to this point strives to identify and correlate the markers for only marbling and tenderness. The next stage will be to develop process around translating this information into the delivery of programs that improve the genetic merit of herd and flock through programs such as Breedplan and Lambplan.
- Process control is a tool that contributes to immediate improvements in eating quality while genetics is likely to provide its contribution in the longer term.

Overview of the MSA requirements

The program is based on a grading system that applies to various beef muscles/cuts predicting the eating quality that the consumer can expect, depending on the cooking method. Chart 2.2 summarises the procedures/requirements at every stage of the value chain necessary to guarantee consistent eating quality at the consumer end.

- There are many factors which impact eating quality and failure to control one of these factors can undermine the positive impact of others.
  - Failure at any control point compromises the integrity of the system, affecting future adoption and outcomes.
  - Segregation of MSA product is necessary at all control points up to retail to maintain the integrity of the system. Mixing higher eating quality product, MSA in this case, with a lower quality one would result in a failure to guarantee consistency to consumers.
- At the pre-slaughter stages (breeding, stock preparation and transport) the efforts concentrate on nutrition, fast growth and minimising stress of the livestock.
- At the processing level, procedures should manage meat properties such as pH and colour primarily. This is achieved through control of:
  - livestock handling;
  - electrical input used;
  - hanging and chilling; and
  - storage and ageing.
- At the 'end user'/retail level, all efforts concentrate on appropriate handling of the product to maintain the meat eating quality attributes.

2.2 **MSA control points along the value chain (beef)**



Source: CIE.

- At the consumer level, storage and the appropriate cooking method would deliver the outcome pursued in the previous stages.
- Under full implementation of the scheme, the product grade is identified with a MSA carton label, inserts or printed bags or accredited-brand label up to the retail level.
  - However, during recent consultation with retailers, it was found that there are compliance issues regarding the product identification as MSA. These issues relate to MSA product being mixed with non-MSA product (for example, when product is sold as MSA when it has not met its minimum ageing requirements); affecting the consistency offered to consumers in some retail outlets.

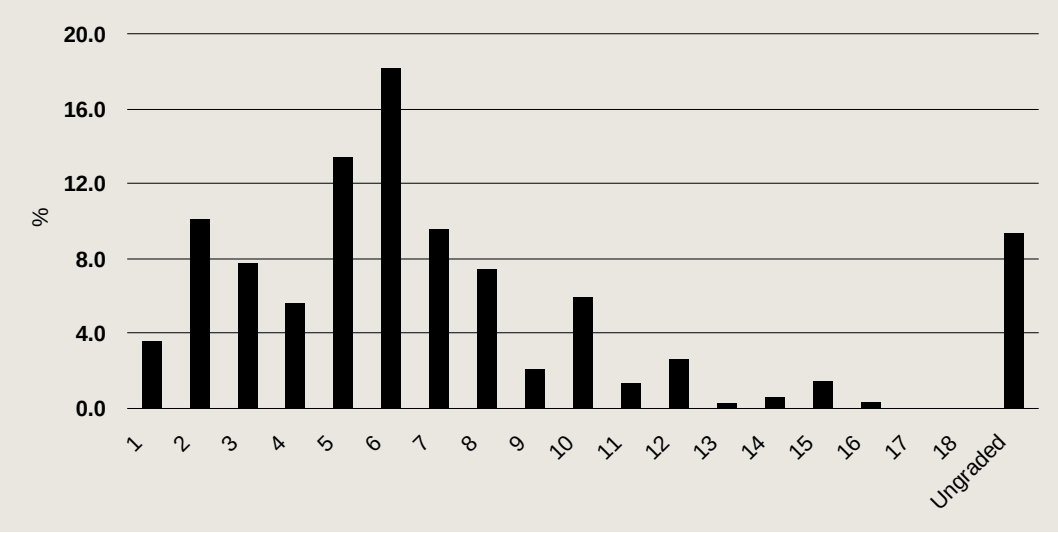
MSA language along the value chain (beef)

MSA beef is a cuts-based system. However, processors tend to take a carcass-based approach to the system given the logistical and technical constraints at the typical processing plant. MSA primals are individually graded from 3 to 5 stars according to their predicted eating quality outcomes after grading and applying the appropriate ageing and cook method for each cut.

- Yet, for processing practicality, carcasses are batched together into boning groups to enable primals with similar predicted eating quality to be packed together in the boning room.

MSA graded carcasses can be assigned into one of 18 boning groups. Currently the majority of carcasses (75 per cent) are assigned to boning groups 1 to 8. Chart 2.3 illustrates current carcass distribution across boning groups.

2.3 **National boning group proportions, 2009–10**



Data source: MLA.

- This reflects the cattle population that has been graded at 2009–10. Regardless of plant location and cattle types, there will be a distribution across a range of boning groups.
- Boning group 6 is the most common group, particularly for southern Queensland and the southern states with a high proportion of HGP treated zero *Bos Indicus* content cattle and HGP free crossbred cattle.
  - There would be some cattle in north Queensland making boning groups at this level, but at a lower percentage compared to more southern states.
  - Boning group 6 is positioned in the middle of the normal average type young cattle (grassfed and GFYG 260kg HSCW).

Table 2.4 provides a *simplified* explanation on how boning groups translate into grading of the cuts/primals of different eating quality.

2.4 **Mapping from carcass processing to a cuts-based grading system[a]**

Cut type	*Boning group 1*	*Boning group 6*	*Boning group 12*	*Boning group 18*
Scenario 1: Carcasses Achilles hung, with product ageing to 5 days				
Tenderloin	MSA 5 star	MSA 4 star	MSA 4 star	Doesn't grade
Cube roll	MSA 4 star	MSA 3 star	MSA 3 star	Doesn't grade
Striploin	MSA 3 star	MSA 3 star	Doesn't grade	Doesn't grade
Other[b]	MSA 3 star or doesn't grade	MSA 3 or doesn't grade	Doesn't grade	Doesn't grade
Scenario 2: Carcasses Achilles hung, with product ageing greater than 14 days				
Tenderloin	MSA 5 star	MSA 4 star	MSA 3 star	MSA 3 star
Cube roll	MSA 5 star	MSA 4 star	MSA 3 star	Doesn't grade
Striploin	MSA 4 star	MSA 4 star	MSA 3 star	Doesn't grade
Other[b]	MSA 4 and 3 star	MSA 3 or doesn't grade	MSA 3 star or doesn't grade	Doesn't grade

[a] Assuming that the cook method is Grill. [b] Refers to blade, rump, knuckle, topside, chuck, think flank, brisket, outside flat and eye round.

Source: MLA.

Table 2.4 shows how graded product can vary between boning groups given two different scenarios about post-slaughter product handling.

- Scenario 1: Carcasses are Achilles hung, and product is aged a *maximum* of five days and cooked using the grill method.
- Scenario 2 Carcasses are hung using the Tenderstretch method: the product is aged a *minimum* of 14 days and cooked using the grill method.

This is a simplification of the detailed MSA stratification tables that provide for a spectrum of eating quality outcomes — across the 18 boning groups, 11 primal groups or cuts, the two carcass hanging methods and six product cook methods.

Generally, the higher boning group number reflects the lower predicted eating quality outcome on average across most beef cuts. For example, carcasses in boning group 1 would have some primals grading 5 star while boning group 12 would have the same primals grading MSA 3 star with the opportunity of getting some of the higher value tenderloin cuts grading 4 stars given more than 14 days of ageing for cuts from Achilles hung carcases.

- The MSA sheepmeat program is inherently different to MSA beef because it is primarily a process control system.

Neither the boning group nor the MSA grading terminology are used to inform consumers by describing predicted eating quality outcomes at the retail level. This is because boning groups have been implemented to better manage producer and processor logistics. They are also used inform producers about the performance of their animals. Their use beyond the processing plant has been restricted purposely because they were not designed for customers or consumers.

The MSA star quality ranking terminology is designed for consumers to distinguish predictions of various eating quality outcomes, however, at this moment consumers seem to relate more to brand names underpinned by MSA rather than the star quality ranking language.

- Retailers and processors who invest in promoting their own brands have not shown an interest in carrying the MSA grading system through to point of sale because at present they do not recognise the value of differentiating MSA 4 and 5 star product.
  - Also, the different cooking methods, part of the MSA grading information/ vocabulary are not always carried through to processing and/or retail.

Because the star terminology is not carried forward from processing onwards down the value chain, consumers are not very familiar with it, and therefore the perceived consistency of the MSA at retail is affected. There is a two way relationship:

- consumers do not know what they do not know, and therefore do not distinguish between MSA 3, 4 and 5 star because the grade of the product has not been apparent at point of purchase; and
- processors and retailers do not want consumers to know what they don't know and therefore don't pass the star terminology forward for several reasons:
  - because it is costly to separately chill and store 3, 4 and 5 star product
  - some processing plants simply don't have the capacity to do so.

For individual processors it would imply significant work to educate consumers to discern the MSA star quality ranking language so that informed consumers would pay for the costs of segregating product according to the star system.

- There is also the potential to undermine the market share protected by proprietary brands which allow a clear commercial point of difference in an attempt to maximise value invested in the brand.

The accreditation task

Together with AUS-MEAT, MSA provides the red meat industry with quality standards to differentiate their product based on guaranteed quality. There are differences and areas of overlap between the two systems. AUS-MEAT audit MSA licensees on behalf of MSA. MSA own the standards that are audited against.

Both MSA and AUS-MEAT have dual purpose functions; *standards* and *certification* with the first focused on practices that guarantee eating quality while the latter focuses on industry practices regarding integrity of product description and quality management services in general. Therefore MSA standards can be seen as a subset of those within AUS-MEAT. While the standards supported by AUS-MEAT are more

generic in their description of red meat products which can be applied equally to both graded and non-graded MSA product.

AUS-MEAT represents a co-regulatory approach whereby government and industry partner to set up quality standards through the Australian Meat Industry Language and Standards Committee (AMILSC) convened by AUS-MEAT. MSA audit and training activities carried out by AUS-MEAT on behalf of MSA are covered under the terms of reference of the AMILSC.

- MSA is an industry approach, with voluntary implementation and is part of the AUS-MEAT language.

AUS-MEAT is responsible for setting industry standards for meat for export based on internationally recognised Quality Management Systems: ISO 9001:2000. MSA is a set of standards and carcase grading system based on the result of consumer sensory testing that applies mainly to the Australian domestic market.

- AUS-MEAT is owned by the meat industry through MLA and the Australian Meat processor Corporation (AMPC).
- MSA is industry owned but managed by MLA only.

3 Eating quality program for beef

This section describes the objectives, activities, outputs and outcomes of the program over 1999–2000 to 2010–11.

The program objectives

The eating quality program is one of a suite of integrated MLA programs to *grow demand for red meat*. The stated objective of the program (in MLA's AOP 2.1 Improved Eating Quality) is to provide industry with the tools to offer red meat of *improved, consistent and predictable eating quality*. Implicitly, the program targets consumers' satisfaction so that they continue buying red meat, despite adverse market effects, such as rising prices.

Therefore the success of the program should be measured in terms of achieving its objective: consumer satisfaction and consequent impacts on demand through MSA red meat.

An intrinsic objective

Given that the program promotes adoption of process improvements/changes in practices and procedures along the value chain to achieve optimal predicted eating quality outcomes; it is also an implicit program objective that such changes can be done by industry in a *cost effective* manner. In principle, the program has not been designed for the industry to necessarily gain an arbitrage profit from such changes but rather to at least cover the implementation cost of making them. The price premiums achieved for MSA graded product should reflect the additional production costs incurred by industry to make changes. These higher prices are generally alleged to be available to processors and retailers as 'premiums'. Box 3.1 outlines some issues associated with of what are measured and claimed as being 'premiums' for MSA product.

Where there is additional value gained from MSA graded product (profits), at any level in the supply chain, on top of cost recovery premiums, it reflects the market effect of under supply of MSA graded product relative to demand for the same ungraded product. This is why there is likely to be profits from MSA graded product for some time, even if the program was not specifically designed for this but rather to achieve an improvement in minimum quality standards. Once the supply of MSA

3.1 What exactly are price premiums?

Care needs to be taken when interpreting the term 'premium' for MSA product. As part of reporting the key performance indicators (KPIs) of the MSA program, retail premiums are collected from licensed wholesalers and retailers.

- This premium is measured by comparison of MSA graded product sold with ungraded young (YG) product for the same cut through the same outlet.
- However, this comparison can be ambiguous due to the spectrum of qualities sold even within the same cut.

For example, consider rump or T-Bone which can be sold at a number of price points differentiated across a spectrum from premium to budget:

- MSA grass or grain fed, non-MSA branded premium grass or grain fed, quality grass or grain fed sold on a price discount and finally budget grass or grain fed product sold at full price or discounted price.

But these premiums do not necessarily reflect increased profitability for the retailer or the value chain supplying that retailer because of the costs involved in obtaining that premium associated with the MSA grade, mainly absorbed by processors.

- In the case of MSA, additional costs are transparently incurred in acquiring MSA eligible livestock and in compliance with required standards in processing.
- The investment in marketing in conjunction with brands are a vital contributor to the achievement of, and then the maintenance of, price premiums — even so, these premiums over other brands and ungraded product may not be able to sustained in the longer term.

graded product increases to meet the market demand, any profit margins are likely to disappear and the premiums would reflect the only the additional costs incurred.

- When MSA graded product becomes the norm, there is a strong possibility that non-MSA product will suffer price discounting in much the same way that dark cutters and bruised carcasses are discounted today.

Other integral objectives

The MSA program is focussed on increasing carcase utilisation — that is, increasing the number of primals marketed as MSA off a single carcase. There are several ways to achieve this:

- increase the EQ of the carcase (decrease boning group, for example, by implementing tender stretch, decreasing TBC, withdrawing HGP's). When the boning group is decreased more primals achieve MSA grade;

- value adding (for example, enhancement or sub-primaling); and
- increasing export demand for MSA product, for example from North America, to enable the additional cut-cook combinations to be utilised.

The inputs: activities and investments

The Eating Quality program includes a large number of activities. To make the describing the program more tractable, we have grouped the activities and outputs in table 3.2.

3.2 Eating quality activities

Eating quality sub- program area
Research and development
▪ Eating quality research including consumer sensory analysis including initial panel research and updates require monitoring consumer trends.
▪ Research of pathways to achieve eating quality outcomes.
▪ Genetics and genomics to enable livestock selection with better eating quality performance (conducted by the Beef and Sheep CRC and jointly funded.
Training and extension
▪ Training of accredited MSA assessors is imparted by MINTRAC and AUS-MEAT.
▪ Extension of required process controls particularly to licensed processors.
Scheme integrity
▪ Licensing and audit of processors, food service and retailers.
▪ Farm level accreditation and audit is controlled through Livestock Production Assurance (LPA) scheme.
Marketing and retail communications.
▪ Support of licensees in retail and food service

Source: MLA.

Investments funding the activities of the beef program are outlined in table 3.3. Since 1998 the industry, through MLA, has spent around $75 million, an average of $6 million a year (including approximately $27 million of government matching funds over the same period). Research and development of the pathways and standards to improve eating quality and how to implement them have absorbed approximately 58 per cent of the program investments or $44 million. Marketing and communications with retail and food service have taken 35 per cent, and training and auditing activities, each accounting for approximately 3 per cent.

A small part of this investment has been recovered through fees paid by processors to become MSA accredited, approximately 6 per cent of the total expenditure by MLA or some $4.3 million.

3.3 MLA expenditure on Beef MSA program

	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
	$m	$m	$m	$m	$m	$m	$m
R&D	5.2	7.1	5.2	5.9	4.0	3.3	3.7
Training and extension	0.1	0.2	0.2	0.1	0.3	0.6	0.4
Scheme integrity	0.5	0.1	0.0	0.0	0.3	0.6	0.5
Marketing and channel communications.	0.9	4.7	3.2	1.7	1.6	1.0	1.0
Total MSA expenditure	6.7	12.1	8.7	7.7	6.3	5.5	5.5
Cost recovery	0.0	0.0	0.0	0.0	0.8	0.9	0.8
Net MSA expenditure	6.7	12.1	8.7	7.7	5.4	4.5	4.8

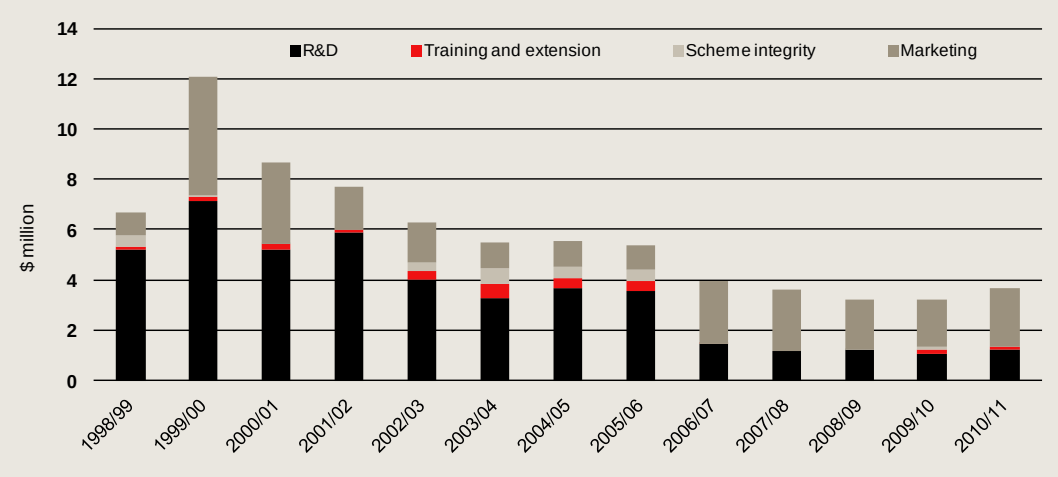
	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Total
	$m	$m	$m	$m	$m	$m	$m
R&D	3.5	1.4	1.2	1.2	1.1	1.2	44.1
Training and extension	0.4	0.0	0.0	0.0	0.1	0.1	2.5
Scheme integrity	0.5	0.0	0.0	0.0	0.1	0.0	2.6
Marketing and channel communications.	0.9	2.5	2.5	2.0	1.9	2.3	26.2
Total MSA expenditure	5.4	3.9	3.6	3.2	3.2	3.7	75.4
Cost recovery	0.7	0.3	0.2	0.2	0.2	0.1	4.3
Net MSA expenditure	4.7	3.7	3.4	3.0	3.0	3.5	71.1

Note: Actual figures MLA only.
Source: MLA.

- Note that the annual program expenditure has been reduced substantially over time (see chart 3.4). This is because the majority of the infrastructure building in terms of required research and development and the implementation of support systems for MSA are now complete.
  - However it should be noted that the MSA model only captures about 50 per cent of eating quality variation (estimate).
  - Critical mass on the domestic market is approaching, therefore, there is a need to shift the program to seek cost recovery for business as usual activities to 'free up' levy funds for business development activities focussed on capturing greater value for the MSA system.
  - This new focus would continue to include R&D because investment in research can be used to develop more sophisticated carcass sorting tools, for example.

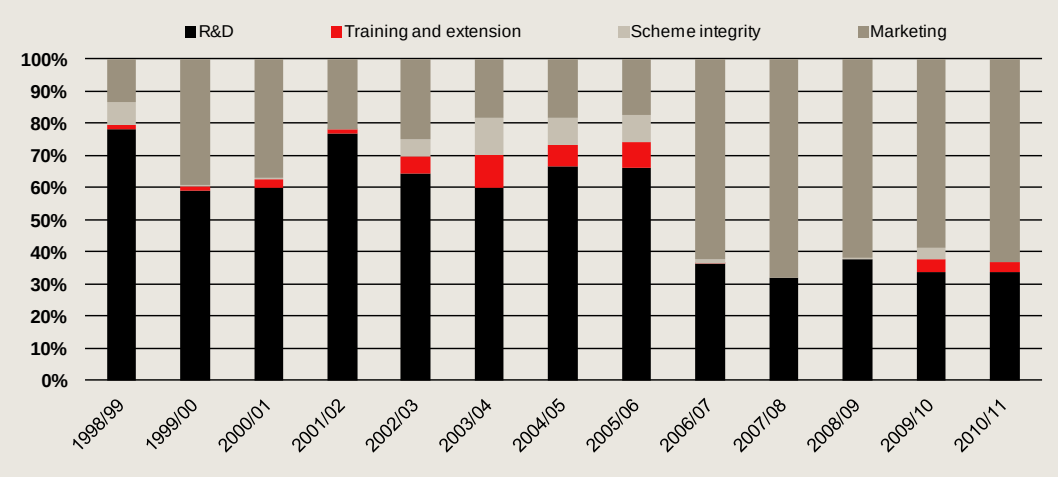
That is also reflected in the composition of the expenditure. R&D has halved its share of the budget; while it represented around two thirds of total expenditure until 2005–06, in the later years it represented a third (see chart 3.5). In contrast, marketing has become a larger component of total program expenditure in later years. It appears sensible to focus more on communication of the program to market channels once the majority of the R&D is established.

3.4 Expenditure on Beef MSA by area



Data source: MLA.

3.5 Composition of expenditure on MSA



Data source: MLA.

Eating quality is a key component of Australian beef's competitive advantage; therefore, investment in R&D to ensure the best technologies are available over time is an important component of the program. That being said, over time the emphasis of the program has shifted to focus more heavily on adoption of R&D outcomes (that is, the MSA model and supporting process interventions). This effort draws on both activities which qualify for the government matching dollar (development, extension and adoption activities) and promotional activities.

The CRC activities and corresponding MLA investments

There is an additional set of inputs to the eating quality program that is conducted outside of the MLA Eating Quality program, by the Cooperative Research Centres (CRC) for beef and sheep, but jointly funded with industry partners. These inputs refer to genetic and genomics research in relation to cattle and sheep selection for

better eating quality. The nature of the scientific work by the CRCs results in highly interrelated projects whereby outputs from some projects become inputs to others. The implication of this being that it is difficult to allocate activities and costs to individual project areas, such as those related to eating quality research.

For this evaluation the CIE has asked the Beef CRC to provide their judgment on the proportion of their work and expenses that directly relates to MSA/eating quality science. Similarly, they have provided this analysis with an approximate allocation of MLA overall contributions to CRC that have been used for eating quality development.

MSA-related work by the Beef CRC goes back to the early 1990s, before the eating quality program was formally established at MLA. See appendix A for further detail on the activities.

- During the 1990s the Beef CRC conducted work on various foundation areas of eating quality outcomes such as genetics, growth and nutrition, health and welfare among others.
- This preliminary work is identified as CRC I (*meat quality* CRC). It is estimated that approximately three quarters of this work was directly related to eating quality outcomes.

A later stage, CRC II, from 2000 to 2005 (CRC *for cattle and beef quality*), consisted of projects that were more marginally related to MSA; between a fifth and a third of this work directly related to eating quality science.

- The projects in this second phase of the CRC that were MSA related involve mostly strategic science to deliver beef quality through nutrition and technologies for the beef supply chain.

The CRC III (CRC *for beef genetic technologies*), from 2005 to 2010, includes seven research projects, of which one is entirely related to eating quality; *high quality beef for global consumers*.

Beef CRC and MLA investments in eating quality science

MLA cash investments in MSA-related science undertaken by the Beef CRC amounts to $4.7 million (table 3.6):

- this corresponds to approximately 6 per cent of in-kind and cash resources dedicated by the beef CRC to MSA-related research; and
- the majority of the investments correspond to the early stages of research and development of the science behind improving eating quality: the 1990s.

3.6 **CRC and MLA investments on eating quality science**

Program	*Project*	*CRC cash and in-kind investment*	*MLA cash investment*	*MLA share*
		$m	$m	%
93-94 – 98-99	CRC I	42.7	2.7	6.4
99-00 – 04-05	CRC II	13.3	0.9	7.1
05-06 – 09-10	CRC III	16.6	1.0	6.0
Total beef		***72.6***	***4.7***	***6.4***

Data source: Beef CRC

Outputs and outcomes

The key outputs of the program relate back to the input activities performed:

- Research and development outputs are the development of **standards and protocols** for livestock producers, for processors/abattoirs, saleyards and end users (retail), for the beef value chain.
- Key outputs of the program are the **underpinning science** for eating quality (see box 3.7 on the outputs and outcomes of the scientific research by the CRCs), **the grading system and the labels** used to identify MSA product.
- Training and extension outputs are **supportive material** provided to processors through the Red Meat Innovation website jointly developed with the AMPC.

The standards and other **useful information** are readily available to industry through MLA. Additional outputs are:

- approximately 19 000 producers, 46 processors, 55 underpinned brands and 1 550 licensed end users.

Scheme integrity outputs are the **audits conducted, the corresponding corrective action reports issued and resolved**. In the past three years, there have been between 1 200 and 1 500 audits conducted a year. Coverage of audits has increased over the past year to reach over 90 per cent of end users and the totality of processors.

The outcomes of the program relate to:

- rates of adoption along the value chain; as an indication of the system's cost effectiveness;
  - number of cattle graded;
  - producers, processors and end users involved in the program;
  - MSA graded beef being marketed; and
- improved, consistent and predictable red meat eating quality.

3.7 Outputs and outcomes of the CRC scientific research on eating quality

An initial point to be made refers to the potential for outcomes of scientific research to take years to be seen. Extension is very important for industry to ensure adoption is facilitated. At this stage, some of the outputs and outcomes relate to:

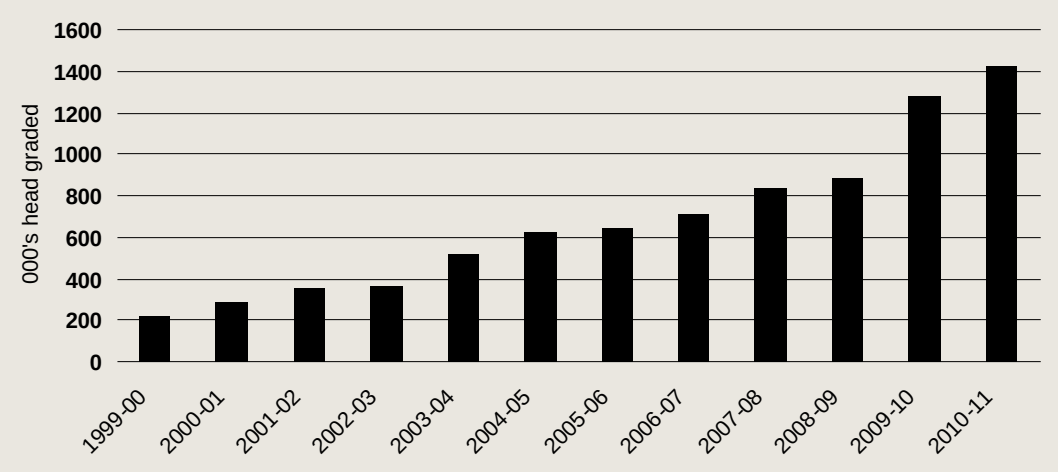
- Extensive **data gathering** and study of samples.
- Understanding of **factors affecting marbling and fat consistency** (tenderness/toughness).
- **Technology to predict marbling** but adoption of it is really low.
- **Knowledge on breed effects on eating quality.**
- Knowledge underpinning the development of the **MSA pH/temperature window**.
- Improved understanding of the **tenderstretch mechanism.**
- Knowledge underpinning the development of **tenderness, fat and marbling markers** for beef cattle.
- Better understanding of the **effect of HGPs on palatability**.
- Understanding the **effect of stress and nutrition on meat quality**.
- Understanding the **effects of growth path** into all MSA input traits; marbling, ossification, score fat depth.
- Identification of **gene networks** that impact on meat quality traits.
- Knowledge underpinning the standards on **pre-slaughter management** of cattle for MSA.
- Understanding the relationship between **electrical input** used and meat quality and appropriate protocols.

Adoption along the value chain: Number of cattle graded under MSA

Overall the program can now be identified as a success story with over 1 million carcasses now being graded with significant premiums being achieved at retail, especially for higher value cuts.

- Chart 3.8 shows that an outcome of the program is the strong growth in number of cattle graded:
  - in 2010-11, 1.422 million carcasses were MSA graded;
- the numbers of graded carcasses have grown at 17 per cent each year since 1999–2000.

3.8 **MSA beef carcasses graded**



Data source: CIE based on MLA numbers.

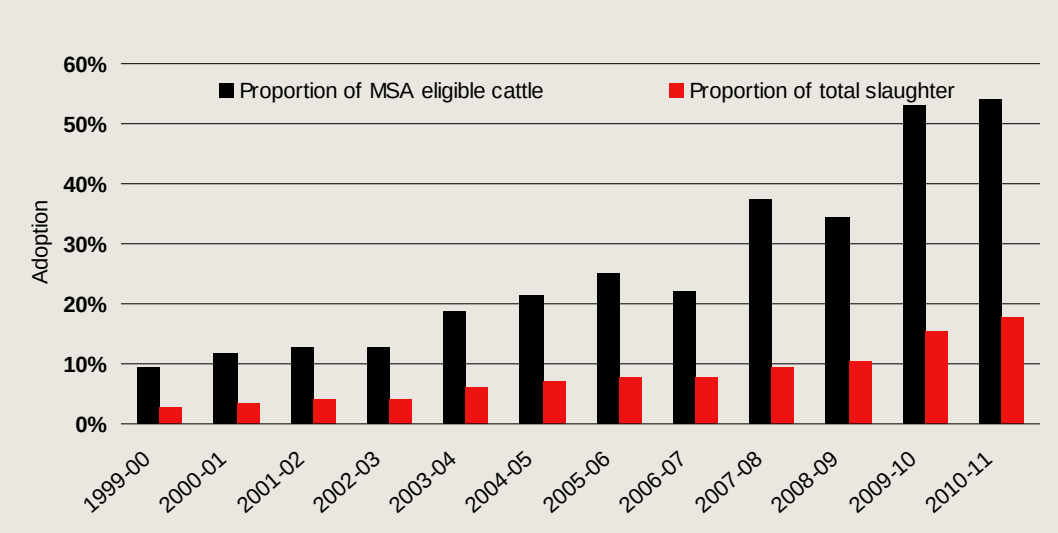
Analysis on the premiums at various levels in the value chain is presented below in the section about the impacts of the program.

To put the graded carcasses in context, they have been compared to the total kill and to the total MSA eligible group. See chart 3.9.

- As a proportion of total slaughter, current MSA adoption represents 18 per cent.
- However, it could be argued that total slaughter is not the best suited benchmark for assessing MSA adoption. This is because a significant part of the slaughter numbers would hardly ever be eligible for MSA grading.
- Cattle sold through saleyards are unlikely to be eligible under MSA. Despite that there are protocols/standards for maintaining the integrity of the system when saleyards are involved, the typical distances and times from farms to saleyards and from saleyards to processing plants that apply in some regions makes it difficult to comply with the specifications in the MSA manuals.
  - Transport distance is one of the areas of new work for addressing this issue in the future.
- Mixing of mobs through the saleyard system is also a major challenge.
- On the other hand, old cows, bulls, bullocks and any six teeth cattle are unlikely to be presented for grading under MSA because the age would affect the score of their cuts on the basis of ossification and other variables.
  - The number of cuts that can be harvested from older animals limits the demand for these cattle and the compliance to MSA specifications is often lower than younger cattle.

Compared to the cattle that would in principle grade under MSA; that is eligible young cattle, capable of delivering the predicted eating quality outcomes; more than 50 per cent are now being graded (black bars in chart 3.9).

3.9 **Adoption of MSA beef since 1999-00**



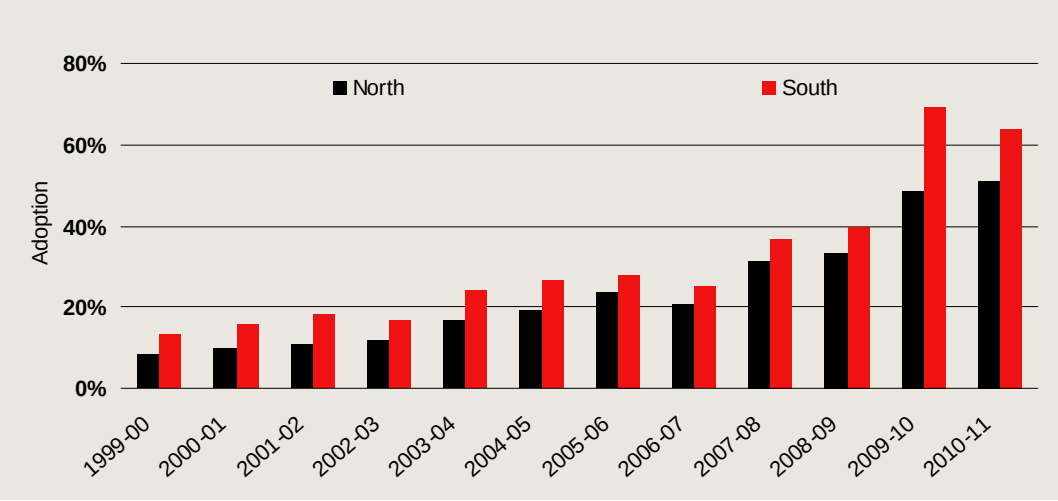
Data source: MLA and CIE calculations.

There are also different rates of adoption in the north and the south regions. The differences refer to a combination of factors influencing the eating quality outcomes from the cattle in each region, some of them are:

- the type of cattle typically traded;
- the distances from farm to abattoir/processing plant;
- the use of saleyards as intermediaries; and
- the use of HGPs and finishing feed system.

Chart 3.10 illustrates the rates of adoption in the two main cattle regions, as a proportion of the MSA eligible cattle.

3.10 **Adoption of MSA beef North versus South[a]**



a As a proportion of MSA all eligible cattle.

Data source: MLA, ABS and ABARE Commodity statistics tables.

It shows that rates of adoption have usually been higher in the southern region. In the north approximately 70 per cent of the cattle would go directly from farm to abattoir, increasing their suitability for MSA, however a variety of factors including; the distances between farm and abattoir, the higher content of *Bos Indicus* breed and the strategies to improve their feed efficiency at final stages; all conspire to impact on the MSA compliance rates of northern cattle. In the south, approximately half the cattle sent to slaughter are direct from farm to abattoir and the majority of these cattle are *Bos Taurus*, which have higher MSA compliance rates on average. Traditionally there has been more cattle for slaughter in the north than in the south; some 25 per cent higher.

- Industry projections by MLA suggest that in the coming years the growth in the Australian herd will come primarily from the northern region with the potential implication of even slower rates of adoption of MSA in the future, given estimated historical trends of the program to date.

Involvement through the chain

Another indicator of the success of the program is the involvement of stakeholders along the value chain (see table 3.11).

- Of particular note is the number of brands that are currently underwritten by MSA. This represents an output or outcome that may not have been intended at the time and represents a shift away from MSA as a brand itself to being a secondary brand or quality assurance mark. Much like what is observed in the key export markets with the 'Aussie Beef' and 'Chungjung Woo' now underpinning private company branding.
- The involvement of 35 beef processors covers around 70 per cent of the beef processing capacity in the industry (recognising that MSA graded cattle represent only one part of their total slaughter).
- Currently over 19 000 out of a total of over 30 000 producers are accredited to supply MSA cattle, or over 60 per cent.

3.11 **Involvement in the MSA beef program in 2010–11[a]**

Stakeholder/element	*Number*
Producers	19 000
Livestock agents	256
Processors	46 (35 beef and 11 sheep)
Brands	55
Wholesalers	303
Retailers	797
Foodservice	425

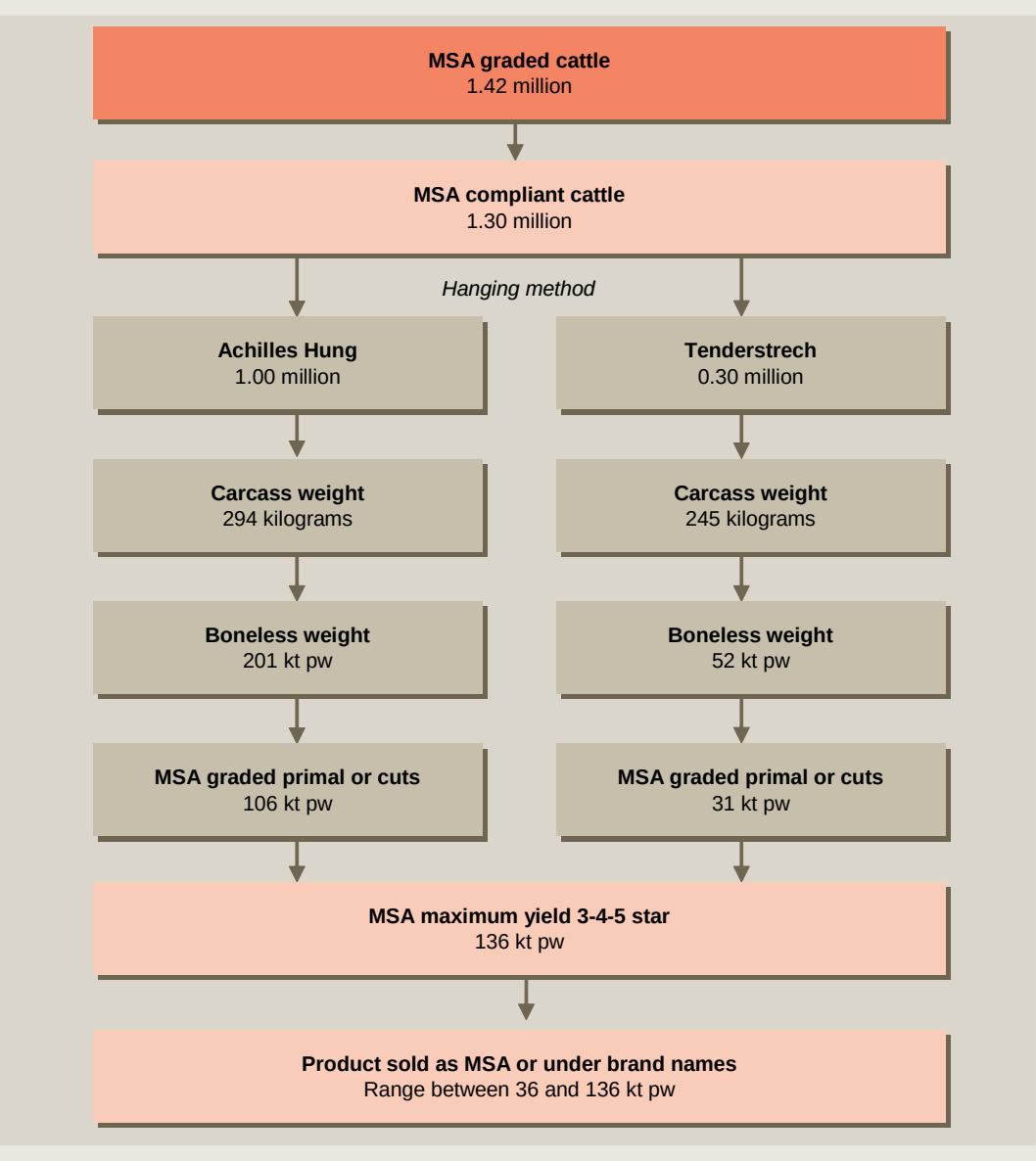
Source: MLA.

MSA graded beef

It is estimated that somewhere between 36 and 136 kt of beef were MSA compliant and sold as MSA and/or under brand names in 2010–11, or 8.2 to 30.3 per cent of domestic disappearance.

- A range has been is estimated because it is uncertain how much of the MSA graded carcasses have actually been marketed as MSA product. The minimum is where only the four main primals have been marketed as MSA, while the maximum number in the range is based on marketing of all MSA cuts.
- Chart 3.12 illustrates the basic assumptions for this calculation (see appendices C and D for further details on this calculation).

3.12 **MSA graded beef in the market, 2010–11**



Data source: CIE based on workshop with MLA program managers 2011 and appendix C.

- 1.42 million carcasses graded in 2009–10, of which 8 per cent was found not compliant (this means less than 3mm rib fat, meat colour 1A or >3, pH 5.71 or higher or a combination);
- Most of the carcasses were hung by the tendon; Achilles hung method; approximately 77 per cent of the compliant graded carcasses, with the remaining being hung by the Aitch bone, the tenderstretch method.
  - Carcasses hung using the Achilles method tended to be heavier than those under tenderstretch; average of 294 kilograms compared to 245 kilograms.
- The cuts that would grade MSA 3, 4 or 5 star would likely represent between 40 and 50 per cent of the carcass (see appendix B on the details for this calculation).
- It is estimated that the supply of MSA beef has grown approximately 15 per cent a year, from 19 kt in 1999–2000 to 136 kt in 2010–11.

To this point, MSA is almost exclusively used for beef sold to the domestic market, with very little reach into export markets.

- Reasons underlying the lack of adoption by exporters will be discussed in chapter 6.

Improved beef eating quality

Given the underlying rationale for MSA was around improving quality, this would be expected to be a leading output and outcome of the program.

The 'Meat Expectations' survey conducted in July 2009 showed that consumer measures of beef quality remain high. The average quality rating for beef from the MLA 2008–09 annual report was 8.0 out of 10.

- In addition, 85 per cent of Australian grocery buyers say they trust their normal butcher or supermarket to sell good quality beef.

In 2009–10 MLA commissioned an external market research agency to evaluate the program in the retail sector. Of the MSA licensed retailers surveyed near 80 per cent considered that MSA is a system for providing customers with more consistent quality product, it is easy to implement given the good training and support.

Improved genetic performance

Genetic change within the underlying Australian herd has improved the MSA outcomes through changing the shape of the current distribution of slaughter by boning groups.

- An improvement in the number of suitable cattle grading at lower boning groups, particularly through better selection for marbling, would be observed as a shift left of the distribution seen in chart 2.3.

- In practice such a shift would be very difficult to observe because it would have to be isolated from the range of other factors that influence it such as weather and pasture conditions (important for north versus southern cattle), and improvements in on-farm management and selection and process control along the chain that also result in improved eating quality performance within boning group ranges.

Expert opinion indicated that over the timeframe of the evaluation, genetic change in British breed cattle (Angus, Hereford, Shorthorn, Murray Grey) and their crosses are *unlikely* to have had detectable changes in MSA traits.

- Primarily because these breeds already have favourable genetic makeup that have significant effects on tenderness, and there is no evidence of unfavourable changes in intra-muscular fat percentage.

While a DNA test is now available for tenderness in Brahman cattle, and that test contributes to an estimated breeding value (EBV), and there is some adoption of the test (a number of bulls have got EBVs), there is no evidence as yet of any genetic trend for improved tenderness (and hence MSA score) in Brahman cattle.

One potential area of benefit could be that through faster growth of cattle, as a result of genetic changes, such that animals get slaughtered a little younger which would increase MSA score.

4 Eating quality program for sheep meat

In 1998, consumer research conducted by the Sheep CRC established that approximately 30 per cent of sheep meat failed consumer expectations of eating quality. The main issue affecting sheepmeat eating quality related to lack of tenderness which was mainly a influenced by processing factors rather than animal and cooking factors. To address this issue MLA initiated the Sheep Meat Eating Quality program (SMEQ) and the Meat Quality Science and Technology program (MQST).

The objectives

The SMEQ is one of a suite of integrated MLA programs to *grow demand for red meat*. From the eating quality perspective, consumer demand can be encouraged by *achieving a more consistently tender product*. Electrical stimulation is one of the intervention methods widely recognised for realising this. However, electrical stimulation technologies that were available to the industry prior the program were not well accepted due to safety concerns and the associated risk management costs. Therefore, a subsequent objective for the MQST programs was *to develop practical, safe and effective electrical stimulation systems* for the industry and then achieve a tender product.

The inputs: activities and investments

Activities conducted under the SMEQ program include:

- R&D;
- training and extension;
- audit and scheme integrity; and
- marketing and communications.

Table 4.1 presents the investments in SMEQ program by MLA since 2005-2006. MLA has invested approximately $6 million, or an average of $1 million a year. Forty seven per cent of the total investment has funded marketing and communications activities and 35 per cent has funded the standards research and development. Training and extension activities represent on average 15 per cent of total investment.

4.1 **MLA expenditure on Sheep MSA program**

	1998-99	*1999-00*	*2000-01*	*2001-02*	*2002-03*	*2003-04*	*2004-05*
	$m	$m	$m	$m	$m	$m	$m
R&D	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Training and extension	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scheme integrity	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Marketing and channel communications.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total MSA expenditure	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cost recovery	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net MSA expenditure	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	2005-06	*2006-07*	*2007-08*	*2008-09*	*2009-10*	*2010-11*	*Total*
	$m	$m	$m	$m	$m	$m	$m
R&D	0.2	0.1	0.3	0.3	0.5	0.9	2.2
Training and extension	0.2	0.2	0.2	0.1	0.1	0.1	0.9
Scheme integrity	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Marketing and channel communications.	0.0	0.0	0.2	0.3	0.8	1.4	2.7
Total MSA expenditure	0.4	0.3	0.7	0.7	1.4	2.4	5.9
Cost recovery	0.0	0.0	0.0	0.0	0.1	0.1	0.2
Net MSA expenditure	0.4	0.3	0.7	0.6	1.3	2.4	5.6

Note: Actual figures MLA only.
Source: MLA.

Chart 4.2 illustrates the composition of the investment by area and shows the increasing share of marketing over time in contrast to R&D, training and extension.

The Sheep CRC scientific research inputs

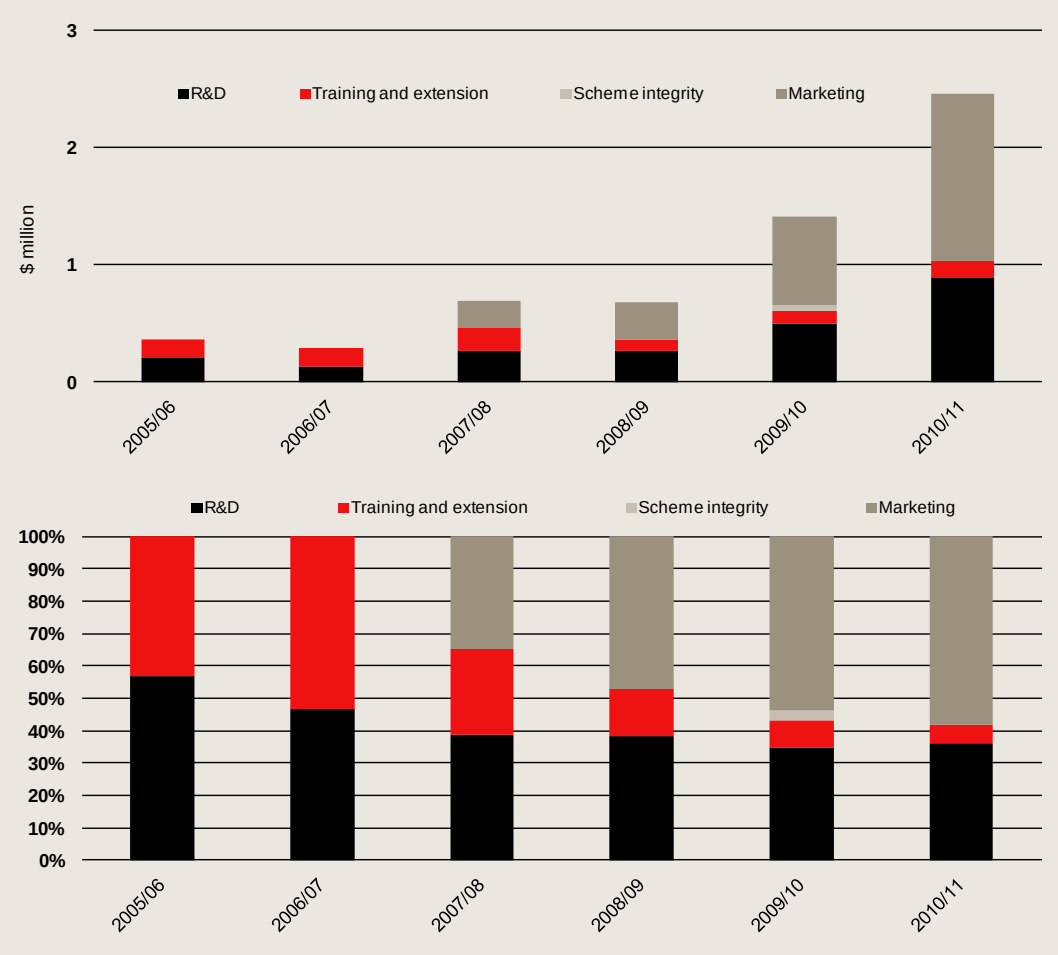
Research by the Sheep CRC directly related to eating quality was initiated in 2002 and represents between a quarter and a third of the CRCs ongoing work. The first five years focused on muscle and fat biology, sheepmeat flavour, and processing quality and efficiency.

- This initial stage is known as CRC I.

The past three years the CRC has worked on multiple genetic areas; CRC II:

- Information Nucleus Flock: design, analysis, operation and information management.
- The information nucleus comprises eight flocks of ewes across Australia dedicated to scientific research. A total of 5000 ewes, mated to 100 industry sires annually for five years to generate a diverse range of phenotypes and genetic information with which to develop new and improved breeding values. The sires used are chosen from industry. The eight flocks are based on different locations

4.2 **Composition of the expenditure on Sheep MSA by area**



Data source: MLA.

across Australia representing a range of environmental conditions, being particularly important for assessment of the interactions of genetics with the environment.

  - The Information Nucleus meat and wool test data feeds a database to ultimately develop tools that are practical and affordable to the industry.

- Genetics: Phenotype measurement, biology and production pathways for improved eating quality.

  - Work on this area focuses on understanding how certain traits and their variation influences consumer perceptions of eating quality. This is how phenotypic traits affect meat tenderness, ultimate pH, colour, colour stability, glycogen concentration, and intramuscular fat content, among others. Simultaneously, traditional carcase measures are taken to trace meat yields as well as a skin quality grade.

  - From this research and the data collected, protocols are written for abattoirs. Also, data from this project is input into the other genetics work on these traits such as the improvement in lamb nutrient composition that would reach

official dietary content claims. Another part of the work focuses on improving eating quality of cuts that have been judged by consumers to have unsatisfactory eating quality, such as topside.

  - ⋯ The work points towards discovering and understanding of genes that would assist new molecular technologies for gene marker selection. It is not clear what the time frame is for this achievement.
  - ⋯ The genetics work is complemented by consumer sensory testing.

- Supply chain: technologies and yield improvement.
  - This part of the work concentrates on examining sheepmeat eating quality attributes affected by procedures at the plant such as chilling conditions, the use of electrical stimulation, effects of packaging systems on meat colour and shelf life.
  - There has been significant investment into developing new technologies to achieve a 'tender in 24 hours' product but there are no outcomes of this research yet.
  - Additional work includes research on improved ways to estimate sheep age apart from the traditional dentition system.
  - Other work is underway to improve the fat measurement and exploring other carcase measurement such as lean meat yield and feedback systems that will enhance supply chain efficiency.

Table 4.3 presents the investments in scientific research by the Sheep CRC and the cash contribution by AMPC/MLA. Over the past eight years, AMPC and MLA have provided $2 million cash to the Sheep CRC, representing approximately 33 per cent of total cash and in-kind resources by the CRC in scientific research directly related to eating quality.

4.3 **CRC and AMPC/MLA investments on sheep eating quality science**

Program	*Project*	*CRC cash and in-kind investment*	*AMPC cash investment*	*MLA share*
		$m	$m	%
02-03 – 06-07	CRC I	2.0	0.4	17.7
07-08 – 09-10	CRC II	3.9	1.6	40.6
Total sheep		**6.0**	**2.0**	**32.8**

Data source: Beef and Sheep CRCs

The outputs and the outcomes

The development of the **standards** is underpinned by **scientific research** conducted within the SMEQ program and other related research in the beef industry and internationally.

Training and extension outputs are **supportive material** provided to processors through the Red Meat Innovation website jointly developed with the AMPC.

Currently the MSA system for lambs is substantially less prescriptive and detailed than it is for cattle. There are a number of reasons for this contrast between MSA sheepmeat and the system for cattle:

- is not a cuts-based system as the case with MSA cattle but is based on assessment of whole carcasses only;
- graded assessment is made on a mob or a batch basis, not an individual basis;
- the focus of MSA sheepmeat is process control at processing where a critical requirement is the effective use of electrical stimulation of carcasses; and
- it is important to note that many of the MSA process controls can be considered as 'best-practice' in the beef and lamb industries from on-farm through transport to processing.

The main safety concern regarding the electrical stimulation technology at the time referred to the use high voltage discharges. Over the life of Generation 1 R&D stage, two new technologies were developed for electrical stimulation that reduced the voltage to mid and low level controlled doses.

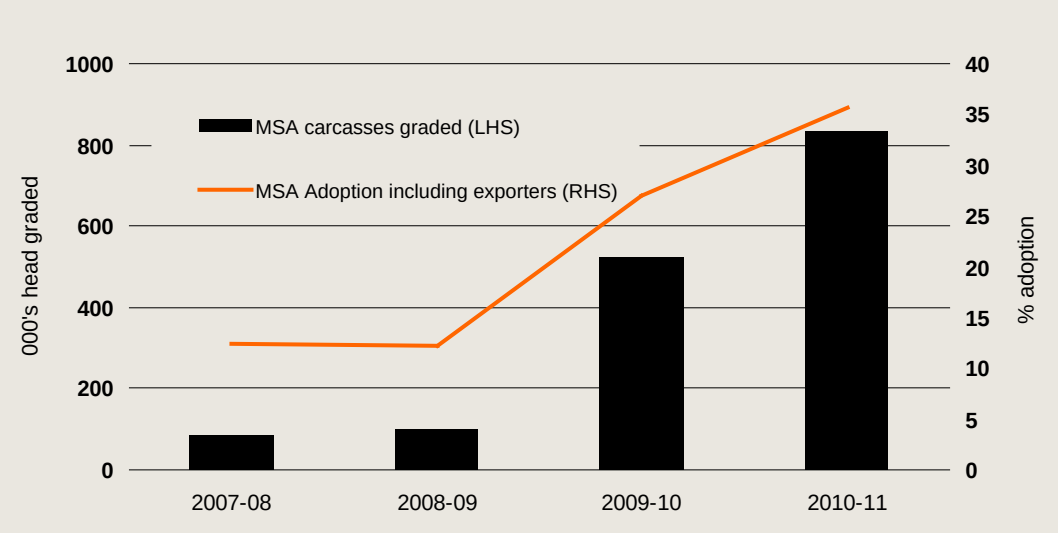
The outcomes of the program relate to:

- rates of adoption along the value chain; as an indication of the system's cost effectiveness;
  - lamb carcasses graded;
  - producers, processors and end users involved in the program;
  - MSA graded lamb being marketed; and
- improved, consistent and predictable red meat eating quality.

Sheep graded

Chart 4.4 shows the time profile of lambs graded under MSA over the evaluation period. Number of sheep graded is lower than that of the beef industry but observed growth in adoption has been significant since the introduction of the system in 2007; approximately 130 per cent per year. The MSA sheepmeat and MQST programs have enjoyed accelerated adoption by adapting the program implementation tactics used by MSA beef to the sheepmeat industry.

4.4 **MSA lamb numbers graded**



Data source: MLA and CIE calculations.

In 2010-11 there were 833 thousand lambs graded through MSA. All of these lambs are focused on the domestic market particularly the supermarket chains. These lambs represent 17.7 per cent of total lambs likely to be eligible for this market segment.

There is currently no formal grading for exported product; however, MLA estimates[1] that compliance with MSA standards is around 60 per cent of lambs slaughtered. Accounting for MSA compliance of the export sector, adoption of the MSA system is approximately 36 per cent of the total annual lamb slaughter.

Involvement through the chain

There is approximately 1 800 MSA licensed sheep producers and 11 sheep meat processors involved and three lamb brands underpinned by the program so far.

MSA lamb in the market

The supply of MSA sheepmeat in the domestic market was estimated to be around 17.5 kt retail weight in 2010–11; estimated by using number of carcasses graded and an average carcass weight of 21 kilos and a conversion factor of 0.8 to retail weight. Improved lamb eating quality

Given the underlying rationale for MSA was around improving quality, this would be expected to be a leading output and outcome of the program.

1 These estimates were arrived at in a round table exercise between MLA staff and CIE held in Sydney on 14 July 2011.

The 'Meat Expectations' survey conducted in July 2009 showed that consumer measures of lamb quality remain high. The average quality rating for lamb from the MLA 2008–09 annual report was 7.7 out of 10.

- In addition, 87 per cent of Australian grocery buyers say they trust their normal butcher or supermarket to sell good quality lamb.

In 2009–10 MLA commissioned an external market research agency to evaluate the program in the retail sector. Of the MSA licensed retailers surveyed, nearly 80 per cent considered that MSA is a system for providing customers with more consistent quality product, it is easy to implement given the good training and support.

5 *Electrical simulation*

From the previous chapters, the primary objective of the MSA program for both beef and sheepmeat was to achieve higher levels of consistent eating quality through the introduction of requirements for interventions and process controls along the supply chain.

High voltage electrical stimulation (HVES) has been used in the Australian red meat industry since the early 1980s in both beef and sheepmeat processing. The incorporation of a practical system into the slaughtering process was first used in New Zealand and then Australia to avoid toughness resulting from cold shortening.

Despite that fact that there is significant evidence to suggest that this type of system is very effective at lowering muscle pH (Hopkins and Toohey, 2006) it is not easily installed in abattoirs subsequent to construction. Therefore, adoption of this technology in the Australian sheep meat processing industry was minimal and mostly associated with the use of hot boning.

The development of new modular form of Low and Medium Voltage ES technology has allowed the installation of stimulation modules in abattoirs where the larger footprint HVES units could not be used. This approach also reduces the installation costs with respect to occupational health and safety, but the extent of it's use has not been well monitored and so the potential impact on eating quality is not known (Hopkins, 2008).

- The investment in LVES and MVES was made through the MQST program: Generation 1 or Meat Electronics program.

This chapter has the objective of providing some background to ES by summarising possible adoption of the technology across industry.

Background to ES

ES is the term applied to the use of electrical pulses post slaughter in abattoirs, across low, medium and high frequencies that can have a number of objectives, to:

- assist immobilisation, bleeding and back stiffening of the carcass; and
- improve meat quality.

While not formally part of the requirements of the MSA program, ES has the potential to have contributed to overall MSA outcomes. There are currently two technologies available for ES at it relates to eating quality outcomes.

- Generation 1: where all carcasses are provided the same controlled electrical doses at low or medium voltages.
- Generation 2 (*SmartStim*): is an improvement where sophisticated electronics can provide individually tailored electrical pulses to carcasses according to their requirements.
  - This innovation was developed around 2007–08.

Relationship with eating quality outcomes

A current requirement of the MSA system is that beef and sheepmeat carcasses, post-slaughter, should meet a specified 'window' in which carcass eating quality is maximised as carcass temperature and pH decline over a specified period.

- If this temperature falls too fast while the pH is still above 6, then the carcass can be 'cold shortened' resulting in potentially tough meat. If the temperature falls too slowly and the pH passes through pH of 6, then the carcass could be 'heat toughened', again with adverse outcomes to eating quality.
- ES can result in a reduction of cold shortening in beef and particularly sheep carcasses with an associated improvement in eating quality.
- New generation (Generation 2 — SmartStim) may reduce variability in eating quality across beef and especially sheepmeat batches of carcases by delivering precise electrical doses to meet carcases individual requirements.
- In terms of ES to be used as an input to MSA requirements, MSA currently only requires the temperature and pH window to be achieved in 80 and 100 per cent of beef and lamb carcasses, but is not prescriptive on how this window is achieved.

ES is more suited to some applications than others.

- The rate of temperature decline in carcasses is directly related to among other factors, the mass (weight) of the animal at the time of slaughter. The level of glycogen in muscles controls the extent of pH decline in the carcase.
- Due to the relatively small carcass mass and primarily grass fed diet, lambs are most likely to benefit the most from ES. Baseline data (retailer survey in 1998) showed tenderness (as measured by shear force) of lamb loins were highly variable with more than a third being considered as unacceptably tough (CRC retailer survey data of 1 000 samples — available on request).
- Heavy cattle and longer lotfed cattle are likely to have little to no benefit from ES (given normal ambient temperatures in processing) because of their carcass mass and other inherent factors that result from grain feeding. The level of glycogen controls the extent of pH fall in the carcase, with a minimum threshold of 57 umol of glycogen required for the carcase to fall to pH 5.4. Higher pH (pH 5.8 and

above) produces darker colour and associated quality defects and may compromise eating quality.

  - For beef, the majority of benefits would be expected to flow from use on smaller grass fed and short fed carcasses.

ES may also result in an improvement in colour (that is, lighter bloomed colours) and enhanced colour stability, especially for beef, which is reflected in a premium paid in many markets reflected in customer demand for meat appearance (that is, lighter meat appearance).

- This benefit could be at the expense of meat quality (in severe cases, there is a tendency for higher drip-loss and failure of the product to age to its potential).

Compliance of existing LVES and MVES installation to optimal operating specifications has been proven in some cases to be problematic, MSA has had a good track record of detecting issues with equipment, resulting in improved performance.

- There is a proposition that current and any new LVES and/or MVES installations need to be supported with ongoing servicing and maintenance to ensure equipment is working optimally. There is also evidence that programming of the electrical pulse may need to be seasonally adjusted for Generation 1 systems to support seasonal variation in livestock.
- The bottom line is that optimal functionality of the equipment requires commitment to ongoing monitoring, servicing and maintenance, however that is achieved. The cost of monitoring product compliance, servicing and maintaining equipment, and optimising systems periodically as required also needs to be considered as part of on-going adoption of the MQST technology.

Adoption levels of ES

A picture of adoption of LVES and MVES by the Australian beef and sheep meat industries can be formed using information on the number of plants with installed capacity and estimates of throughput levels.

The data available on ES installations reflects the timing of investments in ES modules and the number and type of ES modules that were installed through Plant Initiated Projects (PIPs). To date in Australia, there have been around 40 low and medium voltage systems installed and 4 systems installed overseas (see table 5.1).

- This includes 18 installations for beef and 26 for sheep meat.
  - Overseas installations have been in Chile, Norway the United States and New Zealand.
- Within Australia, 27 of these installations were in MSA licensed plants.

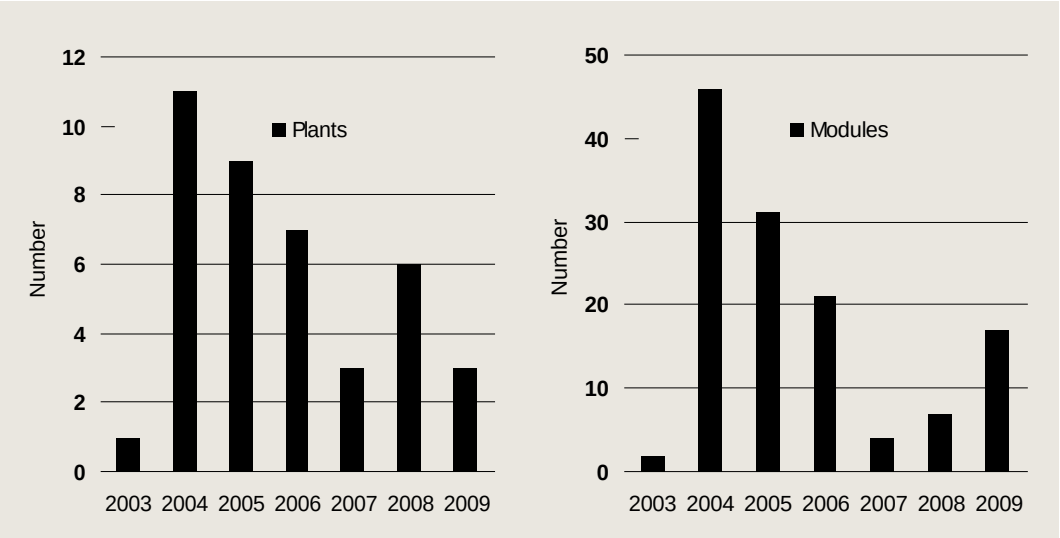
5.1 Number of plants with LVES and MVES systems installed

	Australia and overseas			Australia		
	Beef	Sheep	Total	Non-MSA	MSA	Total
	No.	No.	No.	No.	No.	No.
Low voltage	17	13	30	8	19	27
Medium voltage	1	13	14	5	8	13
Total systems	18	26	44	13	27	40

Source: MLA.

Chart 5.2 below shows the time path of adoption of LVES and MVES systems and modules for beef and sheepmeat processors.

5.2 Adoption of low and medium voltage ES technology[a]



[a] Primarily for the purpose of improving eating quality outcomes.

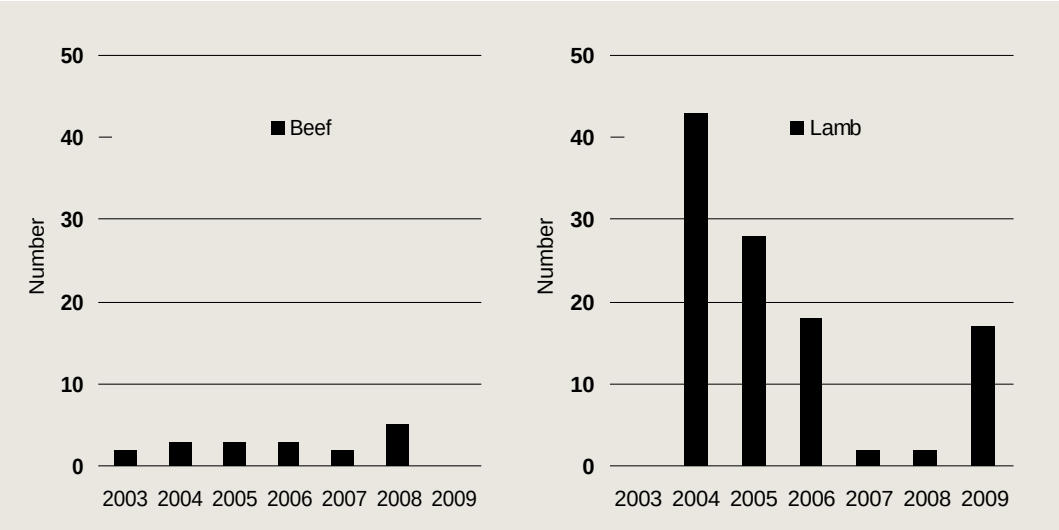
Data source: MLA.

Over the period 2003 to 2010, a total of 40 Australian plants installed ES as process interventions.

- This involved the installation of a total of 128 ES modules. The majority of these modules were installed between 2004 and 2006, since that period adoption has slowed.
- If it is assumed that the average cost of a $35 000 per module in today's values, this implies a total investment by industry over the period of around $4.5 million in 2010–11 terms.

Chart 5.3 shows how ES was used between the beef and sheepmeat industries on the basis on number of modules with 18 modules installed in beef operations and 110 modules in sheepmeat operations mostly during 2004 and 2005.

5.3 **Adoption of low and medium voltage ES modules[a]**



[a] Potentially for the purpose of improving eating quality outcomes.

Data source: MLA.

- The different profile for each meat reflects the relative importance of ES as an intervention for cold shortening in lamb and is less important to improving eating quality of beef.

Adoption on a production basis

To provide a better indication of the level of adoption, the percentage of total Australian meat production utilising ES to improve eating quality outcomes was estimated. But this approach should recognise some difficulties in the available data:

- throughput carcass weight tonnages and relative exposure to the domestic and export market are not known precisely for some plants with ES installations;
- installed systems at some sites may only be used on some lines within each plant;
- ES may be used only on some of the throughput on the installed lines and will exclude heavy grain fed and older cattle and older sheep;
  - That said, older cattle and sheep are not eligible for MSA grading.
- LVES and MVES may not be used to achieve the eating quality window or may be used for other purposes such as the improvement in meat colour.

The use of ES is widespread with the number of companies with installed capacity accounting for 75 per cent of red meat production. ES is significantly more important for lamb than it is for beef.

Lamb

In 2010-11, 833 000 lamb carcasses were presented for MSA grading for which ES is integral to the process controls that contribute to eating quality outcomes. This significantly underestimates the adoption of the technology.

- On the basis of MSA Accredited processors who have installed ES capacity, we estimate that adoption of ES could be as high as 7.5 million carcasses or 75 per of the domestic lamb slaughter.
  - On the basis of installed capacity and including non-MSA processors, this adoption could be high as 90 per cent of domestic lambs.
- MSA accredited processors also use ES on export quality lambs. Given plant capacities and estimates of market orientation, it has been estimated that around 40 per cent of export lambs are stimulated.
- Overall, we estimate that 10.8 million lamb carcasses or 46 per cent of all lamb and mutton carcasses are processed using ES technology in Australia by MSA licensed processors. On the basis of installed capacity, this adoption rate increases to 67 per cent of all lambs processed for domestic and export markets.

Beef

The extent of adoption of ES technology in beef is known. Data supplied by MSA program shows that after making allowances for the number of heavy grain fed carcasses graded under MSA and those carcasses that do not comply with the MSA temperature-pH window, around 85 per cent of MSA graded carcasses are being effectively stimulated.

- In 2010-11 terms this equates to 1.2 million cattle or 15 per cent of all cattle processed in Australia.

Investments made by MLA and AMPC in ES

Table 5.4 shows the investment by MLA and AMPC in ES as laid out in the AOPs. From 2004–05 onwards, MLA investments in ES were about $2.5 million each year until 2008–09 it increased to $3.5 million after which the R&D activity ceased apart from some PIP investments.

5.4 **MLA and industry investment in electrical stimulation technology[a]**

Source	*2003-04*	*2004-05*	*2005-06*	*2006-07*	*2007-08*	*2008-09*	*2009-10*	*Total*
MLA Levy	0.325	0.325	0.325	0.325	0.160	0.255	0.000	1.715
AMPC Levy	0.060	0.162	0.183	0.172	0.216	0.321	0.131	1.245
Partnership (MWNZ)	0.000	0.681	0.685	0.540	0.457	0.270	0.000	2.633
Partnership (RCMM)	0.000	0.000	0.123	0.110	0.125	0.075	0.000	0.433
Partnership (Agres)	0.000	0.000	0.000	0.000	0.225	0.080	0.000	0.305
Partnership (Other[b])	0.000	0.000	0.000	0.000	0.000	0.657	0.000	0.657
Plant Initiated	0.000	0.002	0.023	0.012	0.056	0.066	0.131	0.290
Aust Govt	0.385	1.172	1.338	1.159	1.239	1.725	0.262	7.279
TOTAL	0.770	2.342	2.677	2.318	2.477	3.449	0.523	14.556

[a] 2010-11 data was not available. [b] Other = Food Processing Equipment, Merit of Measurement, MIRINZ

Source: MLA Actual expenditure, various programs – Joint AMPC, PIP, PIIP.

- In total, the total MLA, AMPC, industry and partnership (MWNZ, Real Cold MilMech, Ag Research NZ) investment over the evaluation period could be in the order of $14.5 million in nominal terms.

Using AOP detail, it has been assumed that approximately 75 per cent of these expenditures or $10.9 million have been attributed to sheepmeat with the remaining 25 per cent or $3.6 million to beef.

Benefits of ES

The total benefits of ES in terms of improved eating quality for beef and sheepmeat are not possible to quantify. While we have an estimate of the adoption rate in terms of carcasses, the associated premium per kilogram is difficult to observe.

It is noted that requirements by Woolworths, Coles and other retailers for ES as part of the contract conditions for particularly lamb, in addition to the MSA program, was an important driver of adoption.

- One view is that improvements in eating quality from ES may simply have been incorporated into the minimum standards required by the supermarkets and other customers (just as the case with food safety).
- Another view is that that many of the benefits in terms of eating quality are internalised to the lamb value chain. That is, no additional premiums received by processors can be readily observed due to confidentiality of commercial arrangements. But it certainly assists individual processors securing contracts over competitors that do not have the technology.

MLA played a significant part in identifying and communicating the potential benefits of ES to industry and key customers.

6 *The impacts of the program*

Improved levels and consistency of eating quality should lead to the following impacts compared to the case that would exist without the eating quality program (the baseline):

- increases in consumers' willingness to pay for beef or sheepmeat reflected by premiums paid for MSA product;
- increases in demand for beef and lamb; and
- additional value generated at retail level which is then expected to be passed back down the chain.

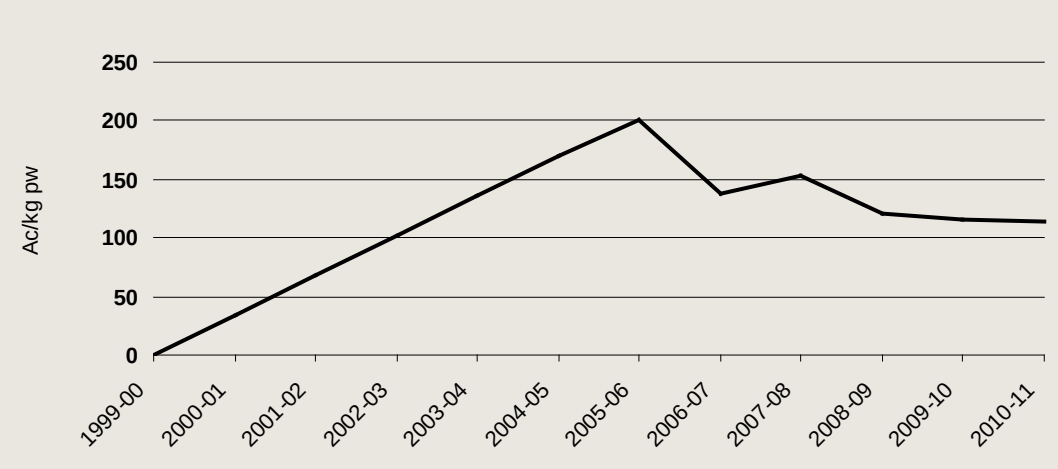
Price premiums

A *first* step towards identifying an indication of impacts on the market is that consumers recognise the improvements in the quality and consistency of the red meat offered and therefore they are willing to pay higher prices for it.

Beef

Chart 6.1 shows the average retail premiums achieved since 1999–2000 in nominal terms. Premiums achieved for graded MSA over ungraded primals or cuts increased to 200 cents per kilogram before falling to 114 cents per kilogram in 2010-11.

6.1 **Average MSA retail premiums for beef[a]**



[a] Premiums compared to the price of the same ungraded cut sold through the same outlet.

Data source: MLA.

- MSA started collecting data on retail premiums in 2005. The premiums for the precedent period until 2007–08 have been estimated by Griffith.[2] The premiums for the last three years are published by MSA in the annual outcomes report.
- The assumed retail premiums suggest a peak in nominal terms around 2004–05 and decline since then. There are several factors affecting the level and trends of retail premiums achieved on MSA product.

With increasing product volume on offer in the market it is likely that premiums start to fall.

- The more consumers that become familiar with the MSA product, when the novelty impact declines and it becomes the minimum standard expected, the associated premiums would likely disappear.
- There is no evidence of price premiums associated to MSA sheepmeat on the domestic market.

It is estimated that approximately half the carcass meat yield would attract a premium as MSA product. This relates back to the meat yields achievable under:

- the two carcass hanging methods available to industry; and
- the boning group distribution of the MSA carcasses graded, which is in turn a function of the quality of the cattle available in Australia. See appendices B and C for greater details on this estimate.

Chart 6.2 shows how these average retail premiums vary across the cuts. The majority of the premiums are achieved from the higher value loin and hind quarter cuts, while on lower value cuts the premiums are distinctly lower on a per kilogram basis. Maximisation of value across the whole carcass is a vital objective of the beef or sheepmeat value chain.

MSA retail price premiums for beef in 2010–11 (table D.3 in Appendix D) was 114 cents per kilogram as simple average across MSA graded primals only compared to the equivalent ungraded primals. As an average weighted by the relative importance of primals or cuts across the carcass, this translates to a premium of 37 cents per kilogram.

The data available to this evaluation included butcher point of sale information (see appendix F) also indicates that MSA cuts are priced higher than the average quality product.

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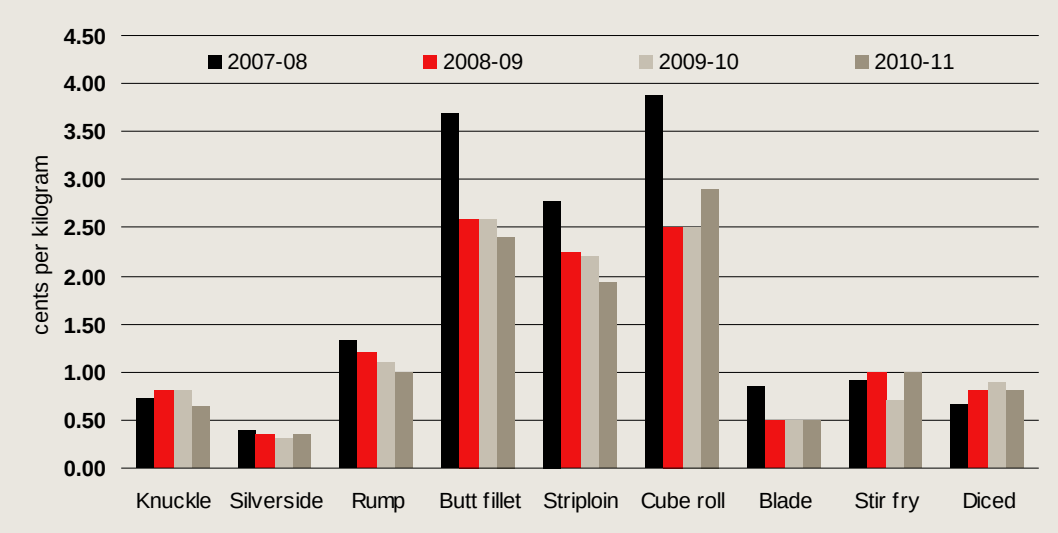
2 Griffith, G., Rodgers, H., Thompson, J., and Dart C., 2009, *The Aggregate Economic Benefits to 2007-08 from the Adoption of Meat Standards Australia*, Australian Agribusiness Review Volume 17, Paper 5.

6.2 **Average retail premiums across beef cuts**



Data source: MLA.

Sheepmeat

There is no routine data collection for retail premiums on lamb sold in the domestic market. In addition, there is no systematic data collection for over-the-hooks lambs that compares returns from MSA and other processors but it is widely recognised that no premium can be identified. This reflects a number of factors:

- MSA for sheepmeat is less sophisticated than for beef, as noted earlier, being based on a mob or batch basis rather than on individual cuts, rather MSA Sheepmeat has evolved as a process control system that improves quality and product consistency;
- for some supermarket customers, MSA sheepmeat has been incorporated directly into the minimum or contract specifications of supply;
  - As identified before for ES, it is difficult to observe a premium because of the highly confidential nature of these commercial arrangements, but it is clear that selling MSA products provides an advantage over competitors who are not licensed.
- given the current strong market conditions for lamb at retail and through all markets, that it would be extremely challenging to extract a consistent price premium for MSA eligible sheep.

Therefore, it is difficult to conduct a parallel analysis to that of beef. The conclusion is that the benefits to individual processors, in terms of prices received and contract terms, must be equal to or greater than their additional costs of supply in providing lamb to customers to the MSA specification.

These additional compliance costs were estimated for an MSA licensed processor including an electrical stimulator, staff training, pH meters, AUS-MEAT and MSA audits and ongoing assessments.

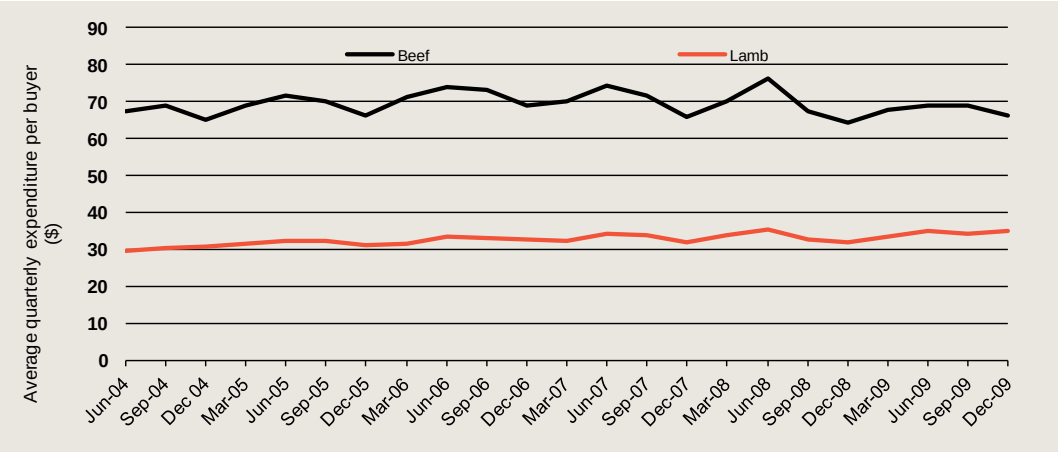
- For a typical plant, this would represent an annual cost of around $30 000 based on an average daily throughput of 3 500 lambs per day, the compliance cost on a per kilogram basis would be very small and would likely underestimate the MSA premium.
- There are likely to be a range of additional in-kind and other costs, such as compatibility of MSA requirements with existing plant operations, encountered by plants in complying with MSA requirements which would better indicate the associated premium involved.

Increased demand for red meat

A *second* step in assessing impacts of the eating quality program on the market is to examine whether the consumers are increasing their demand for red meat or they are just substituting standard quality meat for MSA graded meat. The expected impact is to grow overall demand for red meat because the eating quality program is part of an integrated industry strategy with this objective.

Using *Homescan* data at the retail level, it can be observed that average quarterly expenditure on red meat has remained stable over the past years (see chart 6.3).

6.3 **Average quarterly expenditure on red meat by buyer**

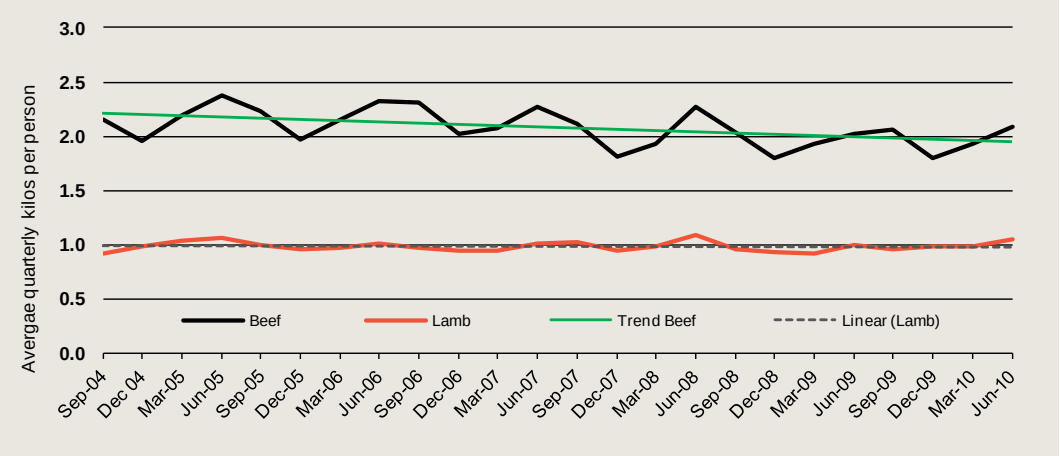


Data source: Homescan Nielsen data.

On an annual basis, expenditure on beef has declined at a rate of 0.3 per cent while expenditure on lamb has increased at approximately 2.4 per cent. It has been argued that the downward trend in consumer expenditure on beef is a reflection of rising retail prices. However the increase in beef retail prices has been lower than that of competing meats; whereas, both expenditure and prices of lamb have increased over time, reflecting stable consumption despite rising retail prices.

Average retail prices for beef and lamb have been increasing at 3 and 4 per cent a year respectively, affecting consumption figures on a per person basis. Beef consumption has declined at 2 per cent a year and consumption of lamb remains stable. See chart 6.4 for an illustration of these trends.

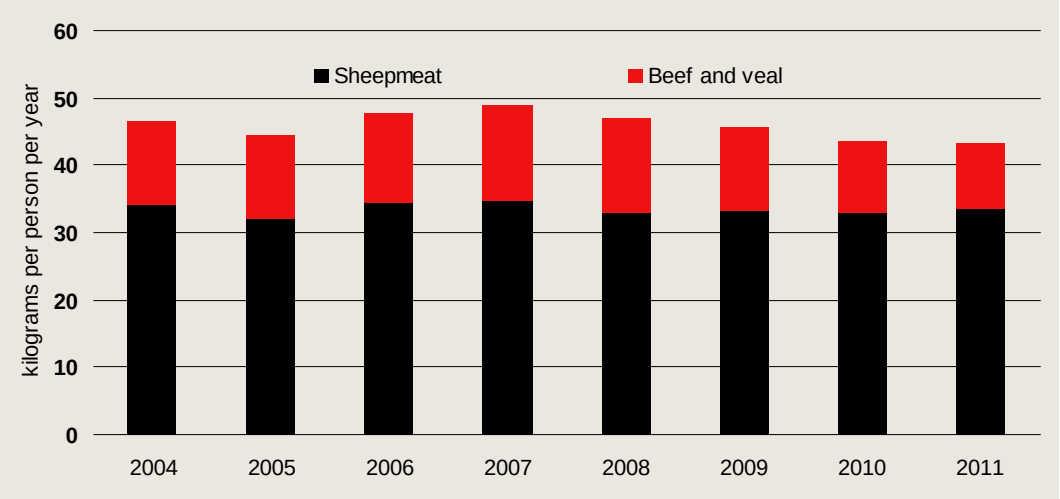
6.4 Consumption of meat per person based on retail-only data



Data source: Derived from Nielsen *Homescan* data and retail prices data.

- Both, the consumer expenditure figures at retail (charts 6.3 and 6.4) and consumption figures calculated using domestic disappearance (chart 6.5) are consistent and suggest a downward trend over time in demand for red meat.

6.5 Consumption of MSA beef[a]

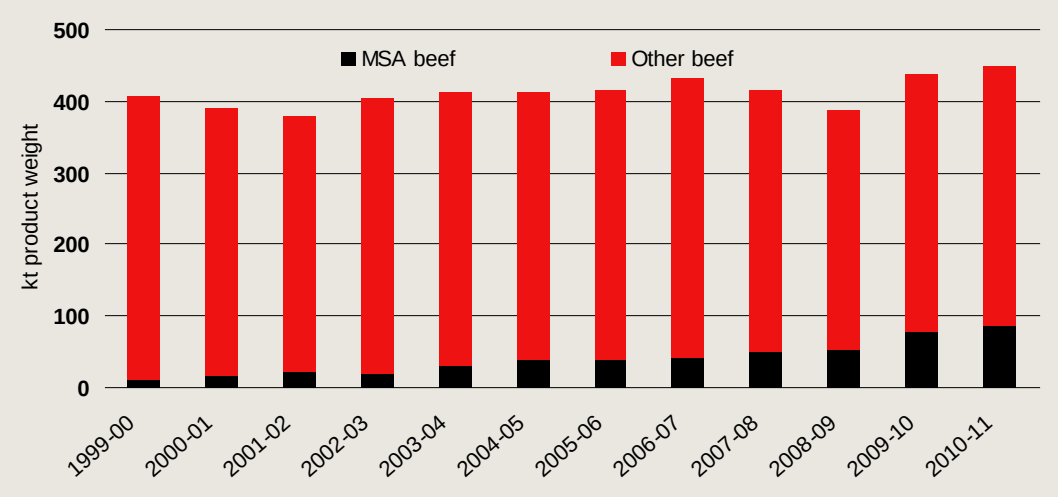


[a] Estimated as domestic disappearance across all channels.

Data source: GMI database.

Chart 6.6 presents the estimated market penetration of MSA beef since 1999–00. In 2010–11, the estimated MSA beef yield (average of 87 kilo tonnes) represented approximately 19 per cent of domestic disappearance (this is volumes across all channels).With an unchanged demand for all red meat, the increasing share of MSA product in the market, suggests the substitution of ungraded product by MSA meat.

6.6 **Consumption of beef, domestic disappearance[a]**



[a] Across all channels.

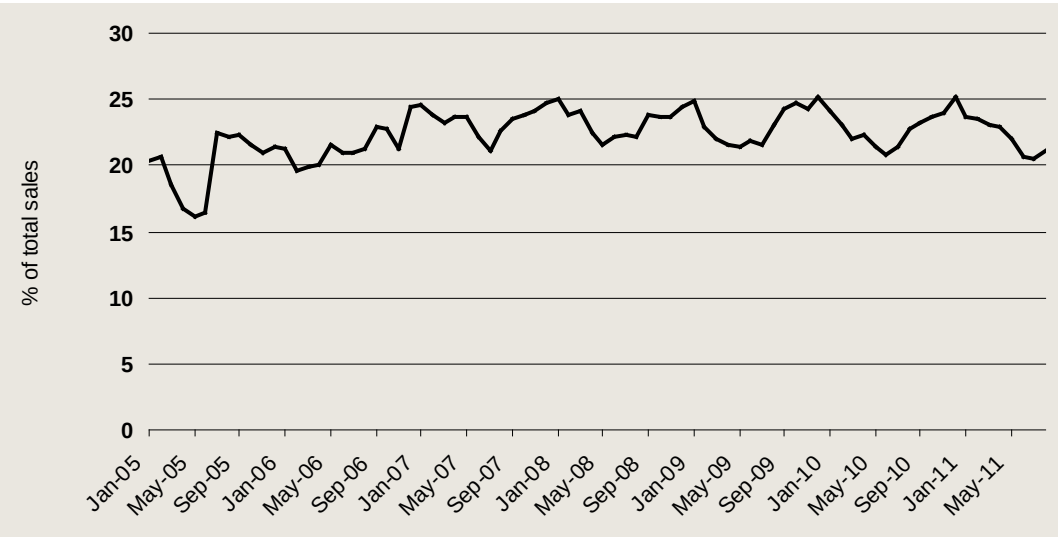
Data source: GMI database.

An additional source of performance indicators for MSA product in the market, although only representing a coverage of less than 1 per cent of the estimated volume of retail product sold on the domestic market, is based on butcher point of sale data. Chart 6.7 shows that in the 100 stores covered in the butchers' database, the MSA contribution to total beef sales has been stable between 20 and 25 per cent of total beef expenditure.

- Unfortunately there is not any equivalent data for lamb.

This data is sourced typically from high end butchers involved in the ICA/MSA program, many of which have sold MSA product since the inception of the database. This fact, plus the limited coverage was results in a consistently steady contribution

6.7 **MSA contribution to total consumer spend on beef**



Data source: MLA Butcher Point of Sale database (appendix F).

of MSA graded product to total sales through these outlets.

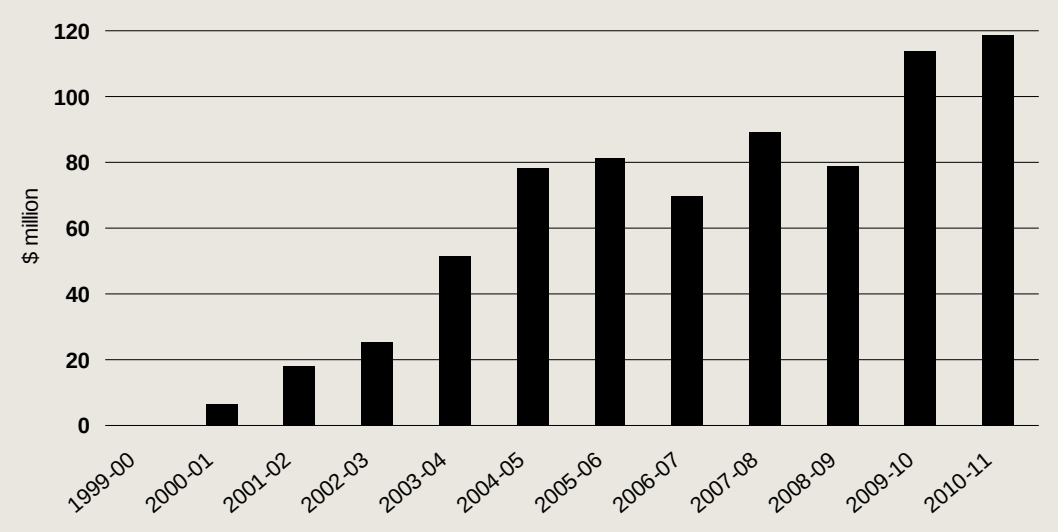
The increasing adoption of MSA, along with the fact that both demand and domestic consumption of beef are not growing, does not imply that the eating quality program is unsuccessful. Indeed, the program may have contributed to the maintenance of demand and consumption at observed levels in the face of otherwise adverse market conditions.

- There are several factors affecting demand, besides eating quality, and it may well be that the integrated approach by MLA is actually offsetting the negative impact on demand from these adverse market effects.
- However, there is not sufficient information available to this evaluation to isolate the effects of each of the domestic demand drivers, eating quality among them.

Additional retail value

A *third* step is to look at the combination of the impacts on retail prices and demand and assess whether the industry is extracting more value out of the domestic market compared to a scenario without the eating quality program. Additional retail value is implied when the number of carcasses graded, and resulting yield in saleable product is combined, with average retail premiums in chart 6.8.

6.8 **Additional value at retail for beef**



Data source: MLA.

- In 2010–11, $119 million of additional value resulted from selling MSA product up by $5 million from the previous year, where much higher product volumes were partially offset by a fall in the average premium.

As already noted, additional value at retail is an impact but the size and distribution of benefits (in terms of profitability) along the chain depend on a range of factors including:

- the contribution of each part of the chain to the retail price including;
  - how large the MSA compliance costs are at each stage of the chain;
- the scope of each part of the chain to pass on these costs forwards or backwards; and
- the contribution of complementary activities to the MSA outcome such as good marketing through the use of brands.

Any additional retail value for lamb cannot be observed at this stage.

The baseline for the program

To establish the benefits of the eating quality program over the evaluation period, we need to compare the outcomes and impacts that are observed in the market as outlined in chapter 3 (the observed case) with those that may have prevailed without the MLA investment (the baseline).

In contrast to other evaluations, the business case for the MSA program requires the collection of supporting data with which to track the outcomes and the impacts of the program.

- The implicit baseline for the evaluation is that without MLA investment, MSA and other eating quality improvement technology would not have been developed.
- It also assumes that individual businesses or groups of businesses in the red meat industry would not have developed a parallel system that would go some of the way to addressing eating quality concerns of consumers.

The obvious alternative to MSA would be that the Australian industry adopts the US grading system, given the high level of recognition in key export markets such as Canada, Japan and Korea.

- This is especially the case given the strong historical links that the Australian industry with the United States through ownership and through shared export markets.
- In absence of the AUSMEAT language and MSA, Australian processors may have had little choice but to adopt the US system. Box 6.9 outlines the US system in broad terms.

In terms of comparing the key disadvantages of adopting the US system:

- MSA is more sophisticated than the current scheme as it is not based on direct measurement of tenderness or eating experience, although marbling and maturity are indicators of tenderness;

6.9 Outline of the US grading system

In the United States, the United States Department of Agriculture (USDA) Agricultural Marketing Service (AMS) operates a voluntary beef grading program.

There are five beef quality grades based on two main criteria: the degree of marbling (intramuscular fat) in the beef, and maturity or the physiological age of the animal as measured by ossification.

- **Prime** — highest quality based on a high and well distributed intramuscular fat content (marbling) representing only a small proportion of carcasses. Is sold to hotels and upscale restaurants.
- **Choice** — high quality but with far less marbling than Prime, representing around half of carcasses from lot fed cattle.
  - Choice is widely available in US foodservice industry and retail markets.
- **Select** — the lowest grade commonly sold at retail that is of minimum acceptable marbling quality, and therefore is less juicy and tender due to lower marbling.
  - US Choice and Select have high levels of recognition in key export markets such as Japan and Korea.

Standard and Utility — low levels of marbling quality, and is also less tender than Select because it is produced from older animals. Cattle and carcasses at this level are almost never offered for grading and primarily used by manufacturers and canners.

Prime, Choice and Standard maturity is USDA A or B maturity (less than MSA ossification of 300) and Select is USDA maturity A (less than MSA ossification of 200).

There are also five beef yield grades 1 to 5 —which estimate the yield of saleable meat product estimated in terms of closely trimmed (retail) cuts. Although consumers are not aware of it, yield grade is an important marketing tool for packers and retailers.

http://meat.tamu.edu/beefgrading.html, Date accessed 30 September 2011.

- MSA also accounts for a larger number of other factors that contribute to eating quality outcomes including livestock preparation and processing, post slaughter handling, product ageing, cut and cook method.
  - 70 to 80 per cent of cattle would fall into 1 quality grade and MSA provides further differentiation than would be available under the USDA system.

- Carcase based description has been surpassed by MSA due to the range of eating quality for different cuts within a carcase let alone between cuts from different carcases.
- Individual cut eating quality is not related to an overall carcase grade. For example, if a carcase is graded Prime, the loin cuts may eat well however this does not automatically mean that the topside will eat well.

Alternatively there would be some significant advantages to adopting the US system:

- Domestic customers and those consumers in key export markets are already familiar with it.
- While not guaranteeing eating quality, the US system incorporates many similar elements and principles when compared to MSA.

To develop a set of baseline outcomes where some part of the Australian red meat industry adopted the US system would be very challenging especially given that data collected and reported by MSA has been designed implicitly around the baseline of 'without investment in eating quality program'.

The costs of the program

The outcomes from the MLA eating quality program observed today are the result of the concerted action by both the MLA and the CRCs, and it appears that research components of the Beef CRC relating to eating quality were already in train well before this evaluation period.

- In addition, the outcomes we see today are also the result of investments made by industry in complying with MSA requirements.

The costs of the program can be split between those incurred through MLA and CRC investments in the program and those directly incurred by industry in the adoption of the scheme. The majority of the total investment along the chain has been made on behalf of livestock producers through levies that fund MLA's work on eating quality.

- A small part of this cost is recovered through licence/accreditation fees paid by processors, approximately 5 per cent, as shown in table 6.10.
- Processors pay the full cost of training and auditing in addition to their license fee.

Costs of the program to producers through MLA (levies)

The previous chapters presented the annual costs of the program, including funding of scientific research by the beef and the Sheep CRCs. In total, the program has cost $92.5 million over the period 1998–1999 to 2010–2011, or approximately $7.1 million a year (gross cost). See table 6.10 for the complete series of investments, including MLA cash contributions to the CRCs, and the recovery of costs through fees paid by processors.

6.10 **Cost of the program to beef producers through MLA**

	1998-99	*1999-00*	*2000-01*	*2001-02*	*2002-03*	*2003-04*	*2004-05*
	$m	$m	$m	$m	$m	$m	$m
Beef							
MLA activities	6.7	12.1	8.7	7.7	6.3	5.5	5.5
MLA cash to Beef CRC	7.4[a]	0.0	0.0	0.2	0.3	0.2	0.3
Cost recovery beef	0.0	0.0	0.0	0.0	0.8	0.9	0.8
Total	14.1	12.1	8.7	7.9	5.7	4.7	5.1
Sheep							
MLA activities	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MLA cash to Sheep CRC	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Cost recovery sheep	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Total beef and sheep	**14.1**	**12.1**	**8.7**	**7.9**	**6.6**	**5.7**	**5.9**
Cost recovery	0.0	0.0	0.0	0.0	0.8	0.9	0.8
NET beef and sheep	**14.1**	**12.1**	**8.7**	**7.9**	**5.8**	**4.8**	**5.2**
Electrical stimulation (MQST)	0.0	0.0	0.0	0.0	0.0	0.8	2.3
Total MLA	14.1	12.1	8.7	7.9	5.8	5.6	7.5

	2005-06	*2006-07*	*2007-08*	*2008-09*	*2009-10*	*2010-11*	*Total*
	$m	$m	$m	$m	$m	$m	$m
Beef							
MLA activities	5.4	3.9	3.6	3.2	3.2	3.7	75.4
MLA cash to Beef CRC	0.2	0.1	0.3	0.1	0.2		9.3
Cost recovery beef	0.7	0.3	0.2	0.2	0.2	0.1	4.3
Total	4.9	3.8	3.7	3.1	3.2	3.5	80.4
Sheep							
MLA activities	0.4	0.3	0.7	0.7	1.4	2.4	5.9
MLA cash to Sheep CRC	0.1	0.1	0.2	0.2	1.2		2.0
Cost recovery sheep	0.0	0.0	0.0	0.0	0.1	0.1	0.2
Total	0.5	0.3	0.9	0.8	2.5	2.4	7.6
Total beef and sheep	**6.0**	**4.4**	**4.8**	**4.2**	**6.0**	**6.1**	**92.5**
Cost recovery	0.7	0.3	0.3	0.2	0.3	0.2	4.5
NET beef and sheep	**5.3**	**4.1**	**4.6**	**3.9**	**5.7**	**5.9**	**88.0**
Electrical stimulation (MQST)	2.7	2.3	2.5	3.4	0.5	0.0	14.6
Total MLA	8.0	6.4	7.0	7.4	6.2	5.9	102.6

a This figure includes MLA cash contributions to the beef CRC that funded scientific research directly relating to eating quality for the period 1993-1994 to 1997-1998.

Source: MLA, CRCs.

- MLA activities have cost $81.3 million:
  - $75.4 on beef
  - $5.9 on sheep.
- MLA and AMPC cash contributions to the beef and sheep CRCs to fund scientific research that directly relates to eating quality amount $11.3 million:

  - $9.3 million to the beef CRC
  - $2 million to the sheep CRC.
- Total cost recovery is of $4.5 million:
  - $4.3 million from beef processors
  - $0.2 million from lamb processors.
- The net expenditure in the program is of approximately $88 million, or around $6.7 million each year.

Including the investment in electrical stimulation through MQST, which is outside of the MSA program, the total investment comes to $102.6 million.

Funding through the CRCs

The Beef and Sheepmeat CRCs have also been significant investors into improving eating quality outcomes for the red meat industry. To get an accurate picture of the CRC contribution to total investment towards eating quality outcomes for this evaluation, two critical factors had to be accounted for:

- the inclusion of investments made by the Beef CRC before the commencement of the evaluation period; and
- allowances made for overhead costs.

To account for these factors, funding contributions are calculated under two scenarios for the beef component of the MSA program.

- An implicit assumption is that these investments were predicated on the basis that the red meat industry would invest in an eating quality scheme through MLA as laid out in industry planning documents such as the Meat Industry Strategic Plan.

In addition, often is the case in a range of R&D activities, the contribution of non-staff in-kind costs can be substantial.

- These values are generally imputed by calculating the opportunity costs of resources that could have been employed in other research areas.
- Over the period 1993–94 to 2009–10, these costs accounted for $37.4 million in nominal terms around 37 per cent of the total investment made by the Beef CRC.

Low CRC case for beef

- This scenario excludes the Beef CRC investments made prior to 1998–99 and the non-staff in-kind expenses.
- The implicit assumptions would be that the Beef CRC would have invested in these activities anyway, especially given the synergies with other areas of CRC research.

- In addition, this scenario assumes that the CRC overheads would not have been fully employed at the time.

On farm compliance costs

A potentially significant factor is the additional costs involved on-farm in complying with MSA requirements. These would be in relation to costs involved in changing procedures at the farm level and possibly developing better management capability.

The production of MSA cattle and sheep requires implementing sound management practices that generally apply across the industry, such as:

- ensuring the livestock are finished to the required specification; and
- using sensible animal welfare practices that minimise stress.

The MSA system has for the most part endorsed best-practice, such as those laid out in existing on farm quality assurance programs such as Livestock Production Assurance rather than developing a completely new set of rules.

- Any additional compliance costs incurred by MSA licensees on farm are very difficult to observe, but given the MSA requirements are consistent with best practice anyway, we have assumed that they are minimal.

Costs of adoption for processors

Costs at this stage of the value chain involve accreditation fees and costs related to changes in procedures at the processing plants and marketing of the graded product to assure return (cost recovery) from end users.

- The increased cost of production, referred to by industry as 'premiums' relative to ungraded product, should translate into higher prices paid by consumers.
- In principle, higher prices should result in a fall in demand, unless the industry is able to market the product as a new higher quality, improved or as a value-added product.

Beef

There are additional costs involved for processors of MSA production at two distinct levels:

- to become an MSA accredited processor and to produce MSA product to the minimum 3 star level; and
- additional costs beyond that required to harvest 4 and 5 star product.

Evidence from the consultation suggested that beyond MSA eligible livestock costs, that the direct or observable increase in cash operating costs are relatively small. These costs include:

- annual MSA license fees;
- training of MSA qualified graders;
- MSA auditing expenses;
- purchase of cartons or inserts for cryovac bags;
- purchase of inserts for vacuum bags; and
- development of carton lids, bags and brand support material.

In the case of sheep and beef plants the installation and/or maintenance of an electrical stimulation unit.

In practice, processing of MSA compliant animals is handled on a batch basis similar to how EU or organically certified cattle must be segregated from other cattle. This segregation also applies to carcasses and primal product. Similar to EU cattle, MSA batches are usually the first run of a shift allowing the processor to prepare for the segregation and special treatment along the chain such as pre-chiller grading, boning, packaging and labelling.

- Rather than direct cash costs, processors indicated that the majority of the costs involved in complying with MSA were adapting the way they ran their plant. Handling non-compliant carcasses may also impose additional costs, especially on smaller operators where production is focussed specifically on MSA as their main market.
- Critical points for logistics were the marshalling of carcasses pre-chiller, the chiller assessment itself and boning-out of carcasses.

The impact of MSA requirements on plant logistics appear to depend critically on chain speed (a function of average throughput levels) and configuration of plant layout.

- Overall, of the sample of processors interviewed during the consultation phase of this evaluation, the majority of problems were faced by processors with high chain speed whereas those with lower daily throughput tended to experience fewer challenges.
- It is noted that MSA staff are currently working with some processors to resolve these problems and to better fit MSA requirements around existing work practices.

The consultation process also revealed that adoption of MSA also required complementary marketing activities to maximise the benefits of MSA, especially from the processors' perspective whose objective is to differentiate themselves in the minds of end user customers from other competing suppliers.

- For this analysis, to this stage, we have included only the additional license fees paid by processors.

- The costs associated with adaptation of existing processing lines are derived from Hassall 2004 evaluation of MSA. At the time, an average additional cost of $7.50 per head was found to be consistent with the cost of processing of MSA cattle. In 2010–2011 prices this is approximately $9.30 per head.

However, further additional costs are incurred in order to extract the higher quality MSA graded cuts, for example 4 and 5 stars product. Indicative costs are summarised below and have been confirmed by processors in the consultation process. They are also consistent with the Hassall report in 2004 and those from pilot work by MLA at some processing plants[3]:

- one extra break in the chain once or twice a week to change packaging and boxes;
- $0.60 per carcass for sorting out carcasses;
- $0.60 per carcass for marketing of the product:
  - these are indicative costs for a processing plant of between 3 000 and 4 000 head a week and processing between 20 and 25 per cent of that as MSA.

These costs have been combined with the data on carcass grading numbers to arrive to an aggregated MSA cost at the processing level.

Sheepmeat

We have already identified the visible compliance costs for MSA sheepmeat processors and observed that, on a per kilogram basis, these costs are very low. The conclusion was that there may be a range of in-kind and other costs that may be important but are difficult to quantify. Therefore, no additional compliance costs for processors of lambs have been identified for the purposes of this analysis.

The benefits to industry

Given the lack of data that limits the ability to identify the impact of improvements in eating quality for lamb, the following discussion will focus on MSA beef. However, while MSA Sheep is still in its early stages, relative to beef, it is clear that it has already made a contribution through an improvement in process control and overall quality levels and consistency of the lamb industry.

There are a number of options for quantifying the benefits from improved eating quality in beef.

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3 MLA 2011.*Beef supply chain post doctoral fellow Project Pilot 4 and 5 star compliance*. Milestone report, project code B.BSC.0089.

Demand–side option: one approach is to represent eating quality improvements as a change in the demand for these commodities, so that an improvement in the quality of the product can be shown to result in an increase in demand.

- An approximation of the gain from this increased demand is the initial increase in retail price reflecting the new level of consumer willingness-to-pay.
- These gains from the increase in consumer expenditure are distributed to participants along the value chain in relation to additional costs incurred at each stage of the chain and the scope for those in the chain to pass on those costs to each other.

Supply-side option: an alternative approach is to view quality-enhancing research as a change in supply — as a new product.

- In this approach an improved eating quality for beef is defined as a different product. A technical change that leads to a change in quality is modeled as a shift in the supply rather than a shift in demand.
- A common assumption in this approach is that there is no or limited substitution in demand between the different qualities.
- This is clearly not the case for beef where processors and retailers attempt to move consumers between quality categories on the basis of a combination of price and non-price promotion.

One view on this issue is taken by Griffith et al (2009):

> …a more fundamental problem for the present application is that MSA is fundamentally just a grading system — it is an improvement in the reliability of information surrounding exchanges…Thus there is no change in quality per se, so there is unlikely to be higher aggregate consumption of beef in the domestic market.

The same report concludes that there has been no change in the average quality of beef, given no change in the underlying quality profile of the cattle herd, but instead, MSA has allowed processors and consumers to more reliably identify the quality beef that was already there.

- This suggests that the primary impact of MSA is substitution of MSA-graded beef for ungraded beef, but currently there is no information on the interaction between these two segments on the basis of relative prices.

Another view is that MSA has not only allowed consumers to better identify quality beef, but also has resulted in an overall improvement in the quality of all beef and so has sustained demand at levels higher than without the scheme.

While recognising that there are many drivers of improved beef eating quality (including use of supplementary feeding and use of best practice process control through the chain), it is apparent that the science of MSA and the extension provided by the MLA eating quality program has formalised and facilitated these improvements.

- The previous chapter identified that MSA product has had significant penetration into the domestic market while the overall level of red meat consumption has remained stable.
- There are also likely to be significant spillover benefits from MSA from both:
  - MSA accredited processors who transfer some of the process control techniques to their non-MSA production; and
  - MSA accredited producers to other, unaccredited producers.

But the impact of these spillover benefits is very difficult to quantify.

Additional value for producers

The additional value to farm level producers from MSA are summarised in table 6.11.

In 2010-11, the average premium reported for MSA yearling cattle sold over the hooks (OTH) was around 15 cents per kilogram dressed weight.

- Using an average price for young cattle as the EYCI, this represented a premium of around 3.9 per cent.

In consultation with stakeholders conducted during this evaluation, it was found that in many cases producers were not achieving premiums from MSA cattle but were being discounted for non-compliance at the processing plant.

- Some processors are now paying differential premiums for cattle between boning groups 1-4 and 5-12.

6.11 **Premiums paid to beef producers**

		2001-02	*2002-03*	*2003-04*	*2004-05*	*2005-06*
MSA premiums						
Cattle from boning group 1-12	c/kg cwe	8.0	8.0	8.0	8.0	8.0
- as proportion of EYCI	%	2.4	3.0	2.4	2.2	2.1
Cattle from boning group 13-18	c/kg cwe	0.0	0.0	0.0	0.0	0.0
MSA premiums paid						
Cattle from boning group 1-12	$m	7.0	6.7	10.2	12.3	12.7
Total	$m	7.0	6.7	10.2	12.3	12.7

		2006-07	*2007-08*	*2008-09*	*2009-10*	*2010-11*
MSA premiums						
Cattle from boning group 1-12	c/kg cwe	8.0	9.0	8.0	15.0	15.0
- as proportion of EYCI	%	2.5	2.8	3.0	4.5	3.9
Cattle from boning group 13-18	c/kg cwe	0.0	0.0	0.0	0.0	0.0
MSA premiums paid						
Cattle from boning group 1-12	$m	13.9	18.4	17.4	48.5	53.6
Total	$m	13.9	18.4	17.4	48.5	53.6

Source: Appendix D.

Based on the premium paid and the EYCI as being representative for these calculations, the acquisition cost of MSA cattle was estimated to be worth over $1 billion in 2010-11.

- The MSA premium component of this total was estimated to be around $53.6 million.

Estimating the additional value from MSA graded primals for meat processors

MLA collects data on premiums at the wholesale level, as an indication of prices received by processors for graded product. The benefits at the processor level in the value chain have been assessed using these prices.

For 2010–11, average wholesale premiums for MSA product were between 7 and 8 per cent of ungraded product. This premium is equal to:

- 109 cents per kilogram as simple average premium across MSA graded primals only over the equivalent ungraded primals; or
- 29 cents per kilogram recognising the contribution of each primal to average carcass weight assuming that all cuts can be harvested.

In 2010-11, the average wholesale premium across all MSA graded primals, accounting for different MSA yields for each boning groups, was 26 cents per kilogram on a carcass weight basis while total value of wholesale premiums is estimated to be worth $95.5 million (see table 6.12).

6.12 **Additional wholesale value from MSA product**

		2001-02	*2002-03*	*2003-04*	*2004-05*	*2005-06*
Wholesale premiums standard carcass						
Simple average across graded primals	$ per kg pw	0.58	0.87	1.13	1.42	1.62
Weighted average across carcass	$ per kg cwe	0.17	0.25	0.33	0.41	0.42
Wholesale premiums MSA production						
Weighted average across MSA primals	$ per kg pw	0.40	0.60	0.77	0.97	0.97
Weighted average across MSA carcass	$ per kg cwe	0.15	0.23	0.29	0.37	0.37
	$m	13.5	19.6	38.1	58.1	59.8
		2006-07	*2007-08*	*2008-09*	*2009-10*	*2010-11*
Wholesale premiums standard carcass						
Simple average across graded primals	$ per kg pw	1.12	1.34	1.14	1.22	1.09
Weighted average across carcass	$ per kg cwe	0.29	0.42	0.32	0.36	0.29
Wholesale premiums MSA production						
Weighted average across MSA primals	$ per kg pw	0.70	0.99	0.75	0.86	0.70
Weighted average across MSA carcass	$ per kg cwe	0.26	0.37	0.28	0.32	0.26
	$m	47.0	78.4	62.4	105.4	95.5

Source: Appendix C.

Estimating the additional value from MSA graded primals for end users (retail and consumers)

The higher retail prices for MSA beef represents consumers' valuation of the benefits they received from improved meat eating quality.

- However, retail premiums for MSA product do not only reveal consumer's willingness to pay for higher eating quality beef, as they are also influenced by the retailers' size and marketing strategy.
- The observed retail premiums are therefore the result of a combination of the consumer and retailer responses to the availability of MSA product.

Average retail premiums for 2010-11 (table 6.13) were around 10 per cent higher than ungraded product:

- 114 cents per kilogram as simple average premium across MSA graded primals only over the equivalent ungraded primals; or
- 37 cents per kilogram recognising the contribution of each primal to average carcass weight assuming that all cuts can be harvested.

6.13 **Additional retail value from MSA product**

		2001-02	*2002-03*	*2003-04*	*2004-05*	*2005-06*
Retail premiums standard carcass						
Simple average across graded primals	$ per kg pw	0.69	1.03	1.38	1.72	2.01
Weighted average across carcass	$ per kg pw	0.22	0.33	0.45	0.56	0.56
Retail premiums MSA production						
Weighted average across MSA primals	$ per kg pw	0.52	0.78	1.05	1.31	1.32
Weighted average across MSA carcass	$ per kg cwe	0.20	0.30	0.40	0.49	0.50
	$m	17.9	25.7	51.6	78.1	81.2
		2006-07	*2007-08*	*2008-09*	*2009-10*	*2010-11*
Retail premiums standard carcass						
Simple average across graded primals	$ per kg pw	1.37	1.53	1.20	1.15	1.14
Weighted average across carcass	$ per kg pw	0.44	0.48	0.40	0.39	0.37
Retail premiums MSA production						
Weighted average across MSA primals	$ per kg pw	1.04	1.13	0.94	0.93	0.87
Weighted average across MSA carcass	$ per kg cwe	0.39	0.42	0.35	0.34	0.32
	$m	69.8	89.3	78.6	114.0	118.7

Source: MLA and CIE calculations.

In 2010-11, the average retail premium across all MSA graded primals, accounting for different MSA yields for each boning groups, was 32 cents per kilogram on a carcass weight basis while total value of wholesale premiums is estimated to be worth $118.7 million (see table 6.13).

Large retailers have not carried the MSA label (brand) despite being the recipients of significant spillover benefits by integrating the system's standards into their own supply chains.

- This is because they perceive the MSA system is not clearly understood by consumers and added a layer of complexity for marketing beef.
- Also, their strategy of holding onto, or setting lower, price points for beef may challenge their capacity to achieve the necessary 'premiums' to justify the compliance costs for MSA product.
  - At the moment both Coles and Woolworths see MSA as underpinning their already established house everyday and premium brands. The addition of MSA label acts as a quality assurance complement, not adding complexity to the information provided to consumers.
  - Both supermarket chains have formally adopted the MSA backing to their everyday product and premium brands.
- Small specialty/gourmet retailers have for the most part, already taken this approach; having MSA to underpin their own high quality brands.

Decay of benefits

To this point the analysis has simply considered the *observed* benefits of MSA for beef up until the end of the evaluation period of 2010–11. The key question is: would benefits from the investments in eating quality continue to flow even if (theoretically) MLA ceased investing in the program from 2011-12 onwards?

In terms of the 'otherwise' case: this scenario would practically require, at minimum, a number of the basic regulatory, auditing and monitoring functions currently performed by MSA to be continued to maintain the integrity of the scheme.

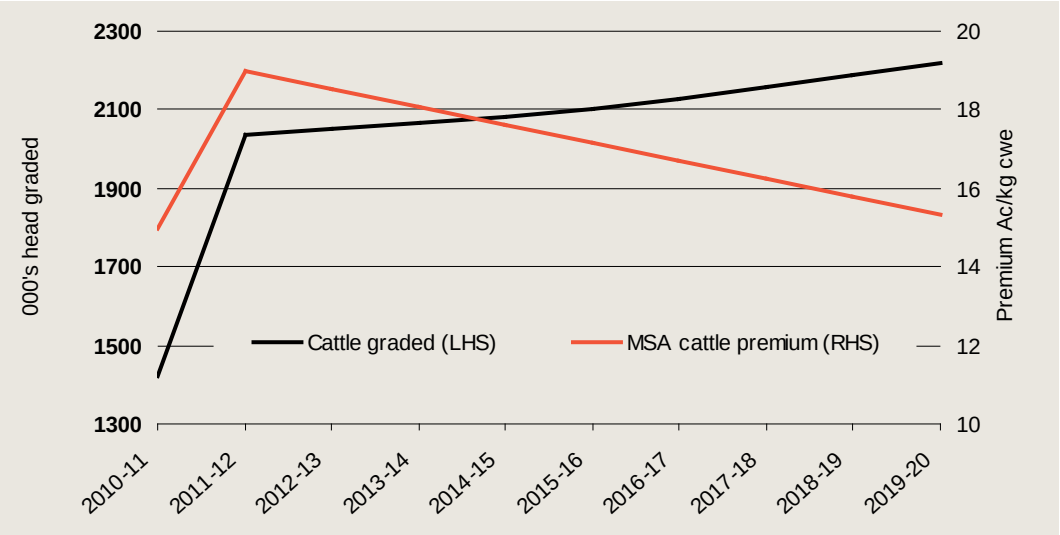
- Alternatively, these activities could be moved to another organisation such as AUSMEAT and be funded by industry.
- In the 2010–11 around $0.766 million (out of a total of $5.8 million) was spent by MSA on activities that support the integrity of the MSA system and brand.
- For this analysis we have assumed that the MSA program would move forward only with basic auditing and integrity related activities (at a cost of $0.766 million each year out to 2015–16).
- As part of the baseline, we have therefore also assumed that the MSA *does not* invest in R&D and marketing activities beyond the timeframe of this evaluation from 2010–11 onwards.

Many of the other activities outside audit and integrity activities conducted within the evaluation period, such as R&D and marketing, would be expected to provide benefits into the future beyond 2010–11. Indeed, stakeholders in the chain who have invested in the MSA brand and technology, from farm through to retail, would have a strong vested interest to at least maintain and use the current system for as long as possible without ongoing MLA support.

To reflect the fact that many of the MSA benefits should persist, at least, over the medium term, a scenario was developed out to 2015–16 which includes:

- total beef carcasses 'graded' MSA reaches 2.0 million in 2011–12 and, following the anticipated growth in the herd, reaches 2.1 million by 2015–16 (see chart 6.14);
- price premiums paid at all levels of the chain are expected to peak in 2011-12 and then fall back to those levels observed in 2010-11 by 2019-20;
  - by 2015–16 we would expect that without continued MLA support for R&D and marketing, that growth in demand would slow, relative to supply of MSA eligible cattle.
  - but this would not result in a significant change in the market from the current position. As a result, price premiums would fall from current levels (19 cents per kilogram in 2011–12) to around 15 cents per kilogram (a 15 per cent fall) back to the level of premiums observed in 2010–11.

6.14 **Baseline MSA number of cattle graded and premiums**



Data source: MLA and CIE calculations.

Payoffs from the program

Table 6.15 summarises the estimates of aggregated costs and benefits for MSA beef at various levels in the value chain and the corresponding benefit cost ratios.

- No equivalent analysis has been conducted for MSA sheepmeat.
- It should be noted that estimates in table 6.15 should not be added across each level of the value chain to avoid double counting.
- In addition, comparing the costs to producers with the benefits at retail should be avoided, unless the benefits at retail that flow back to producers, who fund the program, are translated into saleyard equivalent terms.

Key messages from table 6.15 are:

- In present value terms, the MSA program has invested $99.3 million on behalf of levy payers up to 2010–11. Under the baseline assumptions, another $3.6 million in present value terms of expenditure would be required to run MSA compliance and auditing tasks up to 2015–16.
  - In addition, around another $3.9 million could be included as a result of MLA's investment in electrical stimulation attributable to beef.
  - The anticipated net benefits at the producer level were found to be $650.9 million resulting in a benefit cost ratio of 6.2 to 1 up to 2019–20.
  - There has been a significant net benefit to processors who have adopted MSA.
  - The total additional benefit at wholesale terms was over $1 442.5 million over the evaluation period up to 2019–20.
  - After deducting the acquisition cost of MSA cattle and selected compliance costs, the net benefit was $605.6 million, results in a benefit cost ratio of 1.7 to 1.

6.15 **Benefits and costs at various levels in the beef value chain[a]**

	Costs	*Benefits*	*Net benefits*	*B:C ratio*
	$m	$m	$m	
Beef Producers				
Levy funds	105.1			
On-farm compliance	0.0			
MSA premiums for cattle	0.0	650.9		
Total	105.1	650.9	545.8	6.2
Processors/wholesale				
MSA premiums on cattle	650.9			
Processing compliance	185.9			
MSA wholesale premiums	0.0	1 442.5		
Total	836.8	1 442.5	605.6	1.7
End users				
MSA premiums on beef	1 442.5			
Retail premiums	0.0	1 455.3		
Total	1 442.5	1 455.3	12.8	1.0
CRC investments				
Low – beef	24.9			
High – beef	101.1			
Electrical stimulation (MQST)				
Total - beef	3.9			
All sectors including CRC and MQST[b]				
Total – low CRC	319.9	1 455.3	1 135.4	**4.5**
Total – high CRC	396.3	1 455.3	1 059.0	**3.7**

[a] Net present value basis in 2008-09 dollars over the period 1999-00 to 2019-20 using a real discount rate of 7 per cent. [b] Total costs and benefits of the beef chain exclude costs passed between segments of the value chain.

Source: CIE.

- At retail level, premiums paid by consumers on upgraded beef, indicate a substantial benefit in terms of their willingness to pay.
  - Over the evaluation period up to 2019–20, consumers paid an additional $1 455.3 million for MSA product through retail and food service outlets.
  - The net benefit at the retail level was estimated at $12.8 million. This benefit is calculated primarily on the small difference between retail and wholesale premiums that were observed from the MSA data.
  - It would be expected that the value that retailers capture from selling MSA product would be significantly larger than indicated because the analysis does not reflect the benefits of the improved red meat offer on overall store turnover, relative to their competitors, from attracting new customers.

Taking a whole of chain approach, and including the investments by the CRCs under a low and high scenario and the investment by MLA in electrical stimulation, the net benefit of MSA beef is between approximately $1 059.4 and $1 135.4 million in present value terms representing a benefit cost ratio between **3.7** and **4.5** to 1.

Sheepmeat

There has been no analysis of benefits and compliance costs of the MSA sheepmeat program. This does not mean that there are any benefits from MSA. As identified earlier, we cannot observe any premiums for lambs that are processed through MSA. This is because any benefits of using MSA are captured by processors in terms of gaining access to key customers who now require it as part of their supply contracts. This fact, plus the tight supply conditions for lamb that has prevailed over recent years means that there is unlikely to be any benefit, in terms of higher prices, that has been passed back to producers in terms of higher prices.

Therefore, for this evaluation, we are unable to put a value on the benefit from MSA Sheepmeat, even though at processing level we recognise that the benefits of adopting MSA must be equal to, or greater than, the additional costs of those who have adopted it.

Attribution

The outcomes from the MLA eating quality program observed today are the result of the concerted investments by MLA, AMPC and the CRCs, and infrastructure investments particularly by processors.

Given that the nature of the impacts from improved eating quality, attribution between the contributors is required. Where possible, attribution is generally determined on a share of cost basis. This can be difficult where:

- many of the research components of the Beef CRC relating to eating quality were already in train well before this evaluation period;
- the contribution of other stakeholders, particularly the CRCs, AMPC and individual processors, are not easy to value — because of in-kind contributions and the use of shared infrastructure; and
- leverage from additional funding has been possible, which may have contributed to a larger project and better outcomes than would be possible from the direct contribution alone.

Funding contributions from the Beef and Sheep CRCs have already been outlined and will be used to assist with attribution of benefits arising from the MSA program.

- Here there is a significant area of uncertainty — the distinction between the role of the CRCs as a *source of funding* and as a *service provider* — which makes the issue of attribution more complicated.

The table 6.16 shows that the total investment in projects and programs associated with eating quality is significant on behalf of the red meat industry including the MLA investment in MQST. These costs include:

- investments made by MLA, the CRCs and industry up until 2010-11; and

6.16 **Investments by MLA, AMPC and CRCs**

		High CRC case for beef			*Low CRC case for beef*		
		Beef	Sheep	Total	Beef	Sheep	Total
Nominal terms							
MLA[a]	$m	92.8	15.9	108.7	92.8	15.9	108.7
Beef CRC	$m	71.3	0.0	71.3	20.5	0.0	20.5
Sheep CRC	$m	0.0	4.2	4.2	0	4.2	4.2
Industry[b]	$m	279.6	na	279.6	279.6	na	279.6
Total	$m	443.7	20.1	463.8	392.9	20.1	413.0
Net present values[c]							
MLA[b]	$m	109.0	16.7	125.7	109.0	16.7	125.7
Beef CRC	$m	101.3	0	101.3	24.9	0	24.9
Sheep CRC	$m	0	4.5	4.5	0.0	4.5	4.5
Industry	$m	185.9	na	185.9	185.9	na	185.9
Total	$m	396.3	21.1	417.4	319.9	21.1	341.0
Expenditure shares[d]							
MLA[c]	%	**27.5**	78.9	30.1	**34.1**	78.9	36.9
Beef CRC	%	25.6	0.0	24.3	7.8	0.0	7.3
Sheep CRC	%	0.0	21.1	1.1	0.0	21.1	1.3
Industry	$m	46.9	na	44.5	58.1	na	54.5
Total	%	100.0	100.0	100.0	100.0	100.0	100.0

[a] Including MLA's investment in Electrical Stimulation through MQST until 2010-11 and MSA expenditures on program integrity put to 2019-20. [b] Includes compliance costs paid by processors out to 2019-20. [c] Net present values at 2008-09 prices using a discount rate of 7 per cent over the period 1998-99 to 2019-20. [d] Expenditure shares based on expenditures in net present value terms.

Source: MLA and CIE calculations.

- MSA expenditures on activities that support the integrity of the MSA system and brand and also additional costs paid by processors to be compliant with MSA out to 2019-20.

In nominal terms, total expenditures have been up until 2010-11:

- between $284.9 and $335.6 million in nominal terms for the beef industry; and
- $19.9 million in nominal terms for the sheep industry.

Table 6.16 then adds-in the including MSA program integrity costs and compliance costs by processors involved in the MSA program

The low and high scenarios for beef obtain significantly different outcomes because of the significant CRC funds that were invested before 1998–99.

- Considering only expenditures from 1999–2000 onwards (the low CRC case), and by excluding non-staff in-kind costs by the Beef CRC, MLA contributed around 34.1 per cent of the total investment in present value terms.
- After incorporation of CRC investments prior to 1999–2000 and accounting for all non-staff in-kind costs by the Beef CRC, the MLA contribution falls to 27.5 per cent.

The other point to highlight from table 6.16 is that industry invested between 46.9 and 58.1 per cent of the costs required to improve eating quality out to 2019-20 which includes compliance costs that would not otherwise have to be paid. It is reasonable to assume that this approach probably underestimates the contribution of industry because of the in-kind costs required to modify plant processes for MSA.

To determine MLA's true attribution is very difficult because it involves a range of factors that cannot be quantified and so the bottom line is that the attribution requires judgement.

- Table 6.17 shows that the benefit cost to each of the contributors to improving eating quality in beef based on attribution of benefits based on estimated contribution to investment and compliance costs.

Internal rate of return

Table 6.18 shows the breakeven point for the discount rate, where the present value of benefits equals costs, is between 74.1 and 78.9 per cent.

6.17 **Attribution between contributors for beef eating quality**

	Costs		Benefits		Net benefits	Benefit cost ratio
	%	$m	%	$m	$m	
Low beef CRC						
MLA	34.1	109.0	34.1	496.1	387.1	4.5
CRC	7.8	24.9	7.8	113.3	88.4	4.5
Industry	58.1	185.9	58.1	845.9	659.9	4.5
Total	100.0	319.9	100.0	1 455.3	1 135.4	4.5
High beef CRC						
MLA	27.5	109.0	27.5	400.5	291.4	3.7
CRC	25.6	101.3	25.6	372.1	270.7	3.7
Industry	46.9	185.9	46.9	682.8	496.9	3.7
Total	100.0	396.3	100.0	1 455.3	1 059.0	3.7

[a] Net present value basis in 2008-09 dollars over the period 1999-00 to 2019-20 using a real discount rate of 7 per cent.

Source: CIE.

6.18 **Internal rate of return[a]**

Scenario	Internal rate of return
	%
Low beef CRC	78.9
High beef CRC	74.1

[a] Calculated using net present value flows in 2008-09 dollars over the period 1999-00 to 2019-20 using a real discount rate of 7 per cent.

Source: CIE.

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Appendices

A Beef CRC eating quality related work

MLA has provided the CIE with details of the eating quality research work conducted by the beef CRC during the period covered by the evaluation. It includes inputs, outputs, outcomes and MLA's estimate of the proportion of the work that directly relates to MSA science.

A.1 **Beef CRC work related to eating quality**

Subprogram	*Inputs*	*Outputs*	*Outcomes*	*Proportion of project that has relevance to MSA*
1.1 Evaluation of cattle, carcasses and meat samples	The core straight breeding and crossbreeding programs of Beef CRC I were aimed at providing a data base which would be used to estimate genetic parameters for live and carcass traits.	A unique data base was set up to contain live and carcass data from the straight bred and crossbred CRC core breeding programs as well as non-core cattle from other CRC projects.	Outcomes from this project fed into other CRC or MSA programs.	100%
1.2 Accurate description of carcass and meat quality traits.	This project undertook a number of studies including development of an ultrasound method to measure marbling in live animals, validation of the TENDERTEC probe, and the accuracy of whole carcass VIASCAN to predict carcass yield. Postgraduate studies examined the role of marbling in consumer satisfaction.	The ultrasound method was of lower accuracy to the Iwoa State technique and was not perused. Similarly TENDERTEC algoritms were not transportable and this technology was shelved. Whole body VIASCAN did provide accurate estimates of yield.	Some technologies (marbling prediction and Tendetec) did not progress past the experimental stage, technology such as VIASCAN whilst accurate and far superior to other technology available at the time was not taken up by industry. Marbling/consumer studies formed part of the technology package used by MSA.	100%
1.3(1) Vitamin A status and degree of marbling in long fed cattle.	Experimental resources were set up to investigate the relationship between Vit A (retinol) in plasma and liver and marbling. There were real welfare concerns in terms of making the animals Vit A deficient with subsequent clinical problems.	Welfare concerns meant that cattle did not become deficient in Vit A to the level required to effect a response	Understanding of the Vit A marbling interaction. Given welfare concerns this technology was not extended to industry.	100%
1.3(2) Fatty acid composition and the hardness of bovine fat.	Fat samples from carcasses the Northern breeding project were analysed for fatty acid composition.	Outputs included knowledge of the main effects of finishing system, market category on fatty acid composition and fat hardness. In addition genetic parameters for individual fatty acids were generated.	Knowledge of how fatty acid composition can be manipulated within a breeding program to change softness/hardness of fat. Currently this technology is not being used but can be implemented if there is an industry requirement.	100%

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A.1 **Beef CRC work related to eating quality** (Continued)

Subprogram	*Inputs*	*Outputs*	*Outcomes*	*Proportion of project that has relevance to MSA*
1.4(1) Implementation of best practise and PACCP	Strip loin samples from the core program were prepared and processed through the MSA consumer taste tests.	Palatability assessments on strip loin samples from a range of breeds which had been grown to domestic, Korean and Japanese slaughter weights under a matrix of management systems. These samples had much more detailed phenotypes than most other samples in the MSA BLUE data base.	These data formed a substantial portion of the MSA BLUE database which was used to develop the MSA model.	100%
1.4(2) Factors affecting tenderness of beef from Brahman cattle	Muscle samples from Brahman animals were used to study the interaction between electrical stimulation and sarcoplamic membrane functionality. Other experiments investigated the interaction between pre-slaughter treatment, Bos indicus content and tenderstretch	High content Brahman carcasses had a slower glycolytic rate than *Bos taurus* carcasses. This in combination with reduced membrane functionality meant that high *Bos indicus* carcasses were more responsive to stimulation	Knowledge of breed effects on quality helped underpin the MSA program and highlighted the importance of best practise processing of carcasses from *Bos indicus* cattle.	100%
1.4(3) Optimising the pre and post slaughter treatment of cattle and their carcasses to maximise palatability	A series of postgraduate studies investigated the interaction between glycolytic rate and tenderness. Also mechanisms to explain more tender meat in tenderstretch carcasses was investigated	Outputs included the relationships between glycolytic rate and eating quality. Also the overlap between actin and myosin was not responsible for the tenderstretch response.	Knowledge of glycolytic rate helped underpin the development of the MSA pH/temperature window. Improved understanding of the tenderstretch mechanism.	100%
1.4(4) Communication of the outcomes of the meat science program	Meat science staff prepared the meat science outcomes for release to industry for a variety of media and at a number of events	Meat Science outcomes were communicated to all sectors of the beef industry via conferences, seminars and workshops.	The meat science outcomes helped underpin the delivery of MSA to industry sectors.	100%
1.4(5) Meat science to underpin the new beef grading scheme being developed by Meat Standards Australia	Meat science staff participated in the development of MSA at a number of levels	Participation in the development of MSA via the pathways committee and also via analysis of data for specific tasks.	These inputs helped underpin the development and delivery of MSA to industry.	100%

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A.1 **Beef CRC work related to eating quality** (Continued)

Subprogram	*Inputs*	*Outputs*	*Outcomes*	*Proportion of project that has relevance to MSA*
Sub Program 2. Genetics				
2.1 Quantitative Genetics (Straight breeding)	Data from the core breeding program (straight bred) were analysed to provide inputs into Breed plan and MSA	Outputs included genetic parameters for live and carcass traits, along with fixed effects for design variables.	These outputs underpinned improvements in Breedplan and also had implications for MSA in the potential of genetic manipulation of meat quality	75%
2.2 Quantitative Genetics (Crossbreeding)	Data from the core breeding program (crossbreeding) were analysed to provide inputs into Breedplan and MSA	Outputs included genetic parameters for live and carcass traits, along with fixed effects for design variables.	These outputs underpinned improvements in Breed plan and also had implications for MSA in the potential of genetic manipulation of meat quality	75%
2.3 Molecular Genetics	This project undertook DNA analyses from samples from Phenotypic data base (Projects 1.1, 2.1 and 2.3). The investigations focused on meat quality markers.	The outputs comprised gene markers for meat quality (calpain lysyl oxidase), yield and tenderness.	The outcomes were knowledge that underpinned the development of the tenderness markers for beef cattle.	50%
Sub Program 3. Growth and nutrition				
4.1 Development of bovine respiratory vaccine	The CRC developed technologies to improve the general standard of health and welfare of cattle kept under intensive management systems.	Vaccines for Pasteurella hemolytica (respiratory disease) Pestivirus were developed.	Although the commercial release of these vaccines was initially delayed they were finally released to industry and now form part of induction procedures.	0%
4.2 Immunological competence of cattle	This project aimed to develop a panel of immune competence tests in cattle	The outputs included the impact of dam and calf supplementation on meat quality, including Nutri-charge. It also confirmed the relationship between temperament and immune competence. Finally the effect of the stress of feedlot entry on immune competence was quantified.	The outcomes were knowledge that has been integrated into management packages for cattle producers to reduce stress and losses of animals as they enter an intensive feeding system.	20%

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A.1 **Beef CRC work related to eating quality** (Continued)

Subprogram	*Inputs*	*Outputs*	*Outcomes*	*Proportion of project that has relevance to MSA*
6. Feedlot waste management				
6.1 Sustainable bio-solid utilisation	This program used the experimental feedlot at Tullimba along with other industry sites to collect data on waste utilisation systems.	Workshops were run in conjunction with ALFA at commercial feedlots on composting, liquid effluent, odour, manure application and environmental monitoring. In addition feed intake and manure data from Tullimba was used to model and validate waste prediction in feedlots.	Increased awareness of the problems associated with handling feedlot waste management. New models on waste accumulation were integrated into feedlot design and EIS.	0%
6.3 Nutrient and water balance monitoring	This program used the experimental feedlot at Tulimba along with other industry sites to develop a comprehensive understanding of water nutrient and salt balances of feedlot and their waste utilisation systems.	A better understanding of nutrient recycling from the feedlot to pastures application and uptake by plants	Strategies to monitor cycling of nutrients were developed and extended to industry.	0%
7. Education and Technology Transfer				
7.1 Postgraduate education	This program provided postgraduate scholarships to work within ongoing Beef CRC projects	A total of 32 postgraduate students were supported to undertake postgraduate studies on projects directly assessing meat quality issues.	Better trained students to progress in the beef industry on issues related to meat quality	50%
7.2 Course work awards	Develop Certificate in Rural Science course work material	Certificate course material assembled and delivered	This course was a precursor to the Meat Quality Short course which is delivered as part of grader and industry training	75%
7.3 Undergraduate education	This project developed undergraduate education as part of the Rural Science degree.	Undergraduate units developed for delivery to students	Undergraduate units were delivered to students at UNE and other Universities associated with the Beef CRC	50%

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A.1 **Beef CRC work related to eating quality** (Continued)

Subprogram	*Inputs*	*Outputs*	*Outcomes*	*Proportion of project that has relevance to MSA*
7.4 Industry Training	To develop educational and training programs to all sectors of the meat industry	Short courses were run utilising outputs from various Beef CRC programs	These courses generally included the meat quality outcomes from the Beef CRC	75%
7.5 Technology Transfer	This program disseminated the Beef CRC research findings to relevant industry sectors.	Technical materials in the form of booklets, brochures and fact sheets were used to underpin technology transfer events such as Beef 2000, "The Feeder Steer Schools", and other industry courses.	Technical transfer events were run at a number of levels to ensure that meat science outcomes were delivered to relevant industry sectors.	75%
Program 1 Strategic Science to Deliver Beef Quality				
1.1/1.2 Regulation of growth, carcass composition and beef quality	An experimental cattle resource comprising extreme genotypes with early nutrition treatments (both pre- and post-natal) was created to understand the effect of early growth restriction on growth rate and meat quality when animals were slaughtered at 30 months of age.	Quantifying the early life growth restriction on carcass traits and meat quality.	Understanding of how nutritional restriction applied at different stages of growth (prenatally, pre-weaning, backgrounding and finishing) in diverse genotypes impacts on growth, carcass composition, MSA inputs traits (marbling score, ossification score fat depth) and meat quality traits (shear force). The most important outcome for MSA was no effect of early life growth pattern on eating quality.	50%
1.3 Regulation of intramuscular fat in beef cattle	Experiments to define the regulatory steps in the development of adipocytes in beef. Also the interaction of nutritional factors with the deposition of marbling depots.	Special edition in AJEA entitled "The role of marbling in the eating quality of beef". The effect of induced depletion of Vitamin A on marbling deposition. Understanding of the developmental pattern of marbling fat in the muscle	Understanding how growth path impacted on marbling deposition. Novel ways to describe the pattern of marbling in beef. The data suggests that early nutritional supplementation may impact on marbling at slaughter. The converse of early growth restriction had no effect on marbling at slaughter.	50%

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A.1 **Beef CRC work related to eating quality** (Continued)

Subprogram	*Inputs*	*Outputs*	*Outcomes*	*Proportion of project that has relevance to MSA*
1.4 Functional Genomics of beef quality	This project developed molecular techniques (microarrays) to characterise the expression of muscle and fat genes under a range of genetic and nutritional treatments. The project aimed to identify biochemical pathways associated with key meat quality outcomes.	A better understanding of gene networks responsible for fat deposition and protein turnover in beef cattle. Develop new "bioinformatics" procedures to understand the outputs from the microarray methods.	Identification of gene networks that impact on expression of carcass and meat quality traits.	0%
Program 2 Innovative Technologies for the Beef Supply Chain				
2.1 Genetic markers for production, adaptability efficiency and beef quality	To fine scale map genes for net feed efficiency, carcass, meat quality and adaption traits in beef cattle. Test candidate genes that can be used to produce commercial DNA tests for a range of traits.	Gene markers for tenderness, retail beef yield and tick resistance progressed to varying degrees towards commercial tests. A number of DNA data bases were used to map net feed efficiency genes.	Marbling and tenderness genes licensed or patents applied for. Potential markers for Net Feed Efficiency were identified.	10%
2.2 Improving the efficiency of feed utilisation for beef production	To evaluate key genetic relationships between NFI and other economically important traits. To develop the NFI technology for industry application.	A tend for more efficient animals to be leaner than less efficient animals.	Variation about genetic relationships and NFI meant that it was possible to select bulls with desired combination of traits for commercial breeding	0%
2.3 Links between the genetics of beef quality and components of herd profitability in northern Australia	To determine the correlated responses to selection for increased retail beef yield and increased marbling on body composition, efficiency of feed utilisation, adaptability to stressors in tropical environments and female reproductive traits in tropically adapted cattle.	Genetic relationships between retail beef yield and marbling and other compositional, meat quality, adaptability traits and reproductive performance in tropically adapted cattle. The relationships with of the above traits with meat quality traits were assessed with normally hung and tenderstretched sides.	Breeding guidelines for tropically adapted cattle on the usually antagonistic relationships between marbling and retail beef yield.	50%

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A.1 **Beef CRC work related to eating quality** (Continued)

Subprogram	*Inputs*	*Outputs*	*Outcomes*	*Proportion of project that has relevance to MSA*
2.4 Managing stress to improve cattle welfare and beef quality	This project aimed to identify gene markers for adaptation, stress perception and activation of the stress response. It involved experiments to evaluate the different methods of assessing stress in cattle. Also different methods of feedlot handling and abattoir delivery were investigated.	With relevance to MSA this project quantified relationships between handling and temperament in cattle with meat quality traits.	The project outputs were integrated into systems designed to improve cattle welfare and meat quality. This had direct relevance to pre-slaughter management of cattle for MSA.	20%
2.5 Pre-slaughter control of pathogens affecting beef products	This project used survey and experimental resources to quantify the human health risk associated with contaminated beef carcasses.	This project quantified the level of contamination in Australia and tested packages to reduce that load	A package of recommendations to the beef industry on how to reduce the risk of contamination of beef carcasses.	0%
Program 3 Delivery of Technologies to the Beef Business System				
3.2 Best Practice for consistent meat quality (MSA and beyond)	This project examined the management of electrical inputs on the slaughter floor to maximise meat quality. Several experiments examined the rapid glycolytic rate oin long fed animals as a means to better understand heat shortening in long fed cattle.	Systems were devised to manage electrical inputs to achieve an optimal; rate of decline for meat quality. The problem of heat shortening in long fed cattle was not associated with insulin sensitivity as previously proposed, rather heat shortening was largely a function of heat build-up in the post mortem carcass.	Better guidelines for managing electrical inputs on the slaughter floor. An understanding of factors that impact on glycolytic rate in carcasses, including genotype, muscle type and fatness.	100%
3.3 Regional beef systems to achieve market specification	The regional combinations project was devised and test combinations of genetics, nutrition and best practise management to increase the proportion of carcasses achieving market specifications.	The output was a quantification of genetic and nutritional overlays on the ability of carcasses to meet market compliance, meat yield and meat quality endpoints.	The outcomes from this program underpinned the development of prediction models in CRC III to deliver simple messages to producers on the effects of geneotype, EBVs and their required growth rates to achieve satisfactory market compliance.	50%

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A.1 **Beef CRC work related to eating quality** (Continued)

Subprogram	*Inputs*	*Outputs*	*Outcomes*	*Proportion of project that has relevance to MSA*
CRC III				
1.1.1/2 - Genetic markers for improved beef quality	Genome wide association studies (GWAS) for gene markers for intramuscular fat %, fat depth, and tenderness (shear force). The CRC investment includes GWAS, cattle phenotypes and molecular expertise.	Gene marker tests for carcass traits including intramuscular fat %, fat depth and tenderness (shear force).	A suite of commercial gene markers which can be used by breeders to improve carcass traits used as inputs into the MSA model. For traits such as intramuscular fat % and fat depth these markers will allow early identification of traits in breeding animals whilst for the tenderness genes this will be a new trait in the MSA model.	100%
1.1.3 - Biological validation and gene expression underpinning gene discovery	This project investigated the biology of gene markers for tenderness. This included both gene expression in different processing environments and also potential interactions with ageing, HGP implants, tenderstretch, breed and sex. The investment includes the staff, cattle, samples laboratory equipment and expertise to undertake the studies.	Understanding of gene marker expression. There was no interaction with processing environment, HGP implants and sex.	This project provided confidence in the expression of gene markers for tenderness. An additional outcome was knowledge on the potential interactions with other management and genetic factors. The tenderness markers are currently being investigated as an additional input into the MSA model.	100%

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A.1 **Beef CRC work related to eating quality** (Continued)

Subprogram	*Inputs*	*Outputs*	*Outcomes*	*Proportion of project that has relevance to MSA*
1.2 - Prediction of Phenotype	Inputs include CRC databases which have been used to develop the prediction models. Other data sets have been used for validation purposes. Model development expertise has been drawn from the core and supporting parties of the CRC.	Models and tools for producers to use to increase the compliance of cattle achieving market specifications. The models include 'Beef Specs' which was formulated to model changes in growth and fat depth of *Bos taurus* steers at pasture. This model has been enhanced to include females and *Bos indicus* genotypes. There is now a steer performance model which includes automated hip height measurement. An optimisation model has also been developed to take outputs from the growth model along with management and cost of production, product value and marketing data to determine the most profitable strategies. A final maternal model to extend cow calf breeding options is being developed.	A greater number of cattle achieving specification. The suite of models will cover a range of options including compliance with fat and weight specifications to more detailed optimisation models which include management and marketing options.	100%
1.3 - Supply chain and palatability prediction	Analysis of current carcass data to demonstrate both within and between producer variation in compliance and profitability. Working with feedlotters to set up producer groups to improve profitability of cattle enterprises.	Development of feedback templates for producers. Development of models to quantify variation within and between producers. Identification of profit drivers in the feedlot. Quantification of the impact of variation in induction traits on profitability.	Better use of feedback data by feedlotters and producers. Improved understanding of current feedback data by producers. An understanding of how to use both genetic and management factors to achieve improved compliance of market specifications in the future. Feedlotters have a better understanding of the impact of induction traits on profitability.	100%

Source: MLA from Beef CRC

B Simple framework used in the analysis

This appendix summarises some of the key data behind the calculations presented in chapter 4. This analysis builds on previous work by Griffith et al (2009) through the incorporation of more detail on:

- average carcass weights;
- the number of cattle grade by boning group with corresponding MSA yields;
- method of carcass treatment especially with regard to hanging technique; and
- identification of potential yields between 3, 4 and 5 star product.

Table B.1 shows the concordance between the AUSMEAT primal classification and the description of MSA cuts.

- It also shows the typical yield proportions for a 260 kilogram carcass.

B.1 **Boneless yield by AUSMEAT primal and MSA cut**

AUSMEAT primal	*MSA cut*	*Typical carcass yield*	
		%	kilograms
Topside		6.2	16.1
Thick flank	Knuckle	3.7	9.6
Outside	Silverside	5.7	14.8
D-rump	Rump	3.8	9.9
Tenderloin	Butt fillet	1.6	4.2
Striploin	Sirloin[a]	4.4	11.4
Navel End Brisket	Brisket	3.3	8.6
Point End Brisket	Brisket	3.8	9.9
Cube roll	Cube roll	1.7	4.4
Blade	Blade	5.5	14.3
Chuck roll		4.5	11.7
Chuck tender	Stir fry	0.9	2.3
Shinshank	Diced	4.6	12.0
Thin skirt		0.2	0.5
Flank steak		0.4	1.0
Trimmings		18.4	47.8
Meat yield		68.7	178.6
Fat		12.0	31.2
Bone		19.3	50.2
Total		100.0	260.0

[a] Striploin also yields the bone-in cut T-bone. Sirloin is also known as Porterhouse.

Source: AUSMEAT and MLA.

Boning groups

Boning groups are a way of grouping like eating quality carcases together.

- The cut outcomes determine the boning group from the carcass data input during chiller assessment.

The composition of boning groups reflects of the cattle population that is graded. Chart 2.3 shows that boning group 6 is the most common group comprising 17 per cent of MSA compliant cattle.

- Boning group 6 sits at the bottom of the groups containing cattle with better eating quality attributes and in the middle of the average young cattle types (grassfed and grainfed types at 260 kilogram carcass weight) and at the top end of the lower quality.
- This composition reflects cattle supplied from southern Queensland and other southern regions, and is not attributed to any one particular supply chain.
- There would be some cattle in north Queensland making this level, but at a lower percentage compared to more southern states.
- Regardless of plant location and cattle types, there will be a distribution across a range of boning groups.

Ungraded cattle are those which are assessed in MSA batch runs but fail on either MSA or company specifications around dentition or fat score.

Profile of cattle not MSA graded

The profile of cattle not currently graded by MSA is potentially different to that in chart 2.3.

Approximately 600 000 grain fed cattle are graded out of 2 million MSA graded per year.

- This doesn't include many Wagyu type or fed grain cattle over 150 days on feed. These types will perform well as they are more likely to have higher carcase weight for maturity, higher marbling and be HGP free.
- MSA currently does not capture many of the 100 day commodity cattle (medium steers through to Japox) for export markets that are expected to fall in boning groups 6 to 8.
  - It is expected that these types could be potentially diverted through MSA in the future.

In recent years, the majority of growth of Australia's cattle herd has come from the north, and this is expected to continue through to 2020.

Northern cattle tend to grade into lower quality boning groups, compared to European cattle for a number of reasons:

- due to lower feed conversion, especially in grain finishing, *Bos Indicus* cattle types are often treated with HGPs to improve performance in terms of weight gain;
- HGP treated cattle tend to score lower in marbling and higher ossification/maturity for the carcase weight and may grade lower than their southern counterparts of the same age without any *Bos Indicus* content.

Hanging and ageing

In addition to cattle type, the carcase hanging (two methods), meat ageing used post-slaughter and cook method used by consumers (five cook methods are identified by the MSA science) also contribute significantly to overall eating quality outcomes.

Two methods of carcass hanging are identified:

- Achilles hung, which accounts for over 80 per cent of carcasses graded; and
- Tenderstretch, which involves hanging the carcass by the butt rather by the Achilles tendon.

Hanging method does not really change the boning group — it does however change the way the cuts can be harvested and the associated ageing. For example, from the full MSA stratification tables, a boning group 10 carcase that has been Achilles hung – the striploin requires 28 days to be graded as MSA 3 star for use in a grill cooking method.

- If this carcase was tenderstretch, it will still be boning group 10, however the striploin will only need to be aged for 14 days to be MSA 3 as a grill.

Tables B.2 and B.3 show a simplification of these stratification tables, by boning group and MSA cut by each hanging method, which were used for this analysis.

- For each boning group it identifies the potential of each primal (or cut) to grade at MSA 3, 4 or 5 stars.
- Generally, the better quality primals or cuts such as the tenderloin, the striploin, cube roll and rump, the will grade consistently even from cattle from lower boning groups.
- Because of the quality and value of these cuts, these 'top 4' primals or cuts will be harvested at minimum from all carcases, even from the bottom boning groups.

To make the analysis tractable a number of key assumptions were made:

- following consultation, we have assumed that processors grade with *no* allowance for product ageing, principally because of the requirements on both chiller space and working capital would be significant constraints; and
- that the principal cook methods are grill for the 'top 4' cuts and roast or slow cook for other MSA primals or cuts.

B.2 **MSA yield by primal and boning — Achilles hung[a]**

		Boning group								
	Yield	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***
Primal	%									
Topside	6.2	3	3	3	3	3	3	0	0	0
Thick flank	3.7	3	3	3	3	3	3	3	3	3
Outside	5.7	3	3	3	3	3	3	0	0	0
D-rump	3.8	3	3	3	3	3	3	3	3	0
Tenderloin	1.6	5	5	4	4	4	4	4	4	4
Striploin	4.4	3	3	3	3	3	3	3	0	0
Navel End Brisket	3.3	0	0	0	0	0	0	0	0	0
Point End Brisket	3.8	0	0	0	0	0	0	0	0	0
Cube roll	1.7	4	3	3	3	3	3	3	3	3
Blade	5.5	3	3	3	3	3	3	3	3	3
Chuck roll	4.5	4	3	3	3	3	3	3	3	3
Chuck tender	0.9	4	3	3	3	3	3	3	3	3
Shin shank	4.6	4	3	3	3	3	3	3	3	3
Thin skirt	0.2	0	0	0	0	0	0	0	0	0
Flank steak	0.4	0	0	0	0	0	0	0	0	0
Trimming	18.4	0	0	0	0	0	0	0	0	0
Meat yield	68.7									
		10	***11***	***12***	***13***	***14***	***15***	***16***	***17***	***18***
Topside	6.2	0	0	0	0	0	0	0	0	0
Thick flank	3.7	0	0	0	0	0	0	0	0	0
Outside	5.7	0	0	0	0	0	0	0	0	0
D-rump	3.8	0	0	0	0	0	0	0	0	0
Tenderloin	1.6	4	4	4	4	3	3	3	3	3
Striploin	4.4	0	0	0	0	0	0	0	0	0
Navel End Brisket	3.3	0	0	0	0	0	0	0	0	0
Point End Brisket	3.8	0	0	0	0	0	0	0	0	0
Cube roll	1.7	3	3	3	3	0	0	0	0	0
Blade	5.5	3	3	3	3	0	0	0	0	0
Chuck roll	4.5	3	3	3	3	3	3	0	0	0
Chuck tender	0.9	3	3	3	3	3	3	0	0	0
Shin shank	4.6	3	3	3	3	3	3	0	0	0
Thin skirt	0.2	0	0	0	0	0	0	0	0	0
Flank steak	0.4	0	0	0	0	0	0	0	0	0
Trimming	18.4	0	0	0	0	0	0	0	0	0
Meat yield	68.7	0	0	0	0	0	0	0	0	0

[a] Number 0 indicates ungraded, numbers 3 to 5 indicate MSA 3-5 star. Assumes ageing of a maximum of 5 days and the cook method is grill.

Source: MLA.

Tenderstretch improves the eating quality of a considerable proportion of the hind quarter. Tenderstretch also increases the rate of ageing in some cuts. This has a significant impact on the eating quality outcome of equivalent carcases — that is, if you have two carcases of the same measurements and you hang one tenderstretch, there will be a significant improvement in eating quality in the tenderstretch carcase.

B.3 **MSA yield by primal and boning — tenderstretch[a]**

		Boning group								
	Yield	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***
Primal	%									
Topside	6.2	3	3	3	3	3	3	3	3	3
Thick flank	3.7	4	4	3	3	3	3	3	3	3
Outside	5.7	3	3	3	3	3	3	3	3	3
D-rump	3.8	4	4	3	3	3	3	3	3	3
Tenderloin	1.6	5	5	5	5	4	4	4	4	4
Striploin	4.4	4	4	4	3	3	3	3	3	3
Navel End Brisket	3.3	0	0	0	0	0	0	0	0	0
Point End Brisket	3.8	0	0	0	0	0	0	0	0	0
Cube roll	1.7	4	4	4	4	3	3	3	3	3
Blade	5.5	4	3	3	3	3	3	3	3	3
Chuck roll	4.5	3	3	3	3	3	3	3	3	3
Chuck tender	0.9	3	3	3	3	3	3	3	3	3
Shin shank	4.6	3	3	3	3	3	3	3	3	3
Thin skirt	0.2	0	0	0	0	0	0	0	0	0
Flank steak	0.4	0	0	0	0	0	0	0	0	0
Trimming	18.4	0	0	0	0	0	0	0	0	0
Meat yield	68.7									
		10	***11***	***12***	***13***	***14***	***15***	***16***	***17***	***18***
Topside	6.2	3	3	3	3	0	0	0	0	0
Thick flank	3.7	3	0	0	0	0	0	0	0	0
Outside	5.7	3	0	0	0	0	0	0	0	0
D-rump	3.8	3	3	3	3	3	3	3	0	0
Tenderloin	1.6	3	3	3	3	3	3	3	3	0
Striploin	4.4	0	0	0	0	0	0	0	0	0
Navel End Brisket	3.3	0	0	0	0	0	0	0	0	0
Point End Brisket	3.8	0	0	0	0	0	0	0	0	0
Cube roll	1.7	3	3	3	3	0	0	0	0	0
Blade	5.5	3	3	3	0	0	0	0	0	0
Chuck roll	4.5	3	3	3	3	0	0	0	0	0
Chuck tender	0.9	3	3	3	3	0	0	0	0	0
Shin shank	4.6	3	3	3	3	0	0	0	0	0
Thin skirt	0.2	0	0	0	0	0	0	0	0	0
Flank steak	0.4	0	0	0	0	0	0	0	0	0
Trimming	18.4	0	0	0	0	0	0	0	0	0
Meat yield	68.7	3	3	3	3	0	0	0	0	0

[a] Number 0 indicates ungraded, numbers 3 to 5 indicate MSA 3-5 star. Assumes ageing of a maximum of 5 and the cook method is grill.

Source: MLA.

Therefore the structure of this framework allows for the analysis of the key factors that impact on the availability of product that can potentially grade as 4 and 5 star under MSA.

Tenderstretching does not have significant impact the total MSA primals or cuts that can be harvested from a carcass as seen in table B.4.

B.4 **MSA graded primal yield by hanging method**

		MSA primal yield as per cent of carcass	
Boning group	*2009-10 proportion of graded cattle*	*Tenderstretch*	*Achilles hung*
	%	%	%
1	3.6	42.6	42.6
2	10.1	42.6	42.6
3	7.8	42.6	42.6
4	5.7	42.6	42.6
5	13.4	42.6	42.6
6	18.2	42.6	42.6
7	9.6	42.6	30.7
8	7.5	42.6	26.3
9	2.1	42.6	22.5
10	6.0	38.2	18.8
11	1.3	28.8	18.8
12	2.7	28.8	18.8
13	0.3	23.3	18.8
14	0.6	5.4	11.6
15	1.5	5.4	11.6
16	0.3	5.4	1.6
17	0.0	1.6	1.6
18	0.0	1.6	1.6
Ungraded	9.4	na	na
All groups	100	40.7	36.0

Source: MLA and CIE calculations

Tenderstretching has a significant impact on the combination of 4 and 5 star quality primals or cuts that can be harvested from a carcass as shown in table B.5. Total yield of 4 and 5 star almost doubles as a result of moving from Achilles hung, used by the majority of the industry, to tenderstretch.

- Alternatively, tenderstretching permits the same outcomes to be achieved with cheaper input cattle from lower quality boning groups.
- This can be very important when livestock acquisition makes up around 70 per cent of the total revenue from a carcass and particularly so when suitable cattle for MSA grading are short in the market.

This analysis could be expanded to incorporate the impacts of aging on overall MSA yields given the current structure of cattle and boning groups.

- As indicated, ageing for up to five weeks has the significant potential to improve overall product quality but at a cost.
- Alternatives are for wholesalers and retailers to age the product or for aging to take place during transport to export destinations.

B.5 Potential MSA yields by hanging methods[a]

		Tenderstrech				*Achilles hung*			
		3 star	*4 star*	*5 star*	*Total MSA*	*3 star*	*4 star*	*5 star*	*Total MSA*
Topside	%	14.8	0.0	0.0	14.8	11.3	0.0	0.0	11.3
Thick flank	%	6.9	1.5	0.0	8.4	8.9	0.0	0.0	8.9
Outside	%	13.0	0.0	0.0	13.0	10.3	0.0	0.0	10.3
D-rump	%	7.8	1.6	0.0	9.3	8.8	0.0	0.0	8.8
Tenderloin	%	0.5	2.1	1.3	3.9	0.1	3.6	0.7	4.4
Striploin	%	6.6	2.8	0.0	9.4	9.2	0.0	0.0	9.2
Navel End Brisket	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Point End Brisket	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cube roll	%	2.7	1.3	0.0	4.1	4.4	0.2	0.0	4.6
Blade	%	12.6	0.6	0.0	13.1	14.8	0.0	0.0	14.8
Chuck roll	%	10.8	0.0	0.0	10.8	11.8	0.6	0.0	12.4
Chuck tender	%	2.2	0.0	0.0	2.2	2.4	0.1	0.0	2.5
Shinshank	%	11.0	0.0	0.0	11.0	12.1	0.6	0.0	12.7
Thin skirt	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flank steak	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trimming	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	%	88.8	9.9	1.3	100.0	94.2	5.1	0.7	100.0

[a] Per cent of MSA yield from an average across all boning groups.

Source: MLA and CIE calculations.

C Baseline MSA production

This appendix summarises the key underlying data used in this evaluation.

Table C.1 shows the time path of adoption of cattle into the MSA system as shown in chart 3.8 of this document.

C.1 **Adoption of MSA by number of cattle processed**

		1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Total Australia							
Slaughter (cattle and calves)	000s	8 505	9 081	8 893	9 240	8 874	9 023
Direct from farm to abattoir	000s	3 997	4 289	4 685	4 840	4 868	5 121
Eligible for MSA	000s	2 163	2 321	2 537	2 616	2 632	2 768
Through saleyard	000s	4 507	4 792	4 207	4 400	4 006	3 903
MSA graded	000s	225	291	353	366	523	626
Adoption of MSA	%	10	13	14	14	20	23
North							
Slaughter	000s	3 402	3 777	3 628	3 628	3 705	3 825
Direct from farm to abattoir	000s	2 212	2 380	2 685	2 539	2 594	2 678
Eligible for MSA	000s	1 216	1 309	1 477	1 397	1 427	1 473
Through saleyard	000s	1 191	1 398	943	1 088	1 112	1 148
MSA graded	000s	101	131	159	165	235	282
Adoption of MSA	%	8	10	11	12	16	19%
South							
Slaughter	000s	5 103	5 304	5 265	5 612	5 169	5 198
Direct from farm to abattoir	000s	1 786	1 909	2 001	2 301	2 274	2 443
Eligible for MSA	000s	947	1 012	1 060	1 220	1 205	1 295
Through saleyard	000s	3 317	3 394	3 264	3 311	2 895	2 755
MSA graded	000s	124	160	194	201	288	344
Adoption of MSA	%	13	16	18	17	24	27
Average carcass weight							
All cattle	kg cwe	234	233	228	224	229	240
MSA eligible and MSA graded	kg cwe	228	239	257	237	250	253
Other cattle	kg cwe	234	233	227	224	228	239
Beef production							
Total	kt cwe	1 988	2 119	2 028	2 073	2 033	2 162
Total MSA graded	kt cwe	51	69	91	87	131	158
Other cattle	kt cwe	1 937	2 050	1 937	1 986	1 902	2 004

(Continued)

C.1 **Adoption of MSA by number of cattle processed** (Continued)

		2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Total Australia							
Slaughter (cattle and calves)	000s	8 544	9 308	8 859	8 657	8 348	8 112
Direct from farm to abattoir	000s	4 647	5 786	4 532	4 492	4 117	4 546
Feedlot	000s						
Eligible for MSA	000s	2 508	3 123	2 446	2 424	2 227	2 477
Through saleyard	000s	3 897	3 522	4 327	4 166	4 231	3 566
MSA graded	000s	645	716	839	883	1 280	1 422
Adoption of MSA	%	26	23	34	36	57	57
North							
Slaughter	000s	3 749	3 922	3 637	3 505	3 498	3 582
Direct from farm to abattoir	000s	2 249	2 824	2 182	2 173	2 274	2 507
Eligible for MSA	000s	1 237	1 553	1 200	1 195	1 251	1 254
Through saleyard	000s	1 499	1 098	1 455	1 332	1 224	1 074
MSA graded	000s	290	322	378	397	605	640
Adoption of MSA	%	23	21	31	33	48	51
South							
Slaughter	000s	4 795	5 385	5 222	5 152	4 850	4 530
Direct from farm to abattoir	000s	2 398	2 962	2 350	2 318	1 843	2 039
Eligible for MSA	000s	1 271	1 570	1 246	1 229	977	1 223
Through saleyard	000s	2 398	2 423	2 872	2 834	3 007	2 492
MSA graded	000s	355	394	461	486	675	782
Adoption of MSA	%	28	25	37	40	69	64
Average carcass weight							
All cattle	kg cwe	243	239	241	245	253	283
MSA eligible and MSA graded	kg cwe	252	249	251	253	260	259
Other cattle	kg cwe	242	238	240	245	251	288
Beef production							
Total	kt cwe	2 077	2 226	2 132	2 125	2 109	2 298
Total MSA graded	kt cwe	163	178	210	224	332	368
Other cattle	kt cwe	1 914	2 048	1 922	1 901	1 776	1 930

Source: MLA and CIE calculations.

Total MSA beef production

An important step in the evaluation process is to establish the baseline outcomes for the MSA program in terms of production of beef from MSA compliant cattle and then the quantity of MSA product that can be harvested by boning group.

- This analysis is based on the cattle numbers from table C.1 and the data on yields by boning group and hanging method set out in appendix B.
- Table C.2 sets out the composition of the MSA slaughter by boning group and by handing method from 1999–2000 through to 2010–11.

C.2 Total slaughter and beef production of MSA compliant cattle

		1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Total slaughter	000's	8 505	9 081	8 893	9 240	8 874	9 023
Cattle MSA graded	000's	225	291	353	366	523	626
- in total slaughter	%	3	3	4	4	6	7
Compliant carcasses	000's	187	253	330	316	476	576
- in MSA graded	%	83	87	93	86	91	92
Hanging method - carcasses							
Achilles hung	%	60	60	60	60	60	60
Tenderstretch	%	40	40	40	40	40	40
Achilles hung	000s	113	152	199	190	287	347
Tenderstretch	000s	74	101	131	126	189	229
Boning groups - carcasses							
Boning groups 1-6	000s	121	164	214	205	309	374
Boning groups 7-12	000s	60	81	106	102	153	185
Boning groups 13-18	000s	6	8	10	9	14	17
Carcass weights							
Boning groups 1-6	kg cwe	279	411	411	411	411	411
Boning groups 7-12	kg cwe	269	269	269	269	269	269
Boning groups 13-18	kg cwe	258	258	258	258	258	258
MSA compliant beef production							
Boning groups 1-6	kt cwe	34	68	88	84	127	154
Boning groups 7-12	kt cwe	16	22	29	27	41	50
Boning groups 13-18	kt cwe	1	2	3	2	4	4
		2005-06	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**
Total slaughter	000's	8 544	9 308	88 59	8 657	8 348	8 112
Cattle MSA graded	000's	645	716	839	883	1 280	1 422
- in total slaughter	%	8	8	9	10	15	18
Compliant carcasses	000's	593	649	758	804	1 174	1 304
- in MSA graded	%	92	91	90	91	92	92
Hanging method - carcasses							
Achilles hung	%	60	60	66	68	78	77
Tenderstretch	%	40	40	34	32	22	24
Achilles hung	000s	357	391	500	546	916	998
Tenderstretch	000s	236	258	258	258	*258*	*307*
Boning groups - carcasses							
Boning groups 1-6	000s	385	421	492	522	762	847
Boning groups 7-12	000s	191	208	244	258	377	419
Boning groups 13-18	000s	18	19	22	24	35	39
Carcass weights							
Boning groups 1-6	kg cwe	411	411	415	417	424	423
Boning groups 7-12	kg cwe	269	269	272	273	278	277
Boning groups 13-18	kg cwe	411	411	415	417	424	423
MSA compliant beef production							
Boning groups 1-6	kt cwe	158	173	204	217	323	358
Boning groups 7-12	kt cwe	51	56	66	70	105	116
Boning groups 13-18	kt cwe	5	5	6	6	9	10

Source: MLA and CIE calculations.

The analysis was based on the profile of slaughter and carcass weights by boning groups and the proportion of carcasses hung by each method for 2009–10 and 2010-11. The routine collection of these data by the MSA program started relatively recently. Therefore, parameters for these years were modified and applied to previous years of the analysis largely on the basis of anecdotal evidence.

Table C.3 translates beef production by boning group and handling method into MSA beef yields using the relationships identified in appendix B.

- It is important to note that the yields reported are what are technically possible and so involve some uncertainty.
- For example, processors may not choose to harvest all primals and sell them under the MSA brand or alternatively not segregate product 3, 4 and 5 star product.

C.3 Composition of MSA compliant production

		1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Compliant carcasses	000's	187	253	330	316	476	576
MSA production	kt cwe	51	69	91	87	131	158
Product yield	kt pw	35	48	62	60	90	109
MSA maximum yield							
Total	kt pw	19.4	26.2	34.2	32.8	49.4	59.7
3 star	kt pw	17.9	24.2	31.5	30.2	45.5	55.0
4 star	kt pw	1.4	1.9	2.5	2.4	3.6	4.3
5 star	kt pw	0.1	0.2	0.2	0.2	0.3	0.4
Big 4 primals only							
Total	kt pw	5.2	7.1	9.2	8.8	13.3	16.1
3 star	kt pw	4.0	5.4	7.1	6.8	10.2	12.3
4 star	kt pw	1.1	1.5	1.9	1.8	2.8	3.4
5 star	kt pw	0.1	0.2	0.2	0.2	0.3	0.4
		2005-06	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**
Compliant carcasses	000's	593	649	758	804	1 174	1 304
MSA production	kt cwe	163	178	210	224	332	368
Product yield	kt pw	112	122	144	154	228	253
MSA maximum yield							
Total	kt pw	61.5	67.3	78.9	83.7	123.0	136.5
3 star	kt pw	56.6	62.0	72.9	77.5	114.4	126.9
4 star	kt pw	4.4	4.8	5.4	5.7	7.7	8.7
5 star	kt pw	0.4	0.5	0.5	0.6	0.8	0.9
Big 4 primals only							
Total	kt pw	16.6	18.1	21.3	22.6	33.2	36.9
3 star	kt pw	12.7	13.9	16.5	17.6	26.4	29.3
4 star	kt pw	3.5	3.8	4.2	4.4	5.9	6.7
5 star	kt pw	0.4	0.5	0.5	0.6	0.8	0.9

Source: MLA and CIE calculations.

- During consultation, processors indicated that it would only be economically viable to harvest the four highest value primals or cuts. Therefore, total production based on these four primals has been calculated to indicate a minimum level of MSA production.

By 2010–11, the total MSA compliant yield was found to be around 136.5 kt product weight basis. Of this total, the 'big 4' primals accounted for 36.9 kt product weight.

The next step is to calculate the contribution of MSA beef to the total domestic market as shown in table C.4.

- On the assumption that virtually all MSA product is marketed domestically, this product could have comprised up to 37.5 per cent of the total market made up of retail and high end food service.

C.4 MSA penetration into the domestic market

		1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
MSA yield							
All graded	kt pw	19.4	26.2	34.2	32.8	49.4	59.7
Big 4 primals only	kt pw	5.2	7.1	9.2	8.8	13.3	16.1
Domestic market							
Domestic disappearance	kt cwe	715	684	665	711	723	727
	kt pw	408	390	379	405	412	414
Retail high end food service	%	75	75	75	75	75	75
	kt pw	306	292	284	304	309	311
MSA penetration into domestic market							
Big 4 primals only	%	1.3	1.8	2.4	2.2	3.2	3.9
Maximum	%	4.8	6.7	9.0	8.1	12.0	14.4
MSA penetration into retail and food service							
Big 4 primals only	%	1.7	2.4	3.2	2.9	4.3	5.2
Maximum	%	6.3	9.0	12.0	10.8	16.0	19.2
		2005-06	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**
MSA yield							
All graded	kt pw	61.5	67.3	78.9	83.7	123.0	136.5
Big 4 primals only	kt pw	16.6	18.1	21.3	22.6	33.2	36.9
Domestic market							
Domestic disappearance	kt cwe	732	758	732	681	767	790
	kt pw	417	432	417	388	437	450
Retail high end food service	%	75	75	75	75	75	75
	kt pw	313	324	313	291	328	338
MSA penetration into domestic market							
Big 4 primals only	kt pw	4.0	4.2	5.1	5.8	7.6	8.2
Maximum	kt pw	14.7	15.6	18.9	21.6	28.1	30.3
MSA penetration into retail and food service							
Big 4 primals only	kt pw	5.3	5.6	6.8	7.8	10.1	10.9
Maximum	kt pw	19.7	20.8	25.2	28.8	37.5	40.5

Source: MLA and CIE calculations.

- This market share has increased steadily in proportion to the number of carcasses that have been graded by MSA.

D MSA price premiums

To establish the benefits to producers and consumers, MSA premiums have been systemically collected across licensees.

- The premiums from the point that MSA started collection during 2005 up until 2007–08 are taken from Griffiths et al (2009).
- For the past three years, the data source for these premiums was the MSA Annual Outcomes Report.

As noted in chapter 3, price premiums are calculated by comparison of MSA and ungraded beef for the same cut through the same outlet.

Table D.1 shows wholesale premiums for the period 1999–2000 to 2010–11 while table D.2 shows the equivalent estimates for retail used in this evaluation.

- Premiums by cut and primal are translated to premiums by primal only using the concordance in table B.1.
- All price premiums by primal are recorded on a product weight basis. In each of these tables, these prices are aggregated using yield weights to achieve an average carcass return.
  - This accounts for the fact that major primals and trimmings do not receive premiums and would be aggregated with all other MSA beef for sale.
  - An adjustment is also made for fat and bone yield to get back to carcass weight equivalent.

For 2010–11, average wholesale premiums for MSA product were between 7 and 8 per cent of ungraded product. This premium is equal to:

- 109 cents per kilogram as simple average premium across MSA graded primals only over the equivalent ungraded primals; or
- 29 cents per kilogram recognising the contribution of each primal to average carcass weight assuming that all cuts can be harvested.

Average retail premiums for 2010-11 (table 6.13) were around 10 per cent higher than ungraded product:

- 114 cents per kilogram as simple average premium across MSA graded primals only over the equivalent ungraded primals; or
- 37 cents per kilogram recognising the contribution of each primal to average carcass weight assuming that all cuts can be harvested.

It is difficult to explain why premiums are so similar for 2009–10 and 2010-11 between wholesale and retail level for individual cuts when historically retail premiums have been higher than wholesale.

D.1 **Wholesale premiums for MSA products[a]**

		1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Topside	c/kg pw	0.00	0.11	0.21	0.32	0.41	0.52
Thick flank	c/kg pw	0.00	0.08	0.16	0.24	0.31	0.40
Outside	c/kg pw	0.00	0.15	0.30	0.45	0.58	0.73
D-rump	c/kg pw	0.00	0.29	0.59	0.88	1.14	1.44
Tenderloin	c/kg pw	0.00	0.88	1.76	2.65	3.43	4.32
Striploin	c/kg pw	0.00	0.45	0.90	1.35	1.75	2.21
Navel End Brisket	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Point End Brisket	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Cube roll	c/kg pw	0.00	0.63	1.26	1.89	2.45	3.09
Blade	c/kg pw	0.00	0.08	0.16	0.24	0.31	0.39
Chuck roll	c/kg pw	0.00	0.12	0.23	0.35	0.45	0.57
Chuck tender	c/kg pw	0.00	0.12	0.23	0.35	0.45	0.57
Shinshank	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Thin skirt	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Flank steak	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Trimming	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Meat yield	c/kg pw	0.00	0.12	0.25	0.37	0.48	0.60
Fat	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Bone	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Carcass basis	c/kg cwe	0.00	0.08	0.17	0.25	0.33	0.41
		2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Topside	c/kg pw	0.23	0.07	0.81	0.56	0.31	-0.27
Thick flank	c/kg pw	0.23	0.28	0.55	-0.06	0.57	0.26
Outside	c/kg pw	0.23	0.07	0.81	0.81	0.80	0.68
D-rump	c/kg pw	1.11	1.69	1.27	0.58	1.34	0.96
Tenderloin	c/kg pw	6.00	4.01	3.21	3.96	3.46	3.58
Striploin	c/kg pw	2.82	1.77	1.78	2.17	1.76	1.97
Navel End Brisket	c/kg pw	0.23	0.00	0.00	0.00	0.00	0.00
Point End Brisket	c/kg pw	0.23	0.00	0.00	0.00	0.00	0.00
Cube roll	c/kg pw	4.92	3.06	2.20	2.76	2.44	2.60
Blade	c/kg pw	0.23	0.24	0.64	0.04	0.40	0.22
Chuck roll	c/kg pw	0.23	0.02	1.05	0.29	0.58	0.44
Chuck tender	c/kg pw	0.23	0.02	1.05	0.29	0.58	0.44
Shinshank	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Thin skirt	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Flank steak	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Trimming	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Meat yield	c/kg pw	0.62	0.42	0.62	0.47	0.53	0.43
Fat	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Bone	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Carcass basis	c/kg cwe	0.42	0.29	0.42	0.32	0.36	0.29

[a] Using typical carcass composition. Average premiums from 2000-01 to 2004-05 have been assumed.

Source: Griffiths (2000), MLA and CIE calculations.

D.2 Retail premiums for MSA products[a]

		1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Topside	c/kg pw	0.00	0.18	0.36	0.54	0.72	0.89
Thick flank	c/kg pw	0.00	0.18	0.35	0.53	0.70	0.88
Outside	c/kg pw	0.00	0.12	0.24	0.36	0.48	0.60
D-rump	c/kg pw	0.00	0.32	0.63	0.95	1.26	1.58
Tenderloin	c/kg pw	0.00	0.78	1.57	2.35	3.13	3.92
Striploin	c/kg pw	0.00	0.64	1.27	1.91	2.54	3.18
Navel End Brisket	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Point End Brisket	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Cube roll	c/kg pw	0.00	0.80	1.61	2.41	3.21	4.01
Blade	c/kg pw	0.00	0.18	0.35	0.53	0.70	0.88
Chuck roll	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Chuck tender	c/kg pw	0.00	0.25	0.50	0.75	1.00	1.26
Shinshank	c/kg pw	0.00	0.19	0.39	0.58	0.77	0.96
Thin skirt	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Flank steak	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Trimming	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Meat yield	c/kg pw	0.00	0.16	0.32	0.49	0.65	0.81
Fat	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Bone	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Carcass basis	c/kg cwe	0.00	0.11	0.22	0.33	0.45	0.56
		2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Topside	c/kg pw	2.46	0.64	0.75	0.80	0.80	0.65
Thick flank	c/kg pw	0.66	0.62	0.73	0.80	0.80	0.65
Outside	c/kg pw	-1.18	0.50	0.42	0.35	0.31	0.35
D-rump	c/kg pw	1.19	0.93	1.32	1.20	1.10	1.00
Tenderloin	c/kg pw	2.73	3.10	3.69	2.60	2.60	2.40
Striploin	c/kg pw	3.85	2.64	2.77	2.25	2.20	1.92
Navel End Brisket	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Point End Brisket	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Cube roll	c/kg pw	5.35	3.31	3.87	2.50	2.50	2.90
Blade	c/kg pw	0.68	0.79	0.85	0.50	0.50	0.50
Chuck roll	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Chuck tender	c/kg pw	4.32	1.17	0.91	1.00	0.70	1.00
Shinshank	c/kg pw	0.60	0.83	0.67	0.80	0.90	0.80
Thin skirt	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Flank steak	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Trimming	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Meat yield	c/kg pw	0.82	0.64	0.70	0.58	0.57	0.54
Fat	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Bone	c/kg pw	0.00	0.00	0.00	0.00	0.00	0.00
Carcass basis	c/kg cwe	0.56	0.44	0.48	0.40	0.39	0.37

[a] Using typical carcass composition. Average premiums from 2000-01 to 2004-05 have been assumed.

Source: Griffiths (2000), MLA and CIE calculations.

The next step to calculate the additional value from MSA premiums by multiplication through by product weight yields identified in appendix B.

- Table D.3 compares wholesale premiums calculated by using typical carcass weights with those average premiums based on the potential MSA yield estimated in appendix B.

D.3 **Additional wholesale and retail value from MSA product**

		2001-02	2002-03	2003-04	2004-05	2005-06
Wholesale premiums standard carcass						
Simple average across graded primals	c per kg pw	0.58	0.87	1.13	1.42	1.62
Weighted average across carcass	c per kg pw	0.17	0.25	0.33	0.41	0.42
Wholesale premiums MSA production						
Weighted average across MSA primals	c per kg pw	0.40	0.60	0.77	0.97	0.97
Weighted average across MSA carcass	c per kg cwe	0.15	0.23	0.29	0.37	0.37
	$m	13.5	19.6	38.1	58.1	59.8
Retail premiums standard carcass						
Simple average across graded primals	c per kg pw	0.69	1.03	1.38	1.72	2.01
Weighted average across carcass	c per kg pw	0.22	0.33	0.45	0.56	0.56
Retail premiums MSA production						
Weighted average across MSA primals	c per kg pw	0.52	0.78	1.05	1.31	1.32
Weighted average across MSA carcass	c per kg cwe	0.20	0.30	0.40	0.49	0.50
	$m	17.9	25.7	51.6	78.1	81.2
		2006-07	**2007-08**	**2008-09**	**2009-10**	**2010-11**
Wholesale premiums standard carcass						
Simple average across graded primals	c per kg pw	1.12	1.34	1.14	1.22	1.09
Weighted average across carcass	c per kg pw	0.29	0.42	0.32	0.36	0.29
Wholesale premiums MSA production						
Weighted average across MSA primals	c per kg pw	0.70	0.99	0.75	0.86	0.70
Weighted average across MSA carcass	c per kg cwe	0.26	0.37	0.28	0.32	0.26
	$m	47.0	78.4	62.4	105.4	95.5
Retail premiums standard carcass						
Simple average across graded primals	c per kg pw	1.37	1.53	1.20	1.15	1.14
Weighted average across carcass	c per kg pw	0.44	0.48	0.40	0.39	0.37
Retail premiums MSA production						
Weighted average across MSA primals	c per kg pw	1.04	1.13	0.94	0.93	0.87
Weighted average across MSA carcass	c per kg cwe	0.39	0.42	0.35	0.34	0.32
	$m	69.8	89.3	78.6	114.0	118.7

Source: MLA and CIE calculations.

In 2010-11, the average wholesale premium across all MSA graded primals was 26 cents per kilogram on a carcass weight basis while total value of wholesale premiums is estimated to be worth $95.5 million.

Similarly, the average retail premium across all MSA graded primals was 32 cents per kilogram on a carcass weight basis while total value of retail premiums is estimated to be worth $118.7 million.

Finally the remaining step is the calculation of premiums at the farm level for beef producers for MSA compliant cattle.

Table D.4 sets out the data and assumptions required to calculate the total value of premiums paid to livestock producers for MSA cattle.

To make this calculation tractable we have identified two classes of cattle: younger and old/heavier types. These cattle types are represented by:

- the eastern young cattle indicator (EYCI) and medium steers for prices; and
- cattle from boning groups 1–12 (younger) and boning groups 13–18 (older/heavier).

In 2010-11, the average premium reported for MSA yearling cattle sold OTH averaged 15 cents per kilogram dressed weight.

- Using an average price for young cattle as the EYCI, this represents a premium of around 4 per cent.
- Without any further data on these premiums for other years, assumptions were made on the basis of ad valorem premiums at wholesale level.

Based on the premium and the EYCI as being representative for these calculations, the acquisition cost of MSA cattle was worth over $1 billion in 2010–11.

- The MSA premium component of this total was estimated to be $53.7 million.

D.4 Premiums paid to beef producers

		2001-02	2002-03	2003-04	2004-05	2005-06
Saleyard or OTH prices						
EYCI	c/kg cwe	332	270	327	363	373
Medium steer	c/kg cwe	299	243	294	327	335
MSA premiums						
Cattle from boning group 1-12	c/kg cwe	8.0	8.0	8.0	8.0	8.0
- as proportion of EYCI	%	2.4	3.0	2.4	2.2	2.1
Cattle from boning group 13-18	c/kg cwe	0.0	0.0	0.0	0.0	0.0
Compliant carcasses						
Boning group 1-12	000s	214	205	309	374	385
Boning group 13-18	000s	10	9	14	17	18
Carcass weights						
Boning group 1-12	kg cwe	411	411	411	411	411
Boning group 13-18	kg cwe	258	258	258	258	258
Value of livestock sales						
Cattle from boning group 1-12	$m	293	227	416	559	590
Cattle from boning group 13-18	$m	8	6	11	14	15
Total	$m	300	233	426	573	605
MSA premiums paid						
Cattle from boning group 1-12	c/kg cwe	7.0	6.7	10.2	12.3	12.7
Cattle from boning group 13-18	$m	0.0	0.0	0.0	0.0	0.0
Total	$m	7.0	6.7	10.2	12.3	12.7

(Continued)

D.4 **Premiums paid to beef producers** (Continued)

		2006-07	2007-08	2008-09	2009-10	2010-11
Saleyard or OTH prices						
EYCI	c/kg cwe	323	317	329	330	385
Medium steer	c/kg cwe	291	286	296	297	346
MSA premiums						
Cattle from boning group 1-12	c/kg cwe	8.0	9.0	8.0	15.0	15.0
- as proportion of EYCI	%	2.5	2.8	3.0	4.5	3.9
Cattle from boning group 13-18	c/kg cwe	0.0	0.0	0.0	0.0	0.0
Compliant carcasses						
Boning group 1-12	000s	421	492	522	762	847
Boning group 13-18	000s	19	22	24	35	39
Carcass weights						
Boning group 1-12	kg cwe	411	415	417	424	423
Boning group 13-18	kg cwe	258	260	261	265	265
Value of livestock sales						
Cattle from boning group 1-12	$m	560	649	715	1 066	1 378
Cattle from boning group 13-18	$m	14	17	18	27	35
Total	$m	575	665	734	1 094	1 414
MSA premiums paid						
Cattle from boning group 1-12	c/kg cwe	13.9	18.4	17.4	48.5	53.7
Cattle from boning group 1-12	$m	0.0	0.0	0.0	0.0	0.0
Total	$m	13.9	18.4	17.4	48.5	53.7

Source: MLA and CIE calculations.

E Stakeholder consultation

As part of the evaluation process, the CIE consulted with various industry stakeholders to gather their perspectives on

- The impact of MSA on demand for beef/sheep
- The current premiums/discounts for MSA compliance/non-compliance faced by the various steps in the value chain
- What is the share of the MSA graded carcass that attracts the premiums
- The costs (additional to business as usual) of carrying out MSA procedures
- Any areas of special attention for improvement (gaps)
- What would be the future of the MSA brand and red meat eating quality without continuing MLA support?
- What would be the role for MLA (in the future) in regards to MSA?

The CIE is simultaneously conducting the evaluation of the beef domestic promotion program for MLA, and the list of stakeholders consulted were interviewed on both programs.

The list of stakeholders consulted is below.

- Kevin Stefanowicz, Drake Supermarkets.
- Kevin Cotteril, AMIC.
- Jeremy Nicholas, Dennis Koutoulogenis and Bec Morton, BMF.
- David Barnes, Bush Meats.
- Stuart Hayes, Freshwater Meats.
- Jenny Kroonstuiver, MINTRAC.
- Chris Nicklin, Coles.
- David Beak, B&J.
- Lachie Hart, Stockyard Group.
- Peter Greeham (Jr), Greenham Meats.
- Terry Nolan, Nolan Meats.
- Anthony Pratt, JBS.
- Andrew Negline, Cargill.
- Rob Carratt, Woolworths.

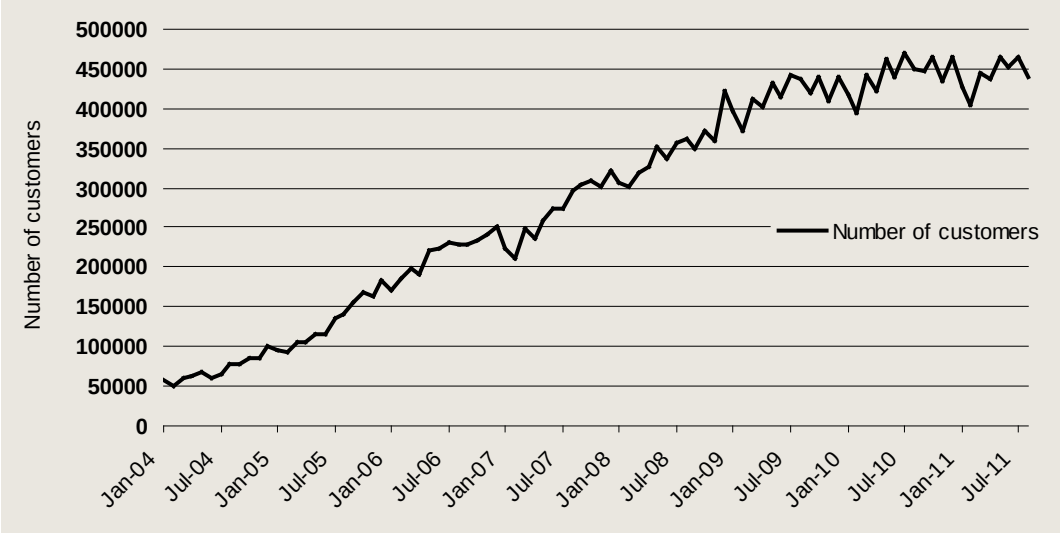
F POS Butchers data

A source of data on retail butchery is from the MLA point of sale data collection. This short note examines this data and investigates how it could complement other data sources available for the Domestic promotion and MSA evaluations.

- The value of this data is to provide better insights on prices paid by consumers and is a partial substitute for supermarket scan data.

Chart F.1 shows that the coverage of the butcher's data has increased significantly since January 2004 through an increase in participating stores. It now covers around 100 businesses that are principally involved in selling Meat Standards Australia (MSA) beef.

F.1 **Number of customers or transactions**



Data source: MLA Point of Sale database.

Chart F.2 shows how average purchase of beef by customer, in terms of weight of serve, has changed little since 2004.

- Average portion purchased has fallen at an annual average rate of 1 per cent each year.

It should be noted that we have to normalise the POS data by the number of transactions to get sensible numbers of values and volumes purchased.

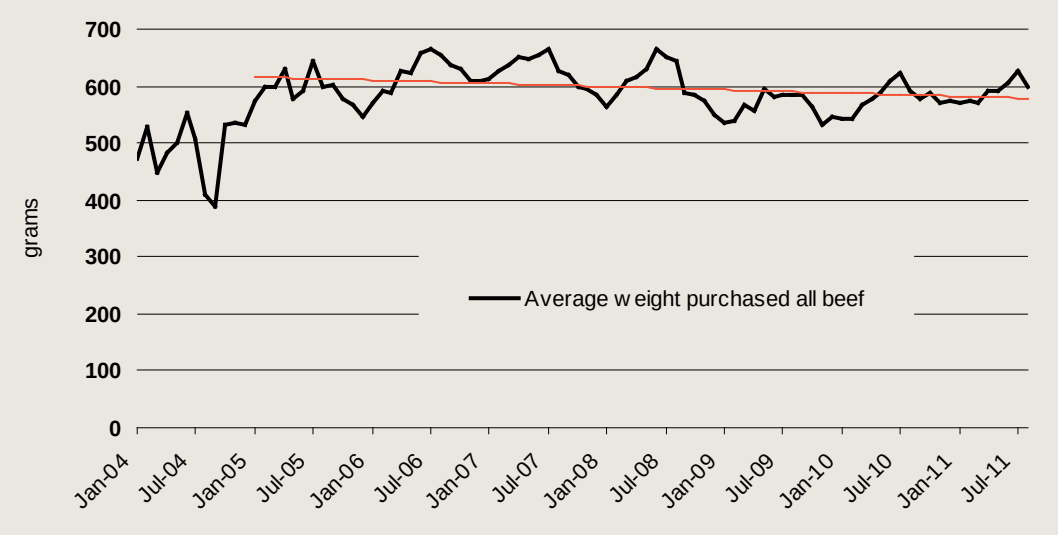
- The series shows the same seasonal variation as the AC Neilsen data (peaks in winter and troughs in summer) and a slight downward trend overall.

- This could be due to the competitive performance of these stores rather than the performance of beef overall.

Beef weight purchased per transaction

Chart F.2 shows that the impact of small sample during the first year of operation of the database, with the series taking some time to stabilise.

F.2 **Average weight of beef purchase by transaction[a]**



[a] Change in the quantity purchased series is more important than the absolute level as explained in the text.

Data source: MLA Point of Sale database.

- Because all transactions may not involve the purchase of beef, the average weight may not be reliable and is most likely below the actual purchase weight.
- This factor has to be kept in mind for all this data but changes in the purchase behaviour over time should be representative of what happened.

This is highlighted in chart F.3 which is for MSA product. This chart:

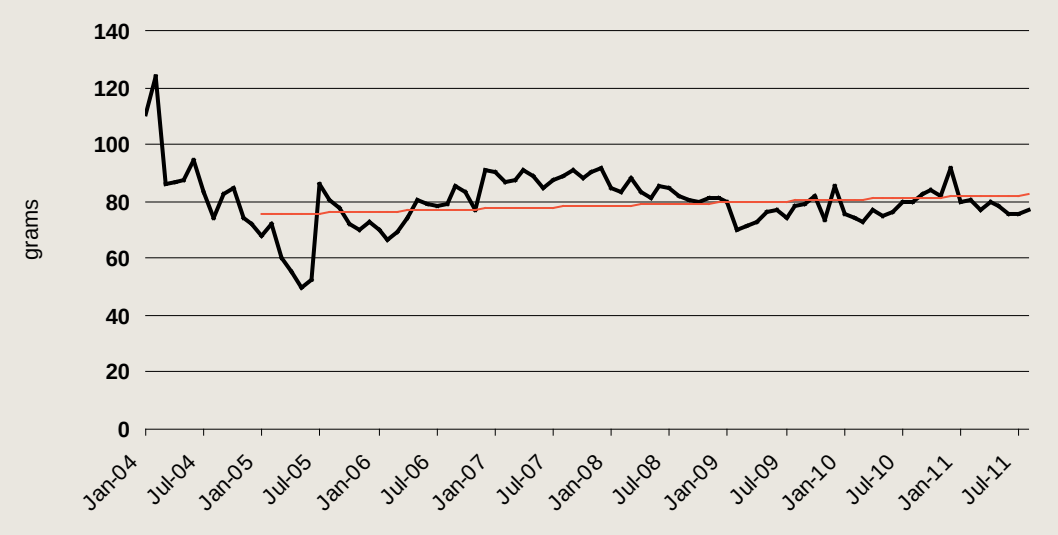
- highlights that the collection of the POS data was linked primarily to butcher shops selling MSA product in the first year of data collection;
- it indicates that probably 15 per cent of transactions involved purchase of MSA beef (if they were to have an average purchase of 500 grams); and
- MSA portions purchased have increased slightly at 1.6 per cent each year.

Expenditure on beef

Chart F.4 shows the average expenditure over time for all beef purchased, which has with a distinct upwards trend.

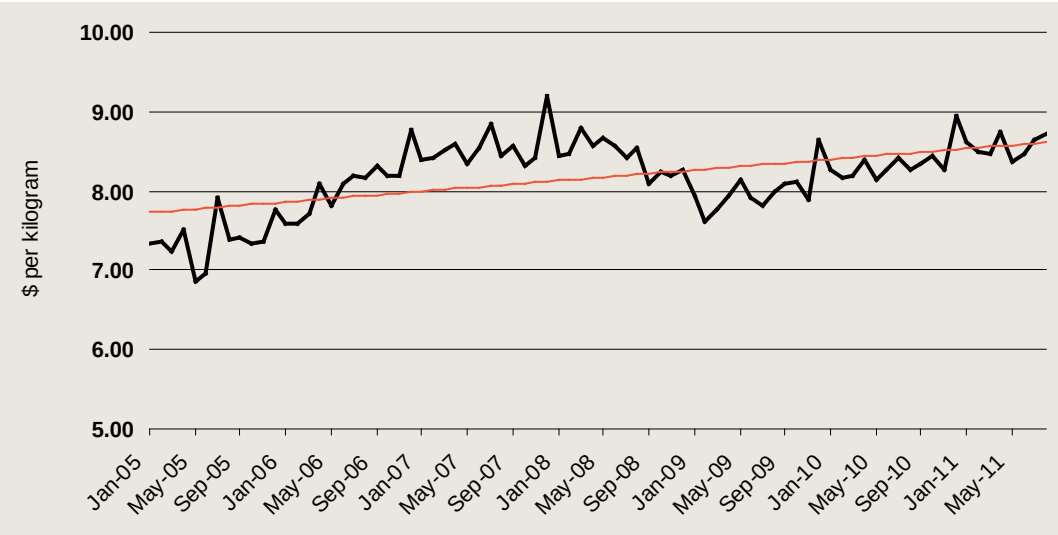
- Again the *level* of the purchase is biased downwards because not all transactions would involve the purchase of beef. But there remains a significant seasonal content. Since 2005, total expenditure on beef has increased at an annual average rate if 1.7 per cent each year.

F.3 **Average weight of MSA beef purchase by transaction[a]**



[a] Change in the quantity purchased series is more important than the absolute level as explained in the text.
Data source: MLA Point of Sale database.

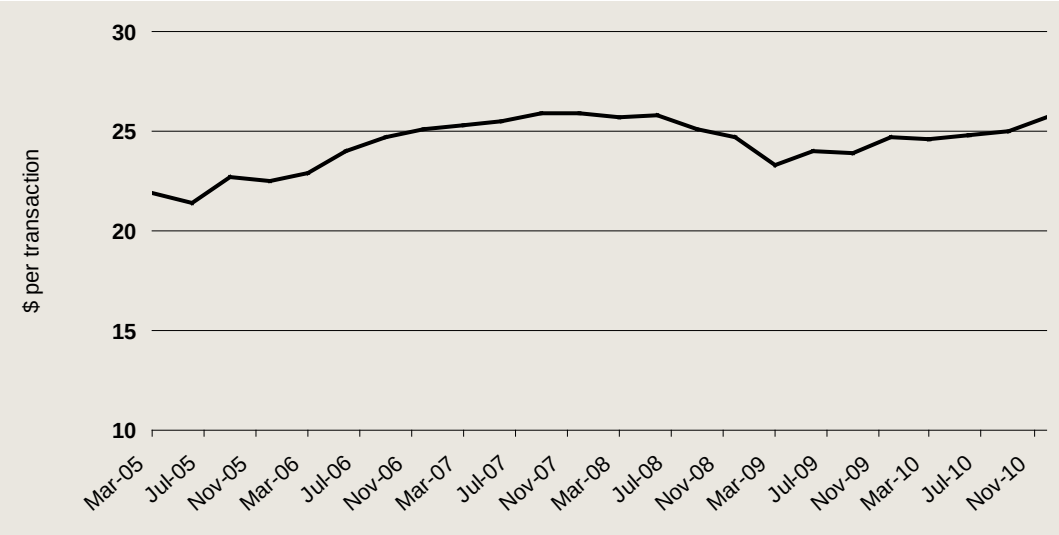
F.4 **Average expenditure per transaction on beef per week[a]**



[a] Change in the expenditure series is more important than the absolute level as explained in the text.
Data source: MLA Point of Sale database.

Chart F.5 shows the average expenditure on beef on a quarterly basis.

F.5 **Average expenditure per transaction per quarter on beef**



Data source: MLA Point of Sale database.

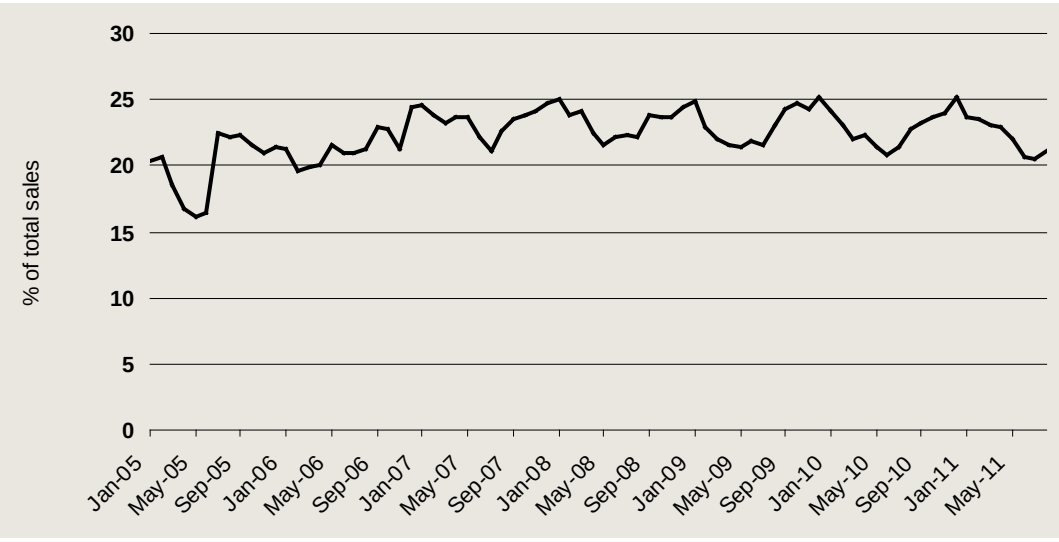
This effectively smooths out the seasonality but the scale chosen exaggerates the increase in spend over the period.

- Spend increases by nearly $3–4 per transaction over the past five years.

Table F.6 shows that through the stores involved in the program, the MSA contribution to total beef sales has been stable between 20 and 25 per cent of total beef expenditure.

- It peaks during summer when consumers purchase steak for BBQ season and has its trough during winter when beef quality lower relative to the value of the MSA premium.

F.6 **MSA contribution to total consumer spend on beef**



Data source: MLA Point of Sale database.

Retail prices

Chart F.7 shows that average prices for both MSA and non-graded product have increased steadily over the past five years, again with a significant seasonal component.

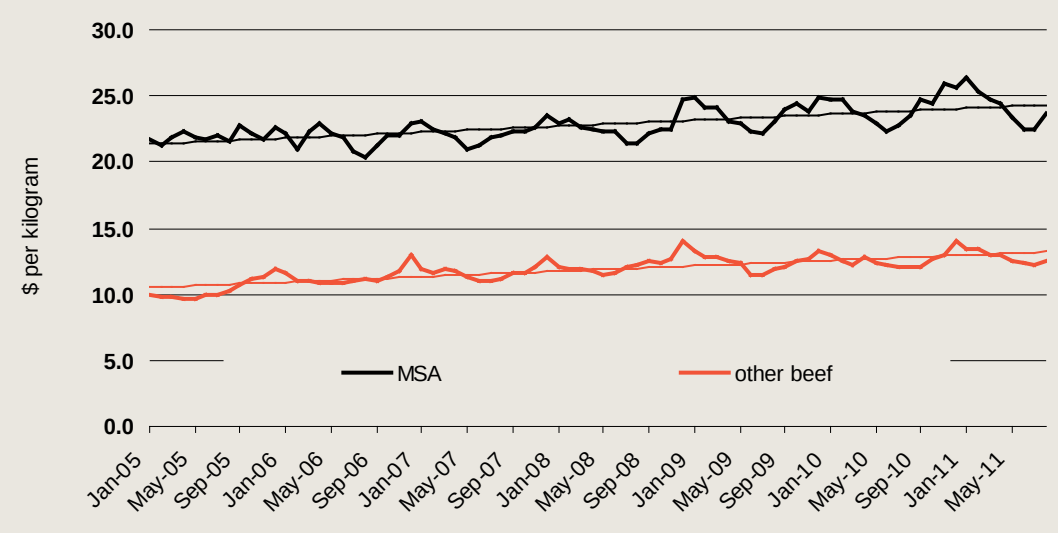
- Retail MSA prices have increased by 0.9 per cent on average over the past five years while non-MSA prices increased at around 2 per cent each year.

So in summary, on average over the period January 2005 to August 2011, in average growth terms each year:

- spend per customer on beef increased by 1.7 per cent;
- retail weight purchased fell by 0.94 per cent; and
- retail prices for beef increased by 2.7 per cent each year.

Taking a long term view, this would indicate that beef purchase though these outlets are *reasonably* unresponsive to price.

F.7 **Average retail prices for beef**



Data source: MLA Point of Sale database.

Performance relative to other meats

Table F.8 shows that beef consumption is falling behind the other meats.

F.8 Summary of butchers POS data for all meats

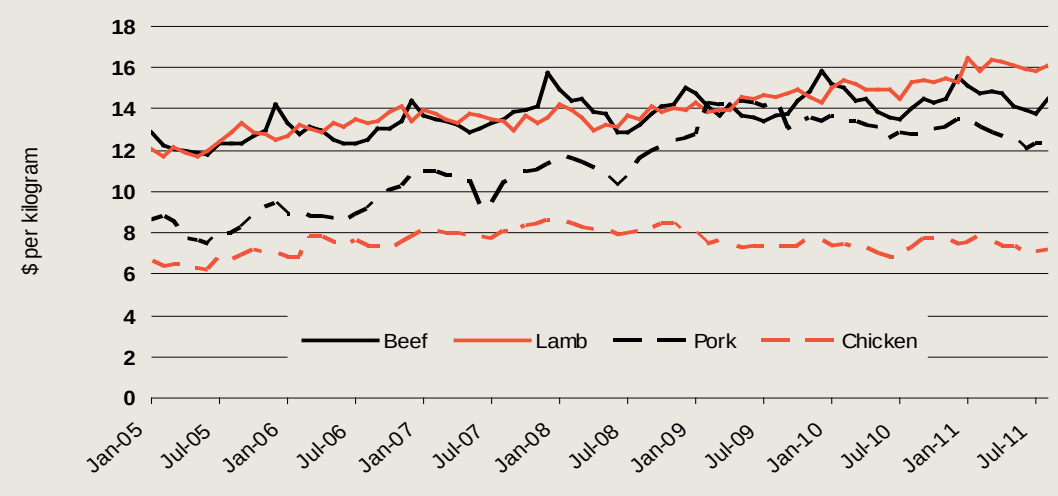
	Beef	*Lamb*	*Pork*	*Chicken*	*All meats*
	%	%	%	%	%
Prices	2.7	4.1	8.8	1.0	2.7
Quantities	-0.9	0.5	-5.8	6.3	0.8
Expenditure	1.7	4.5	2.6	7.4	3.4

[a] Average annual growth from January 2005 to August 2011.

Data source: MLA Point of Sale database.

Chart F.9 shows that retail prices of red meats and pork has increased substantially relative to poultry.

F.9 Retail prices for all meats

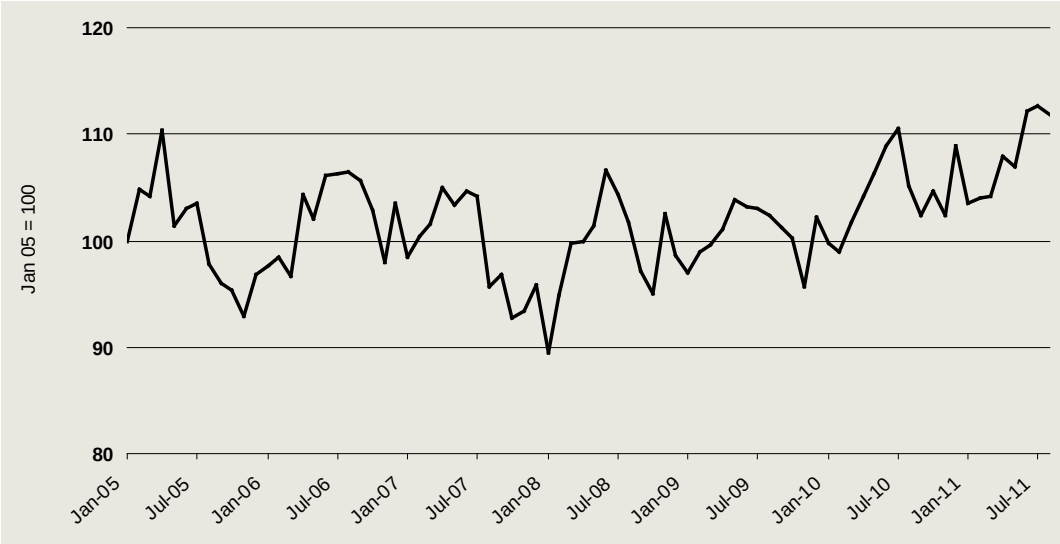


Data source: MLA Point of Sale database.

Chart F.10 shows that total expenditure though butchers covered varies by around 10 per cent through the year with Christmas being the lowest point.

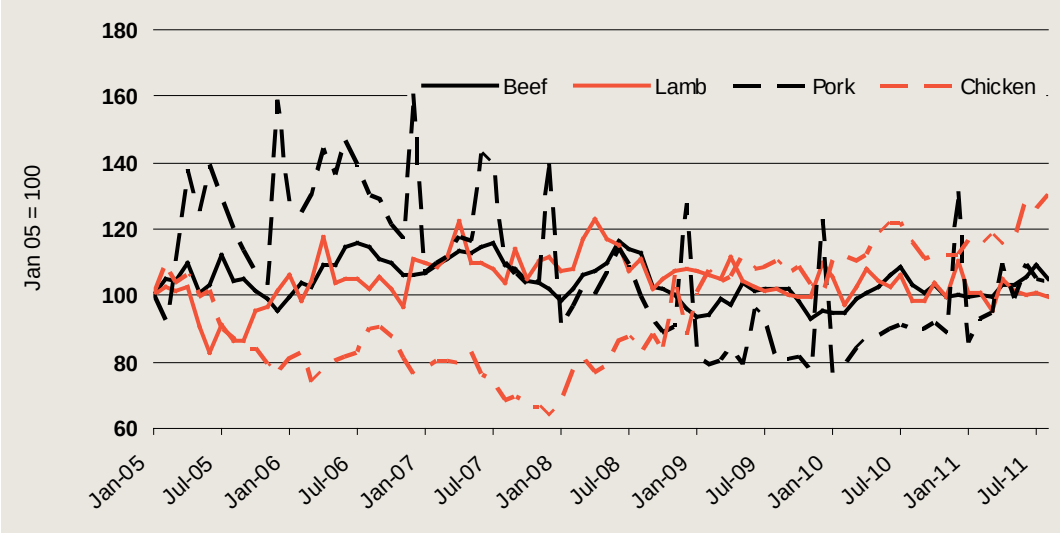
Chart F.11 shows that each meat is affected by seasonality but the big winner has been chicken since January 2008.

F.10 **Total purchase of meat, quantity basis**



Data source: MLA Point of Sale database.

F.11 **Purchase of each meat type, quantity basis**



Data source: MLA Point of Sale database.

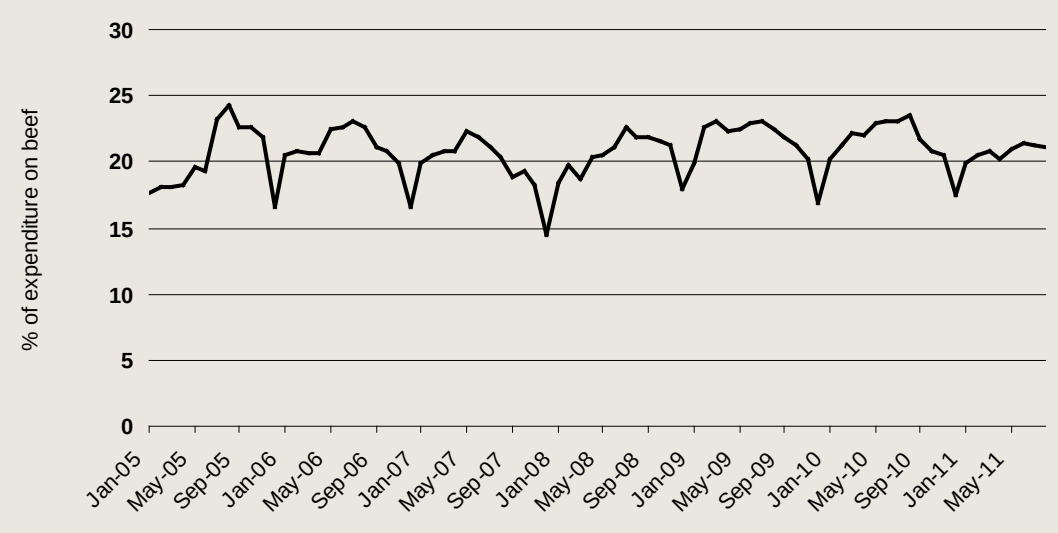
Case study: Mince

Mince is the largest beef line sold in both butchers shops and full service supermarkets. Not only is it widely used in home cooking for a wide range of meal solutions but it also presents retailers with the opportunity to maximise carcass utilisation because of the number of primals that can contribute to the product.

Chart F.12 shows that across the sampled butchers, mince accounts for on average 20 per cent of the total spend on beef.

- The seasonality is quite distinct with troughs around Christmas during the BBQ season.

F.12 **Mince in total consumer spend on beef**

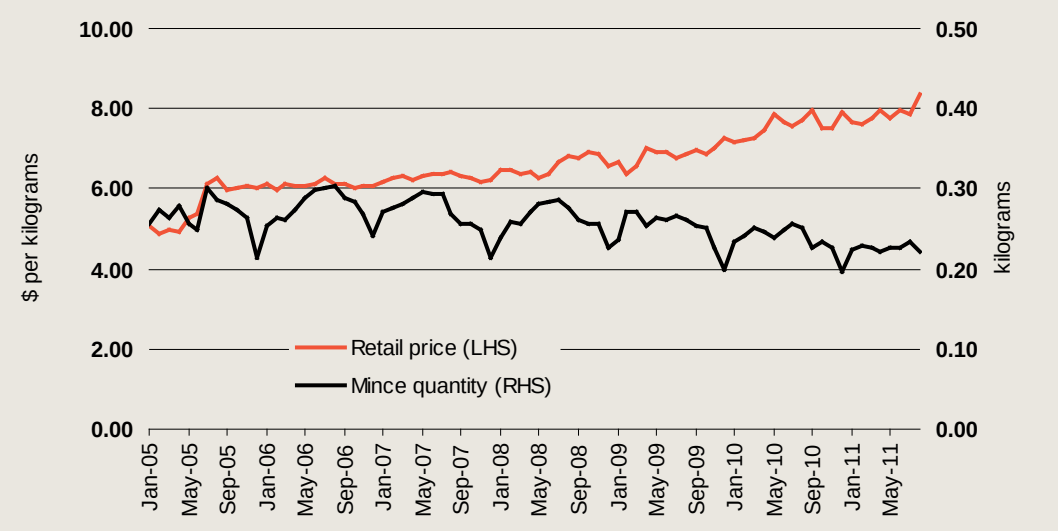


Data source: MLA Point of Sale database.

Chart F.13 shows retail prices and quantities for mince from the POS data.

- While average retail price has increased at a trend rate of 6.5 per cent each year (significantly greater than for the average).

F.13 **Retail prices and average purchases for mince**[a]



[a] Change in the quantity series is more important than the absolute level as explained in the text.

Data source: MLA Point of Sale database.

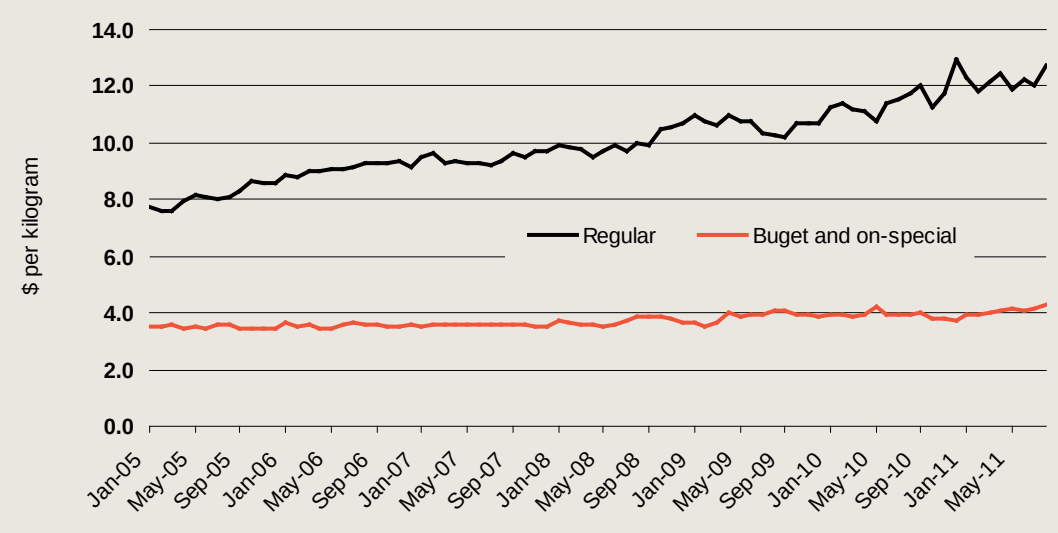
Over the period January 2005 to August 2011, in average growth terms each year:

- average retail prices went up by 6.5 per cent;
- total expenditure increased by 4.75 per cent; and

- quantities purchased fell by 1.6 per cent.

There is another dimension to the total spend and price relationship: the use of price points and price promotions (discounting) for regular product. Chart F.14 shows how these price points have changed over time with retailers holding onto the price point for budget or discounted mince to the $4 per kilogram mark.

F.14 **Mince sold at different price points**



Data source: MLA Point of Sale database.

In terms of mince there are a number of different products within the category at different price points:

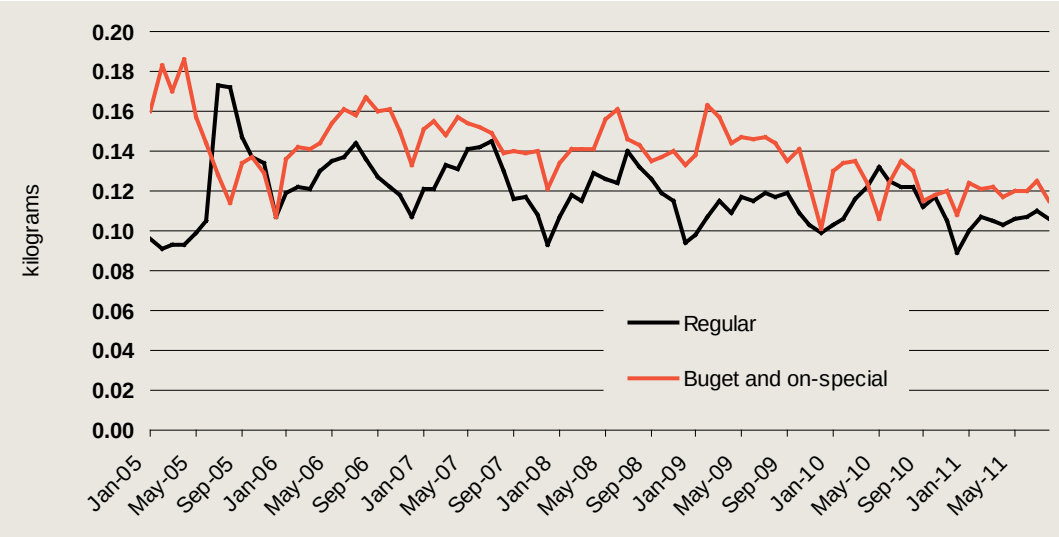
- around quality differences based on MSA, premium or gourmet and budget; and
- discounts for larger pack sizes; and

At these price points, chart F.15 shows that it is difficult to quantify the relationship between on and off price promotion because this data is across a number of outlets that operate on different discounting cycles.

But it can be concluded that price is a significant driver around weekly discounting cycles run by these retail outlets. But over the medium to long term, this price response evens out to reflect the fact that:

- from week to week, consumer have the option of storing (freezing) mince providing them with the opportunity to respond to price discounting;
- beyond this level, consumers have limited capacity to eat more mince because they have to purchase around a relatively fixed weekday menu which is designed to provide variety in meal types.

F.15 **Quantities purchased per transaction for mince**[a]



[a] Change in the quantity series is more important than the absolute level as explained in the text.

Data source: MLA Point of Sale database.

Case study: MSA

Of interest to the MSA evaluation is:

- which MSA cuts are being sold through speciality retail; and
- has this mix changed over time to include more lower value cuts.

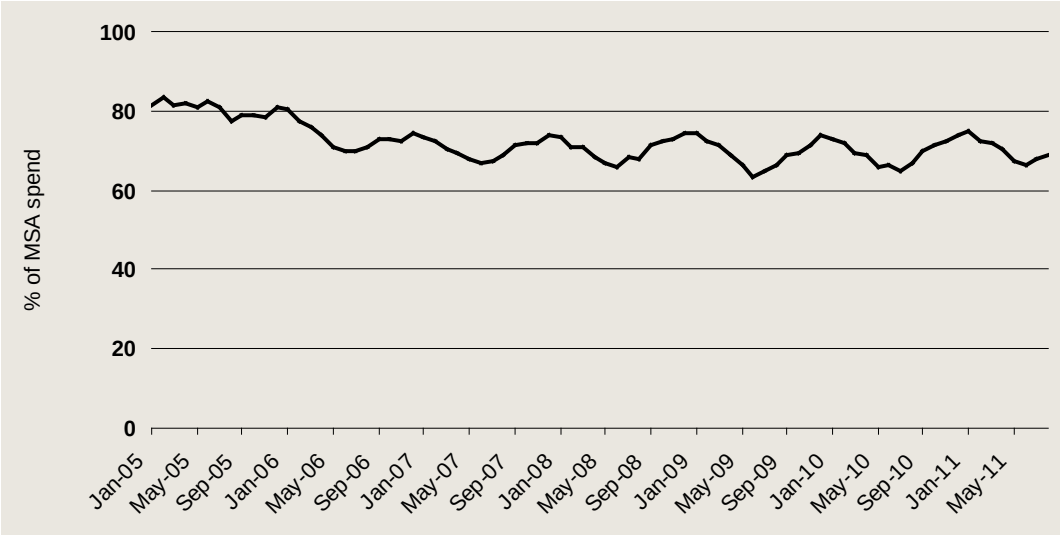
The foundation of MSA was around obtaining premiums for the high value loin cuts:

- scotch fillet, rump steak, New York cut (porterhouse), sirloin and t-bone.

Chart F.16 shows that these cuts have represented an average of 70 per cent of the total spend on MSA beef since 2005, moving around a seasonal variation.

- That is, the composition of MSA cuts has not changed significantly towards lower value cuts and cut-by-cook method value added product (mince, diced beef etc) which would be a good indicator of the intended outcome of the program which is to broaden the range of cuts across the carcase sold as MSA product.

F.16 **High value cuts in total spend on MSA beef**



Data source: MLA Point of Sale database.