REPORT

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An evaluation of lamb on-farm programs

Prepared for Meat & Livestock Australia

Centre for International Economics
Canberra & Sydney

December 2008

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Contents

Boxes, charts and tables

Glossary

ABARE	Australian Bureau of Agriculture and Resource Economics
AMLC	Australian Meat and Livestock Corporation
CIE	Centre for International Economics
DPI	Department of Primary Industries
FAPL	Fresh Australian Premium Lamb
FARL	Fresh Australian Range Lamb
GVP	Gross value of production
IF	Integrated Framework
LISP	Lamb Industry Strategic Plan
MLA	Meat and Livestock Australia
MRC	Meat Research Corporation
TFP	Total factor productivity

Summary

- The transformation of the Australian lamb industry since the early 1990's has been the result of concerted action by:
  - Meat and Livestock Australia (MLA) and its predecessors
  - State Departments of Primary Industries (DPIs)
  - stakeholders from industry along the marketing chain.
- The evaluation of MLA on-farm programs therefore has to be in the context not only of DPI programs but also:
  - MLA domestic and US lamb marketing programs — which is the subject of a separate but concurrent evaluation;
  - other MLA programs impacting on lamb including eating quality, food safety and market access; and
  - actions by industry.
- The approach used to evaluate the MLA on-farm programs - given this high level of inter-connectedness — is a so-called 'tops-down' approach. This involves the development of a 'baseline'.
  - This baseline, developed in consultation with industry stakeholders, describes what the industry might have looked like without the integrated program outcomes.
  - Because of the 'tops-down' approach, an important ingredient is the attribution of the aggregate outcome to each of the contributors.
- By 2007-08, observed annual lamb industry gross value of production is $1.1 billion higher than the case without the integrated program outcomes.
  - Alternatively, without the transformation, industry GVP may be only 20 per cent of its current value.
  - For 2007-08, this benefit translates to around an additional $299 million of industry value-added.
- Table 1 summarises the headline payoffs to each of the contributors to the success of the Australia lamb industry.
  - MLA promotion programs in the domestic and US markets were assumed to contribute one-third to the total outcome from the baseline. This rises to 50 per cent when accounting for MLA's on-farm program.

1 **MLA lamb program results summary — baseline[a]**

Contributor	*Attribution of benefits*	*Total benefits*	*Total costs*	*Benefit–cost ratio*	*Internal rate of return*
	%	$m	$m		%
MLA domestic promotion	12	573	263	2.2	16
MLA US promotion	18	859	120	7.2	34
MLA on-farm	**20**	**955**	**256**	**3.7**	**29**
DPI on-farm	**16**	**764**	**225**	**3.4**	**26**
MLA/DPI on-farm	**36**	**1 719**	**481**	**3.6**	**28**
Total MLA/DPI programs	66	3 151	864	3.6	26
Other industry	34	1 623	na	na	na
All stakeholders	100	4 775	na	na	na

a Net present values calculated over the period 1990 to 2015 with a discount rate of 5 per cent, 2007-08 dollar equivalents.
na Not applicable.
Source: Integrated Framework and CIE calculations.

  - Stakeholders indicated that the developments of the US market were a key driver of the transformation of the Australian lamb industry.

- A key driver of the overall benefit-cost ratio in table 1 is the time profile of benefits and costs — the result of the lag between significant investments in the early 1990's and flow of payoffs largely after 2000.
  - The period 1990 to 2001, in present value terms, accounted for 70 per cent of MLA and DPI investments. While only 20 per cent of the benefits were delivered during the period.
  - The logic presented in this report suggests that attribution of benefits makes little sense in the context of an integrated approach. However, to satisfy reporting requirements, judgements have been made where necessary.
  - Results from the analysis suggest that - once attribution has been made — the payoffs from on-farm programs and promotion in the US market may be higher than for promotion in domestic market. This largely reflects the greater expenditure on domestic marketing relative to the US program.
- Sensitivity analysis revealed that the headline results were robust and showed positive returns to funds invested when key parameters were varied.
  - When a more conservative baseline was adopted that implied that lamb slaughter would have continued to grow at levels experienced throughout the 1990s.
  - When the benefits of the programs, in present value terms, were restricted only to the period of the investments — 1990 to 2007.
- The attribution of the total benefit between contributors is also a very important part of the analysis. While this attribution does not impact significantly on the total benefit-cost ratio across all programs, it does impact on the payoffs to individual programs.

1 Introduction

The turnaround in the Australian lamb industry since 1990 has been remarkable. During the 1980s, the lamb industry was in decline. Domestic consumption was declining rapidly and market research indicated that consumers viewed lamb as a 'fatty' product, which was becoming increasingly more undesirable. In addition to this, Australia's performance on export markets was sluggish. During the 1980s, lamb exports increased only marginally and in international markets, Australian product was regarded as inferior to New Zealand lamb (MLA 2003).

Since 1990, the performance of Australia's lamb industry has improved dramatically. This turnaround is the result of a number of integrated factors that have effectively transformed the industry from one that was seen largely as a subset of the wool industry into a profitable, billion dollar industry. These factors include:

- the identification of a market (both domestically and internationally) for large, lean lambs with a lower fat content;
- a production focus on producing large lean lambs that has driven significant increases in carcass weights;
- investment in and restructure of the processing sector, including a move towards dedicated lamb processing plants;
- product transformation — leaner, more sophisticated cuts; and
- significant investment on the promotion of 'trim' lamb both domestically and in the US.

At the same time, a number of external factors helped facilitate the transformation. In particular, the ongoing decline in the Australian wool industry since the early 1990s has contributed to the shift into prime lamb production, as it encouraged wool sheep producers to move into lamb production rather than into other activities. The other external factor that played a part in the transformation of Australia's lamb industry was the ongoing long-term decline in the United States lamb industry. Australia's exports to the United States have grown significantly to the point where they are now the largest destination for Australian lamb by a considerable margin. Whilst the Australian industry has undoubtedly been successful in identifying and developing the United States market, the continued decline in the domestic lamb industry in the US played a role in facilitating the growth observed there.

MLA is currently engaging in a broad ranging evaluation process. A number of evaluations have already been completed as part of this process. This report presents

an evaluation of on-farm programs undertaken by the Meat Research Corporation (MRC) and Meat and Livestock Australia (MLA) between 1990 and 2007. An associated evaluation is also being undertaken on investments in lamb marketing on the domestic and United States markets over the same period. Due to the integrated nature of the outcomes across the supply and demand side, these evaluations will be directly linked using a 'tops-down' approach to estimating the impact of the programs.

This report builds on a recently completed evaluation (Agtrans 2008). This evaluation examined lamb production RD&E between 1990-91 and 2007-08. It detailed investment both by MLA/MRC and also by the state government DPIs. It utilised a 'tops-down' approach to attributing overall on-farm productivity gains between MLA/MRC and other research providers (including the DPIs), but did not explicitly include a linkage between the demand and supply side outcomes.

This report

The CIE's analysis utilises the Global Meat Industries (GMI)/Integrated Framework (IF) model to quantify the benefits of the on-farm program through an integrated tops-down approach, acknowledging that the turnaround in the performance of the lamb industry has been a result of integrated supply and demand side outcomes.

Chapter 2 provides a summary of the Agtrans analysis of the key outputs of the lamb production RD&E, while chapter 3 provides a broad description of the evaluation approach. Chapter 4 outlines an industry baseline (what would have happened without the integrated effort and turnaround in the lamb industry). This baseline will be common between this evaluation and the associated demand side evaluation. Chapter 5 estimates the impact of the lamb on-farm program.

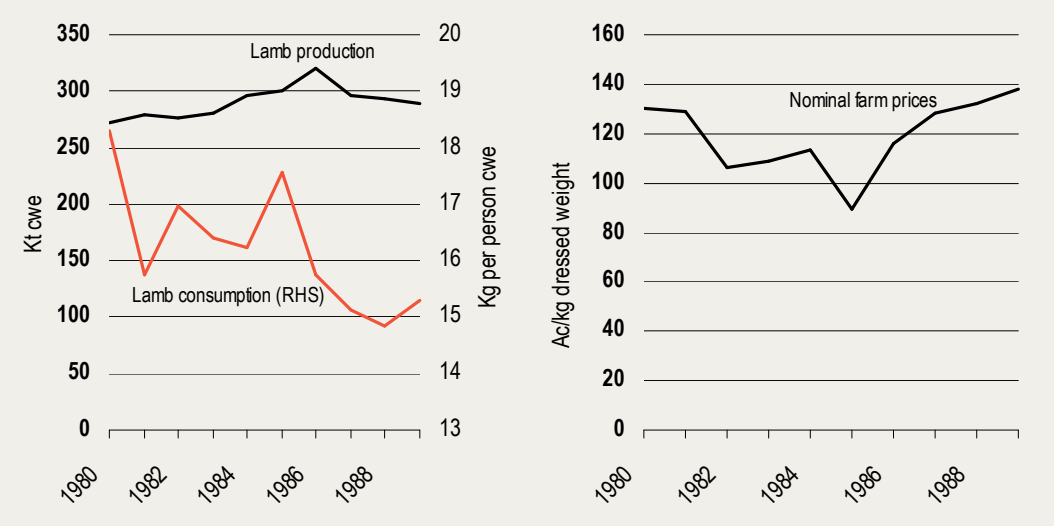
2 *Summary of on-farm program activities*

This section provides a summary of the relevant MLA and DPI lamb RD&E investments, activities and outputs over the period. This material is summarised from Agtrans (2008), and more detailed information can be found in that publication.

Context

During the 1980s, the Australian lamb industry was in decline. Production was flat, prices were weak and consumption was declining (chart 2.1).

2.1 **Australian lamb industry in the 1980s**



Data source: GMI database.

Lamb was not seen as a highly specialist activity and it was largely viewed as a by-product of the wool industry. It was a relatively cheap 'commodity' type product with little value adding. Despite this, there was recognition within sections of the industry that there was an opportunity to turnaround the industry's performance. Research had identified that consumer perceptions and attitudes towards lamb were poor — it was regarded as old fashion and fatty compared with chicken, new fashioned pork and lean beef. Within the industry, there had been efforts going on throughout the 1980s aimed at moving the industry into heavier, leaner lambs on the supply side. However, these were not concerted efforts across the industry. During the late 1980s and into the early 1990s, there was a renewed focus on repositioning the industry to take advantage of opportunities that were available. At a

fundamental level, this meant knowing what consumers wanted, and being able to deliver it on a consistent basis. The focus of investment in the lamb industry by MLA, its predecessors and other stakeholders since 1990 has been on coordinated supply and demand measures to assist the industry achieve this.

MLA and DPI investment

Table 2.2 shows estimated nominal MLA/MRC investment in lamb on-farm activities between 1990-91 and 2007-08, along with estimated total DPI investment. Figures for the early period (1990-91 to 1993-94) have been extrapolated as records of expenditure in this period were limited.

2.2 **MLA/MRC and total DPI investment in lamb production RD&E**

Year	*MLA/MRC investment*	*DPI investment*
	$m	$m
1990-91	4.966	4.230
1991-92	5.185	4.416
1992-93	5.750	4.898
1993-94	5.886	5.013
1994-95	6.836	5.823
1995-96	4.927	5.335
1996-97	3.016	5.596
1997-98	3.263	7.021
1998-99	3.381	7.055
1999-00	4.022	6.480
2000-01	4.863	7.383
2001-02	13.211	8.224
2002-03	19.645	7.499
2003-04	13.720	7.616
2004-05	13.381	8.475
2005-06	12.889	8.189
2006-07	8.763	7.615
2007-08	9.252	7.430
Total	**142.957**	**118.298**

Source: Agtrans 2008.

In total, the estimated nominal expenditure by MLA/MRC over the period is just under $143 million, while for the DPIs the total expenditure is estimated at just over $118 million. The DPI costs in the table above assume a multiplier to cover overhead costs of 1.25. Variations on this multiplier are included in the sensitivity analysis in chapter 5.

Table 2.3 breaks down estimated state DPI investment in lamb RD&E between states. These figures were estimated with assistance from the individual state DPIs for Victoria, New South Wales, South Australia and Tasmania. Figures for Western Australia and Queensland were estimated based on relative state contributions reported in McCausland (2006).

2.3 **State DPI investment in lamb production RD&E**

Year	*NSW*	*VIC*	*WA*	*SA*	*TAS*	*QLD*
	$m	$m	$m	$m	$m	$m
1990-91	1.30	1.551	0.975	0.100	0.195	0.109
1991-92	1.30	1.737	0.975	0.100	0.195	0.109
1992-93	1.30	2.119	0.975	0.200	0.195	0.109
1993-94	1.30	2.119	0.975	0.315	0.195	0.109
1994-95	1.30	3.039	0.975	0.205	0.195	0.109
1995-96	1.24	2.523	0.930	0.352	0.186	0.104
1996-97	1.24	2.799	0.930	0.337	0.186	0.104
1997-98	1.24	4.076	0.930	0.485	0.186	0.104
1998-99	1.24	4.252	0.930	0.343	0.186	0.104
1999-00	1.24	3.739	0.930	0.343	0.124	0.104
2000-01	1.24	4.473	0.930	0.512	0.124	0.104
2001-02	1.97	3.563	1.478	0.851	0.197	0.165
2002-03	1.97	3.254	1.478	0.435	0.197	0.165
2003-04	1.97	3.451	1.478	0.355	0.197	0.165
2004-05	2.05	3.967	1.538	0.543	0.205	0.172
2005-06	2.05	3.699	1.538	0.525	0.205	0.172
2006-07	2.05	3.194	1.538	0.456	0.205	0.172
2007-08	2.05	2.804	1.538	0.661	0.205	0.172
Total	**28.05**	**56.359**	**21.041**	**7.118**	**3.378**	**2.352**

Source: Agtrans 2008.

In total, the investment across MRC/MLA and the DPIs amount to around $262 million, with MRC/MLA contributing approximately 55 per cent of this and the DPIs collectively accounting for approximately 45 per cent.

Summary of outputs and outcomes

This section provides a summary of the relevant MLA and DPI lamb RD&E outputs and outcomes over the period. This material is summarised from Agtrans (2008), and more detailed information can be found in that publication. The key areas of focus for this evaluation are:

- industry policies and programs
- genetics, health and reproduction
- nutrition including the feedbase
- the supply chain including producing to market specifications
- management including enhancing adoption
- other.

Table 2.4 summarises key outputs and outcomes across industry policies and programs.

2.4 Key outputs and outcomes: industry policies and programs

Investment/program	*Outputs*	*Outcomes*
MLA Prime Lamb Industry Key Program	▪ Targeted program involving technology development and information deployment with specific objectives to produce heavier and leaner lambs in line with market requirements.	▪ By 1995, significant progress had been made in laying the foundation for a responsive and integrated supply chain for lamb.
Lamb Industry Strategic Plan (LISP)	▪ A plan that emphasised integration of effort along the supply chain with targets for all industry sectors. ▪ The plan focused on continuity and consistency of supply, and communication across the industry.	▪ The plan provided industry cohesion and a clear goal. By 1999, activities undertaken within the plan led to a more cohesive and consistent supply of lambs, with a higher proportion of product meeting market specifications in both domestic and export markets.
MLA Lamb Consistency Key Program	▪ A targeted program consistent with the lamb industry strategic plan to increase the consistency of supply and quality of lamb and a strong customer focus, through encouraging adoption of best on–farm systems for breeding, growing and marketing lambs.	▪ By 1999, program activities had contributed to a lower peak to trough supply ratio, heavier lambs, higher prices, and with a higher proportion of lambs sold over the hook.
Prime Time	▪ 60 Prime Time producer forums were conducted across Australia between 2003 and 2005 ▪ Prime Time information kits/booklets were distributed to about 18 000 lamb/sheep producers across six states ▪ About 7 000 lamb/sheep producers engaged directly with at least one specific Prime Time program activity (forums, workshops, on-farm trials, on-farm demonstration sites)	▪ 67% of lamb/sheep producers participating in Prime Time or Making More from Merinos activities changed management practices. ▪ Mixed farmers' use of LAMBPLAN® as BVs rose from 9% to 42%, use of Merino Genetic Services as BVs jumped from 6% to 28%, and use of PRO GRAZE® principles increased from 6% to 12%[2]; ▪ 75% of mixed farmers affirmed higher sheep productivity could be achieved without affecting grain production.

Source: Agtrans 2008.

The LISP specified a number of goals for the lamb industry — in particular a goal for total industry value of $2 billion by 2000. The outcome for the industry was that the LISP goal was easily realised.

MLA's Prime Time campaign was launched in 2003 to boost producer awareness of the sheepmeat shortage. The campaign was developed in conjunction with the Sheepmeat Council of Australia, the Sheep Industry CRC and private sector partners including Landmark and Elders Limited. The campaign's objective was to meet growing export demand by empowering producers to take advantage of proven breeding, feeding and management technologies that required little or no cost and would accelerate lamb and sheepmeat productivity. Total investment in Prime Time was $1.6 million over three years from 2003.

Table 2.5 outlines the key outputs and outcomes for genetics, health and reproduction.

Table 2.6 shows key outputs and outcomes for nutrition.

Table 2.7 shows key outputs and outcomes in the supply chain, including programs aimed at producing to market specifications.

2.5 Key outputs and outcomes: genetics, health and reproduction

Investment/program	*Outputs*	*Outcomes*
LAMBPLAN	▪ Information on sires used for producing second cross lambs gave producers the ability to rear lambs with a heavier and leaner carcase at the same age. ▪ Information on sires used to produce crossbred ewes has also been useful in raising the lambing rate of the crossbred ewes as well as the carcass merit of the second cross lambs born to them.	▪ The use of LAMBPLAN increased as producers benefited from information on terminal sires. More recent but smaller benefits have been produced from information on maternal sires. As a result carcass weights of leaner lambs increased. A higher percentage of lambs from high performance sires reached the targeted market specifications. ▪ All major terminal, maternal and dual purpose breeds in Australia use LAMBPLAN. ▪ A total of 31 per cent of sheep/lamb producers use ASBVs or index values in sire selection or purchase. ▪ An estimated 66 per cent of the total lambs produced for slaughter were produced by terminal sires registered with LAMBPLAN and it has been estimated that LAMBPLAN has influenced about 70 per cent of the gene pool of prime lamb production in Australia.
Animal Health and Reproduction		▪ Health: Some improved management of resistance of internal parasites to anthelmentics. ▪ Reproduction: Some improvements in marking percentages in some lamb specialist regions from maternal sire genetics and from improved nutritional management.

Source: Agtrans 2008.

2.6 Key outputs and outcomes: nutrition

Investment/program	*Outputs*	*Outcomes*
Sustainable Grazing Systems	▪ The 'National Experiment' was undertaken on six sites (Albany, Hamilton, Rutherglen, Wagga, Orange and Tamworth), and for each of five themes (water, nutrients, pastures, animals and biodiversity). ▪ Regional committees of producers were established that assisted in the development of sustainable grazing systems and for quickly transferring information to producers. ▪ 100 producer driven regional sites that had strong credibility with producers. Two SGS National Farm Walks (1999 and 2001) were conducted that attracted 6,400 producers and involved 135 regional and national sites.	▪ Surveys reported that the 8000 participants in SGS were more likely than non-participants to rotationally graze; have higher stocking rates; more perennial pasture; assess their pasture, dry matter and digestibility value; calculate a fodder budget, weight and fat scores for livestock; soil test and apply fertiliser and lime; and focus on specific markets. ▪ Among participants in SGS, 81 per cent and 85 per cent respectively stated that the changes they had implemented would increase profitability and sustainability. Involvement in SGS had assisted in their management of animal, pastures, nutrients and water as well as sharing information among their peers.
PROGRAZE and PROGRAZIER	▪ The PROGRAZE course (developed further within SGS) provided technical information and assessment skills, used discussion groups, visits and revisits to grazing properties, and provided takeaway manuals and guidelines for use after the course. The course was based on learning from others, solution seeking and active learning with emphasis on building the capacity to make changes. ▪ By the end of 1996 nearly 4000 producers had undertaken the course. By 2002, some 8500 producers had undertaken the course. These 8500 (6400 businesses) were all from the high rainfall zone of southern Australia. MLA subsumed the PROGRAZE workshops into their EDGEnetwork® education and training program when it commenced in 2000/01. ▪ Up until 2008, 12 269 producers have participated in PROGRAZE (including 8500 under SGS and a further 3769 under EDGEnetwork® from 2001 to 2008; 50 per cent of the 11 269 were estimated to have been sheep/lamb producers. ▪ Prograzier had a subscriber base of 20 000 across the southern states of Australia in 2008.	▪ A high proportion of PROGRAZE participants surveyed (86%) indicated that participating in PROGRAZE would increase profitability and 90% indicated participation will improve the sustainability of their pasture base; 41% of participants changed their grazing approach, many to rotational grazing with 2460 businesses attributing this to PROGRAZE alone. ▪ Confidence in decision making has been often reported by participants as a result of participating in PROGRAZE. This is translated 12 months after completing PROGRAZE to changes being made on the farm. ▪ It was reported that PROGRAZE was the most successful training program ever offered in the red meat industry. ▪ There has been extensive participation by producers with independent verification of changed behaviour and adoption. ▪ The percentage of PROGRAZE attendees who changed grazing practices was 62% and who changed pasture management was 48%. ▪ In a 2004 survey, Prograzier emerged as the source of information most likely to influence producers to change livestock or pasture management practices, with rural newspapers 2nd, field days third, Department of Agriculture fourth, and ABC Radio fifth (Taverner Research Company, 2004).

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2.6 Key outputs and outcomes: nutrition Continued

Investment/program	*Outputs*	*Outcomes*
Grain and Graze	▪ Produced a range of models, tools and knowledge in both the national projects and individual regional projects. ▪ Knowledge related to economics, biodiversity, feedbase management and social aspects of mixed farming systems. ▪ More than 4000 producers were actively engaged in Grain and Graze activities. It is estimated that more than 8000 passively participated. ▪ More than 230 research and demonstration sites operated for some part of the 5 year program.	▪ The likely outcomes from the G&G program are increased average profitability and improved risk management outcomes for mixed farming enterprises. ▪ More than 1800 producers are trialling Grain and Graze recommended practices. ▪ More than 1000 producers have already adopted recommended practices and have attributed the changes to Grain and Graze participation. ▪ Approximately 800 participants claim to have ceased poor farming practices specifically on Grain and Graze advice. ▪ The average increase in profit achieved across the regions from adoption of Grain and Graze recommended practices is 9 per cent.
Evergraze	▪ EverGraze is well recognised in the temperate high rainfall zone. Increased awareness in livestock industries of the potential for farming systems based on perennial plants that can also reduce recharge to control dryland salinity.	▪ Too early to report on any significant outcomes in terms of new knowledge, validation and demonstration of systems. ▪ The target outcomes are a reduction in recharge by 50 per cent (or an appropriate amount for each region) over current farming systems and an increase in profitability by 50 per cent across the whole farm (above best practice animal enterprises).
Biological Control of Weeds	▪ Up to 2006, there had been 4000 releases of specific biological control agents for Patersons' curse, Onopordum thistles, horehound and blue heliotrope. ▪ A network of more than 1700 graziers was involved in the project integrating biological control into their pasture management regimes. There had been 322 weed control training workshop, talks, interviews and field days held across Australia. ▪ The total number of agents released more than doubled over the two years to 2006 compared to the previous seven years. This increased rate of release is due to the success in regional field collections so that the need to rear insects in the laboratory has been by-passed.	▪ Reduction in direct costs (for example, weed toxicity, herbicide use, low pasture productivity) and indirect costs (stock management issues) associated with the targeted weeds. ▪ Improved producer understanding of weeds in farming systems and of the benefits of an integrated weed management approach incorporating the concepts of biological control, herbicide control, grazing management and pasture renovation. ▪ Active participation by producers has led to ownership of the process and outcomes in the context of a community based distribution system.

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2.6 **Key outputs and outcomes: nutrition** Continued

Investment/program	*Outputs*	*Outcomes*
Pasture Breeding and Establishment	▪ Pasture breeding programs have generated improved types of ryegrass, tall fescue, lucerne, and other legumes.	▪ Continual adoption of new pasture species and cultivars by producers in temperate Australia.
Lamb Finishing	▪ Information on supplementation strategies and lot feeding guidelines for finishing lambs.	▪ Adoption of improved nutritional practices in finishing lambs. ▪ Adoption of lot feeding has not been widespread due to the economic sensitivity of such practices to the level of purchased feed inputs.

Source: Agtrans 2008.

2.7 **Key outputs and outcomes: supply chain**

Investment/program	*Outputs*	*Outcomes*
Encouraging value based marketing (including Trim Lamb, Elite Lamb, and the Lamb Consistency Key Program)	▪ The production RD&E component of this investment focused on the importance of: – How to produce what the market required. – How to understand price grids and utilise forward contracts. – The advantage to the producer of selling lambs through value based marketing systems.	▪ The proportion of lamb supply to the market using value based marketing systems increased (e.g. about 6 per cent of lambs were sold over the hooks in 1994 compared to nearly 40 per cent a decade later in 2004). ▪ The number of lamb alliances increased to 26, as did the number of lamb producer groups (78 in 2001 compared to zero in 1990)
Clear Market Signals and LIDS (Livestock Identification and Description System)	▪ System of ticketing carcases with information regarding carcass characteristics.	▪ More even spread of lamb turnoff during the year, illustrated by a falling peak to trough ratio of supply. ▪ Facilitated a higher proportion of lamb product meeting market and consumer requirements. Feedback from butchers and boning rooms to processors and from processor to producers regarding end user requirements.

Source: Agtrans 2008.

It should be noted that a number of the supply chain programs (Trim Lamb for example) are considered demand side programs. However, as noted earlier, the nature and evolution of the overall lamb industry has been one of an integrated strategy of supply and demand changes.

Table 2.8 shows key outputs and outcomes around management and enhancing adoption.

2.8 Key outputs and outcomes: management and adoption

Investment/program	*Outputs*	*Outcomes*
Best Wool/Best Lamb.	▪ As of June 2006, there were 34 groups with 271 enterprises aligned to these groups. Benefits mentioned by group members in a 2006 survey included: – Sheep management and nutrition – Farm management skills – Cost reductions – Forward selling – Technical knowledge – Wool marketing ▪ Marketing of prime lambs and sire selection were mentioned as well as stocking rates and feed requirements.	▪ An evaluation of the Bestwool/Bestlamb program in 2008 by Hassall and Associates reported improvements for members' knowledge, skills, confidence, aspiration and practices with 73 per cent reporting they had used the information to improve their farm practice. ▪ 45 per cent of members felt the changes had led to on-farm production increases, and 33 per cent reported their farm profitability had increased. 43 per cent reported greater emphasis on lamb over the past three years. ▪ Improved technologies included improved sheep feeding, nutrition, drought management, improved pasture production, grazing management systems, sheep reproduction and lambing management, sheep health and diseases, genetics and breeding and animal welfare. ▪ One in seven members reported an increase in productivity of between 10 and 15 per cent. One third of members indicated improvements in profitability varying from 0 to 15 per cent.
Networks of Producer Groups	▪ Networks of producers were important in disseminating the results of research and other MLA and State project information. For example, Lamb Marksman (the Victorian network) was the main delivery method within VIC DPI for WIGS courses and PIRD projects as well as the early days of EDGEnetwork®.	▪ Networks accelerated adoption of both production and marketing practices by lamb producers. These networks were vital in extending outputs through the 1990s (e.g. value chain work and alliances). ▪ Lamb Marksman oversaw the development and facilitation of the prime lamb producer group network in Victoria with a membership of almost 600 producers responsible for around 10 per cent of the Victorian lamb production.
Business Skills and Best Practice	▪ Business Skills and Best Practice developed material that was disseminated to producers in Victoria and elsewhere.	▪ Emphasis on the integration of key management decisions so that profitability improved.

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2.8 **Key outputs and outcomes: management and adoption** Continued

Investment/program	*Outputs*	*Outcomes*
EDGEnetwork®	▪ A total of 2 771 sheep/lamb producer attendances have been recorded at EDGEnetwork® workshops since 2000. In addition, there have been 5 219 mixed farmer attendances where it can be assumed that 50 per cent are sheep/lamb producers. ▪ Courses delivered by EDGEnetwork® since 2000 that are relevant to lamb production include: – Effective Breeding Lamb/Terminal Sire Selection – Money Making Merinos – Wean More Lambs – LambCheque – Prograze (delivered before EDGEnetwork® commenced) – Lean Meat Yield – Marketing Performance – Markets and Customer Needs – Salinity/Profit from Saline Land – Weed Improvers, Pasture Improvers ▪ Since the year 2000, the most frequently attended EDGEnetwork® courses for lamb producers were Prograze (3 769 lamb and southern beef producers), Terminal Sire Selection 1 192 attendees), and Wean More Lambs with 654 attendees.	▪ Enhanced productivity of meat and livestock production through improved management decision making leading to increased net farm income of producers. ▪ Hassall and Associates (2004) undertook a review of EDGEnetwork® with a focus on the impact and management arrangements. It concluded that there had been a greater uptake of R&D findings due to EDGEnetwork® workshops, particularly regarding improvements in pastures, stocking rates and selection of breeding stock. ▪ The review reported a high satisfaction level with the training, although market penetration was low except for southern Australian beef producers and Victorian producers. ▪ Further potential existed in NSW and among lamb and northern beef producers. Marketing investment had been under-resourced and was in need of strengthening in order to increase throughput of participants and in order to get scale effects for the investment. ▪ Collection of data about impacts had not been assembled and needed to be encouraged in future plans. ▪ Producers consulted in the review indicated a 4 to 5.5 per cent increase in productivity in the short term, with productivity increases up to 12 per cent in the long term. ▪ MLA surveys indicate that 75 per cent of these changed management practices occurred as a direct result of EDGEnetwork® courses.

Source: Agtrans 2008.

In addition to the above programs, MLA has provided funding for both phases of the Sheep Cooperative Research Centre (CRC), while the State DPIs have also been CRC members. The main objective of the Sheep CRC (2001-2007) was to develop new technologies, management practices and marketing strategies that would make the sheep industry more profitable and sheep products more highly valued by consumers. The Sheep CRC is now in its second phase (2007-2014). The key focus areas of the first phase of the Sheep CRC included quantitative genetics, sheep meat eating quality, parasite management and precision sheep production, and undergraduate and postgraduate education.

Evolution of the Australian lamb industry

Agtrans (2008) outlines the key drivers of change for the lamb industry. What follows is taken directly from that report – which was an input into this evaluation. For the full text and references please refer to Agtrans (2008).

Pre 1990s

The prime lamb industry has been traditionally based on the progeny of prime lamb sires mated to first cross ewes. The first cross ewes were produced from merino ewes mated to, for example, Border Leicester rams. This mating also produced wether lambs and cull ewe lambs sold as first cross prime lambs. Prime lambs (used to be called fat lambs at the time) were therefore mostly a by product of merino wool production systems in the high rainfall zone as well as from mixed farming properties in the wheat-sheep zone further inland.

In the 1980s the sheep industry was experiencing poor profitability. Slaughter lamb production was fragmented and depressed as lamb consumption was declining. For example, the domestic market was dominant but consumption of lamb in Australia had dropped from 28 kg per person in 1971 to 14 kg per person in the early 1980s (Howard et al, 2007). Lamb portrayed an image of being fatty and variable in quality.

However, a good deal of the groundwork was laid in the 1980s for what happened in the next two decades. DPI Victoria had begun working on lamb carcase attributes and larger leaner carcases with meat science projects including carcase attributes and feedlot trials. The DPI also developed a stronger consumer focus (Howard et al, 2007). with regard to consumer preferences and specifications and the recognition of the importance of feedback along the supply chain to producers. Together with the MLA predecessor, they jointly developed projects on trimmed and boneless cuts as well as the validation of manual fat score assessments.

The genesis of LAMBPLAN also took place in the 1980s in NSW when the opportunity became apparent for making greater genetic improvements using objective measurement for growth initially and then for reducing fat and increasing muscle (Fogarty, 2008). Terminal sire carcase trials and validation then took place in NSW and Victoria.

At the end of the decade the abandonment of the reserve price scheme for wool lead to lower wool prices, reduced profitability of wool growing, and a greater interest in lamb.

1990–94

In the first few years of the decade there were the rudiments of a supply chain for lamb that was beginning to develop, but domestic consumption of lamb was still falling.

State DPIs focused more on new production systems and their integration with the supply chain requirements. Producer focus groups increased and best-bet production systems for meeting market specification were extended to producers. These included aspects of feeding systems for filling lamb supply gaps, use of fertiliser and improved pasture species and alternate forms of grazing management. Increasingly, lamb projects were jointly funded by the MRC and the State DPIs.

The terminal sire central progeny test project was run in conjunction with several state DPIs. This was a national project aimed at validating the LAMPLAN terminal sire estimated breeding values (Australian Sheep Breeding values) that had been developed earlier. This national project was completed during the 1990s. During the decade the genetic focus shifted from terminal sires to maternal sires where trials were established to validate the maternal sire ASBVs.

In the mid-1990s the LISP was developed. The LISP followed MRC's Prime Lamb Key Program (1990–95), the first program to focus nationally on supply constraints via cultural changes needed in the lamb industry to support forecast increases in demand in higher value export and food service markets. Mainstays of the whole of industry plan (LISP) were to link product quality and value to price through the supply chain, as well as ensure consistent product supply and profitable lamb producing enterprises. The LISP was integrated into all MRC activities as well as those of the State DPIs. A key activity within LISP was the creation of Lamb Industry Development Teams in each lamb producing State. These Development Teams encouraged communication along the supply chain and better understanding of industry goals and the part to be played by producers. They also ensured that each State contributed towards the LISP outcomes.

Seven important factors were identified in the LISP (Sheepmeat Council of Australia, 1998):

- the meeting of market segment needs
- a customer focused culture
- consistency of products
- improved image
- consumer driven trading mechanisms
- frequent meaningful communication with industry
- appropriate education and training programs.

At the end of the decade many of the elements of the LISP were still relevant to the progress of the Australian lamb industry.

1995–2000

By the mid 1990s, there were significant improvements evident in the lamb industry due to (Howard et al, 2007):

- a change in producer attitudes regarding integration of farm management and marketing leading to increased carcase weights and greater consistency of supply with a noticeable shift towards year round production; and
- a gradual shift in consumer perceptions of lamb from a new marketing strategy for lamb including short cuts, lamb family favourites, trim lamb, multicultural lamb and new trim lamb.

As marketing and promotion investment intensified during the 1990s, the new image of lamb had started to create an increase in both domestic and export demand with associated price improvements. Lamb marketing alliances were a major driver of change that linked producers through to the requirements of the market. These alliances were facilitated in many cases by State DPIs and MRC.

A high level of investment was evident in facilitating networking (for example, Lamb Marksman in Victoria and the development of similar producer networks in other states), extension and education, including accredited training courses. For example, BSBP (Business Skills and Best Practice) improved overall enterprise management skills, rather than just production skills.

Other joint programs between the States and MRC/MLA were developed such as Sustainable Grazing Management (SGS) and PROGRAZE where both productivity and environmental outcomes were pursued together.

The total number of lambs slaughtered during the 1990s declined slightly but from 1999 commenced to rise. Carcase weights increased during the 1990s. Banks (2003) reported that carcase weights had been growing at 85 grams per head per year pre-1990 but through the 1990s were growing at 260 grams per head per annum, or 3 times as fast.

Domestic consumption remained fairly flat but the proportion and number of lambs exported increased significantly. Prices rose in real terms during the second half of the 1990s, partly in response to the higher proportion exported and the supply of larger leaner lambs. A large part of this change can be attributed to the investment by MLA and the States DPIs in raising the awareness of producers of the opportunities available for pursuing market requirements.

In the latter part of the 1990s investment further pursued consistency and continuity of supply of product that competitively met customer specifications at each stage of

the production and marketing chain. MRC/MLA program objectives at the end of the decade were:

- to increase the consistency of supply and quality of lamb by focusing on the dedicated lamb industry;
- to further increase the number of businesses aiming to meet their customers needs; and
- to increase the number of lambs sold in the large lean lamb category.

Significant marketing and promotional investment was made overseas, particularly in North America. The sheepmeat marketing budget was far greater than that for RD&E on the supply side.

2001–08

The Sheep Industry Strategic Plan for the period 1999-2005 was produced in 1998, but was far less ambitious and had a lesser impact than the earlier LISP.

The last eight years have seen the continuation of value based marketing systems. One objective was to increase the number of lambs sold directly to processors or via lamb marketing alliances. While this was successful in that more producers were delivering lambs to market specifications, a high proportion of lambs are still sold at saleyards. Since 2003-04, other data for 2005-06 and 2006-07 show that the percentage of lamb sales over the hooks has remained at about 30 per cent, paddock sales have remained at about 13 per cent, and auction sales have been 48-56 per cent.

A significant extension and training effort continued during this period. The uptake of technology has continued and has added to improved operating efficiencies on farms. The use of LAMBPLAN increased with LAMBPLAN users and the industry starting to benefit from maternal sire information. Carcase weights continued to increase and then plateau. There were serious interruptions to supply due to droughts in the past 8 years.

There was a reduced variation in turnoff of lambs across the year. Prices increased in the early years of this period and then stabilised. The proportion of lambs exported increased significantly.

A more vertical structure has developed in the lamb industry with greater specialisation by breeders, finishers and feedlotters (Howard et al, 2007). The profitability of lamb producers (excluding the drought periods) increased in the past eight years. The profitability of cropping and beef increased significantly so reducing to some extent the advance of the lamb enterprise in mixed enterprise farms.

In the early part of the eight years (1998-2003), dual purpose first cross lamb production was the most profitable of livestock enterprises (Holmes Sackett and Associates, 2003). Prime lamb profitability had been driven by an increase in the kg

of lamb produced per hectare, through higher stocking rates, weaning percentages, or weight at sale. However, it was difficult to achieve all three increases at once. For example, if higher gross margins were achieved with an increase in weaning rate (more lambs) or heavier lambs, then there was a need for management skills to deal with the extra feed demand from extra mouths and body weight. One way was by reducing stocking rates not by increasing them, others by increasing supplementary feeding, use of fodder crops etc. This meant that stocking rate and genetics were the key factors driving profitability.

Summary of key drivers of change

Nominating key drivers of change is partly a subjective process, particularly in terms of the direction of causality. The key drivers of change over the period 1990-91 to 2007-08 have included the following factors.

Generic/integration drivers

- The recognition of the latent demand for a larger leaner lamb in the market place; this happened during the 1980s.
- The recognition and exploitation of this latent demand through both production and market investment by State agencies and MLA.
- MLA (including AMLRDC and MRC) and State agencies clearly played important roles in planning, funding and coordination. In addition, industry organisations and sectors (including breed societies, producer groups, and the Sheepmeat Council, lamb processors and marketers were also critical players in the progress made.
- Attention to planning and strategy led to the LISP which provided unity of purpose, vision, enthusiasm and a clear industry goal (Banks, 2003).
- Lack of profitability of wool production from the late 1980s was responded to by producers seeking more profitable enterprises and therefore being responsive to a potentially profitable enterprise such as lamb production.
- The coordinated national program of research, production and product development, marketing and promotion was developed in the early 1990s to arrest the declining consumption and boost exports; MLA coordinated and funded the program with the State agencies, with particularly NSW and Victoria taking a leading role in research, production and marketing areas.
- The early successes in demonstrating commercial advantages and production possibilities for heavier and leaner carcasses led to a combined effort to develop a common strategy and plan for the industry; profitable markets were developed by processors with major promotional support from MLA (Fogarty, 2008).

Production drivers

- The ability via LAMBPLAN, and the access to improved genetic technology it provided, to deliver a larger leaner lamb.
- The translation of demand into market specifications and the delivery of market specifications by producers.
- The education of, and extension to, producers regarding market specifications including the role of lamb marketing alliances.
- The development of new technology in terms of feed production year round, feed utilisation and grazing management. New feeding systems including new sources of feed supply that allowed year round production. These included lupins to stimulate ovulation and sperm production, different feed types (stubbles, lucerne, perennial pastures etc), fertiliser rates and timing of operations (Howard et al, 2007).
- Plant improvement including selection, breeding and genetic improvement of grasses and legumes.
- Also contributing was improved weed and pest control, grazing management and generally improved nutritional management.
- A higher level of uptake of both new and existing technology by lamb producers as a result of increasing profitability as well as the industry investment in extension, communication and training packages and the ensuing technology application and skills development by producers.
- Increased prices in the latter part of the period due to higher market satisfaction increased profitability of lamb production and pushed supply higher; for example, prior to 1991 the real price of lamb was declining by $0.26 per year, while from 1991 on, real price has been rising steadily by $0.28 per year.
- The increased lamb numbers for slaughter commenced around 2-3 years after the turnaround in real income per lamb. Between 1997 and 2000, producers responded to rising real prices for lamb (and falling wool prices) and lambs slaughtered rose significantly (Banks 2003).
- An overall lower net cost of production of lamb in real $ terms over the period.

Market drivers

- An improved lamb product commenced with larger leaner lambs and less fatty cuts, new cuts, and boneless lamb from the late 1980s onwards. At the same time, genetic improvement began to deliver larger leaner lambs (genetic change allowed heavier lambs to carry less fat than otherwise). These two factors drove real prices slowly upwards and more producers started to switch to lamb production.

- The promotional effort in the market place, both domestic and international helped develop the market; for example, the professional marketing campaigns of Trim Lamb on the domestic market and the FARL in North America.
- Better defined market specifications.
- Export market entry efforts (for example, the United States).
- Eating quality improvements.
- It should be noted that market research in the 1980s identified that the market was signalling a requirement for less fat, so it is possible some degree of movement away from fatty carcases would have happened without the post 1990 RD&E investment.
- Development of skins as co-products.
- More attention to food safety.

Key lamb productivity drivers

The key drivers of change stimulated by the RD&E investment included:

- genetic improvement potential
- reduced lamb supply variability due to new feeding and grazing management systems
- a higher level of adoption of both the new and older technology due to increased profitability and the active coordination and extension effort made by the State agencies working together under the LISP

The improved genetic characteristics of second cross lamb sires, together with the improved genetics of sires producing crossbred ewes were a major driver of change. Potential productivity and product quality rose by 4 per cent per year on average though the 1990s (Banks, 2003). Also, Howard et al (2007) report the rate of genetic gain in lamb industry was 3.7 per cent per annum from 1996 to 2005 (over a nine year period the index rose from 111 to 148). Banks (pers. comm., 2008) has provided data that demonstrate the rate of genetic gain has continued to rise.

The terminal sire gain has been substantial and, together with lesser gains sourced from the maternal sires, has resulted in a gain of over $10 per lamb since 1990 in constant 1997 lamb price terms. This gain would be far greater in terms of current lamb prices. The actual gain that has probably been realised by lamb producers, given that LAMBPLAN has impacted on about 70 per cent of lambs slaughtered.

The availability of new technology and production systems allowed producers to pursue a more consistent year round supply of lamb. Thatcher (2002) reports data up to 2001 for both standard deviation of the index of monthly slaughter and the peak to trough ratio. Thatcher's figures show that monthly slaughter in Victoria and NSW became more consistent by both measures but SA and WA became more variable in

2001. Analysis in the current analysis of monthly saleyard numbers of lambs sold from 1997 to 2007 did not show any significant trend in the standard deviation of monthly sales within years over that period.

The various extension and communication programs assisted producers to adopt best practice in producing to market specifications and took advantage of the increased profitability of lamb production due to the stronger market demand. The poorer performance in the latter period has been influenced significantly by drought.

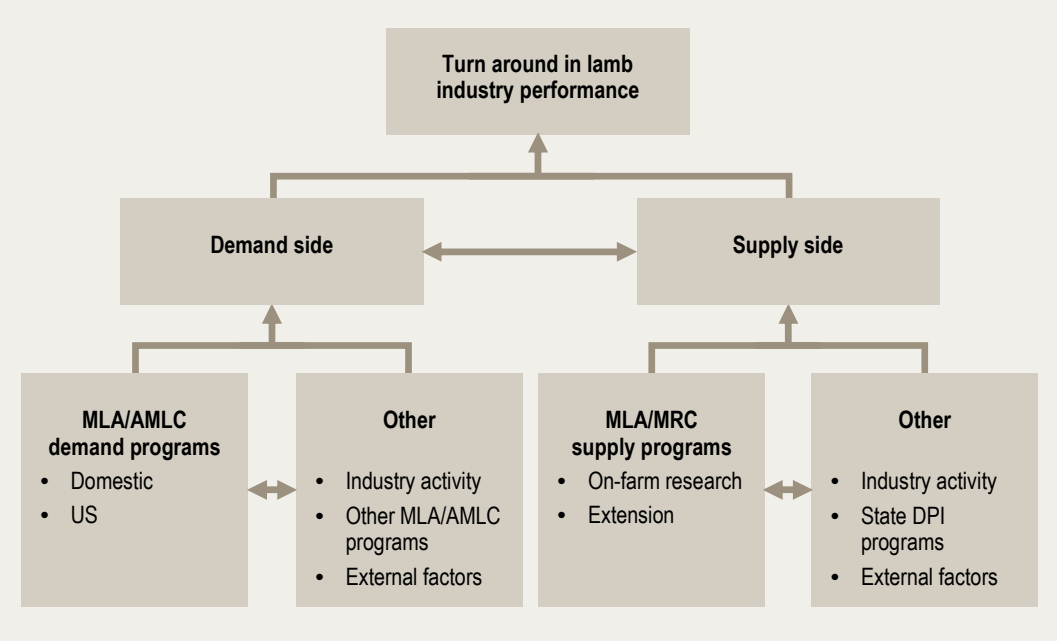
3 *Evaluation approach*

The outcomes observed in the lamb industry over the past 17 years are the product of a range of integrated factors encompassing both demand and supply side outcomes. As a result, the approach adopted in this evaluation is a so-called 'tops-down' approach. Rather than building up from program outputs, to outcomes and impacts as in the 'bottoms-up' approach, the tops-down approach works backwards from impacts and outcomes at the aggregate level.

As the tops-down approach defines aggregate impacts and outcomes, in order to estimate the impacts resulting from lamb on-farm programs, an exercise in attribution is required. At a broad level, this involves determining the proportion of the benefits of a particular outcome or impact that is attributable to MLA/MRC. Given that MLA generally works with a range of stakeholders on any given program, attribution is an important consideration. Where possible, attribution is generally determined on a share of cost basis. This can be difficult where the contribution of other stakeholders is not easy to value — attribution can also be determined through a consultation process. In this case, the key stakeholder partner identified is the state DPIs. Funding contributions from the DPIs was outlined in chapter 2 and will be used to assist with attribution of benefits arising from the on-farm program.

There is an additional dimension to this evaluation due to the close integration between the demand and supply side activities. The fundamental issue is that the transformation of the lamb industry since 1990 was been the result of a shift in on-farm production away from light lambs and into large, lean lambs. This transformation was precipitated somewhat by external factors, such as the decline in the wool industry, but it was also driven by demand side developments. The identification of changing consumer demand trends towards leaner lamb was a significant driver of the shifts in the farm sector. The bottom line is that neither the demand or supply side developments on their own would have achieved the outcomes that have occurred. Promotion of lean lamb clearly would not have had any impact without the supply side changes that lead to a transformation in the product. But similarly, transformation of the supply side would not have made a significant impact without developments on the demand side. Therefore, the tops-down 'aggregate' impacts will include the impact of both demand and supply side outcomes. Given that there is no way of directly determining the attribution across the supply and demand side factors, we need to make some assumptions to split the impacts. Chart 3.1 gives a broad illustration of the approach.

3.1 Evaluation approach



Data source: TheCIE.

The approach taken in this evaluation is to establish a common baseline, or counterfactual, for the key outcomes across the lamb industry. The baseline is also known as the 'without' scenario. In a normal bottoms-up evaluation, this is simply what would have happened in the absence of a project/program. In this case, the baseline is a scenario of outcomes for the Australian lamb industry, where the 'without' scenario is not merely the absence of an MLA program. In this case, we are interested in what the lamb industry would have looked like without the integrated demand and supply outcomes that effectively transformed the industry.

While this report focuses on the supply side outcomes, it includes a discussion of demand side developments and their role in the industry transformation that occurred. The ultimate goal is to portion the overall impacts between demand and supply side outcomes. This will be informed by a discussion around the key drivers of the changes observed since 1990, but will also involve some assumptions and judgements.

The final step is to take the proportion of total benefits attributed to supply side outcomes and to agree on an appropriate basis for attributing these outcomes to MRC/MLA activities against other related activities such as contributions by other stakeholders (DPIs in particular) and associated industry efforts that have contributed to the outcomes. Attribution is discussed further in chapter 5.

4 Establishing a baseline

Chapter 2 highlighted the relatively poor performance of the lamb industry during the 1980s (chart 2.1). It is clear that during the 1990s and 2000s, this performance improved markedly. In fact, the lamb industry is one of the real success stories in Australian agriculture over this period. A key task for this evaluation is to establish a baseline, or counterfactual, for the lamb industry performance. The aim is to determine what the value of the turnaround has been (relative to the baseline) and how much of that value can be attributed to MLA/MRC on-farm programs.

Overall industry performance

There are a number of ways that industry performance can be measured. A common measure is the farm gate value of the industry. This measure is also commonly referred to as the gross value of production (GVP) of the industry. It has the advantage of being relatively easy to measure, and a good representation of what is happening to farm profitability. One of the disadvantages is that it has a limited scope to capture increased value adding in the supply chain. Another measure is to look at industry value in total — this typically involves retail demand and exports. An analysis undertaken in 1996 examined progress towards the $2 billion benchmark outlined in the LISP (Lange 1996). It attempted to value the following segments to estimate the total value of the lamb industry:

- retail market
- food service
- export markets (including offal)
- live lamb exports
- lamb skins.

This analysis put the total value of the lamb industry in 1995 at around $1.5 billion. However, there are issues with attempting to replicate this analysis over time — mainly relating to data availability and consistency. To the extent that it could provide a snapshot of industry value, the Lange analysis could be replicated. But it would not assist a great deal in establishing a baseline, which is the main task. Clearly, industry value has increased significantly since the original analysis was done. A rough calculation of domestic sales (domestic disappearance multiplied by an indicative retail price) yields a value of around $2.9 billion in 2007. In addition to this, lamb exports (not including offal) in 2007 were valued at over $800 million.

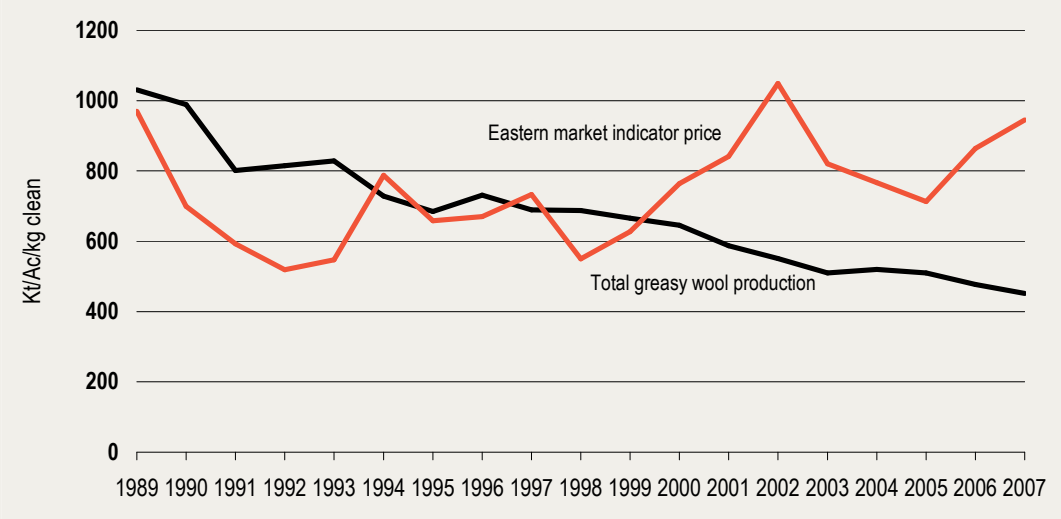
The approach taken in this chapter is to analyse overall industry performance around a few key parameters, namely:

- total lamb slaughter
- average carcass weight
- total lamb production
- farm prices received.

A detailed analysis of the performance in the US export market will also be presented. Using scenarios around these key parameters, a hypothetical baseline will be presented. As noted earlier, this will represent a picture of what the lamb industry might have looked like in the absence of the integrated demand and supply outcomes that drove the transformation in the industry.

One of the key developments that shaped the industry was the rapid increase in wool prices in the late 1980s and subsequent dramatic decrease in the early 1990s. Chart 4.1 shows historical wool prices and production in Australia.

4.1 Wool production and prices

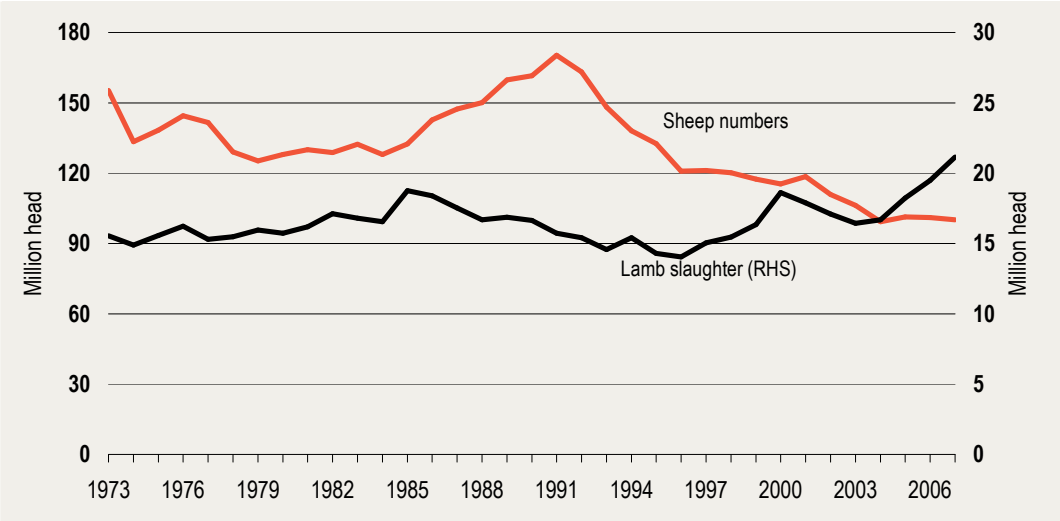


Data source: ABARE.

The wool price more than doubled between 1981 and 1987. This drove a substantial increase in wool production (over 60 per cent between 1982 and 1989). The subsequent decline of the wool industry has been dramatic and sustained. Since it peaked in 1989, Australian wool production has declined at an average rate of 4 per cent per year.

There are clearly linkages between the wool industry and the lamb industry. Chart 4.2 shows historical sheep numbers and lamb slaughter in Australia.

4.2 **Australian lamb slaughter and sheep numbers**

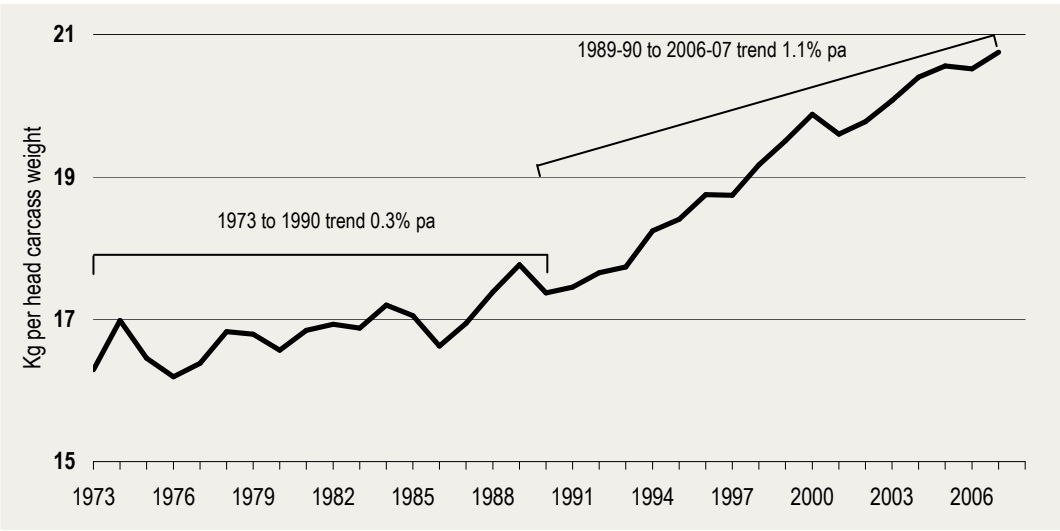


Data source: ABS, GMI database.

As the chart shows, there was a significant build up of the sheep flock during the 1980s. This was largely in response to increasing wool prices, and coincided with a relatively sharp fall in lamb slaughter. Sheep numbers reached a peak of over 170 million in 1990. This was an increase of over 30 per cent on 1980 levels. Lamb slaughter continued to decline until the mid-1990s; however it has increased significantly since then at a rate of almost 3 per cent per year.

Chart 4.3 shows average carcass weights between 1973 and 2007.

4.3 **Australian lamb carcass weights**



Data source: ABS, GMI database.

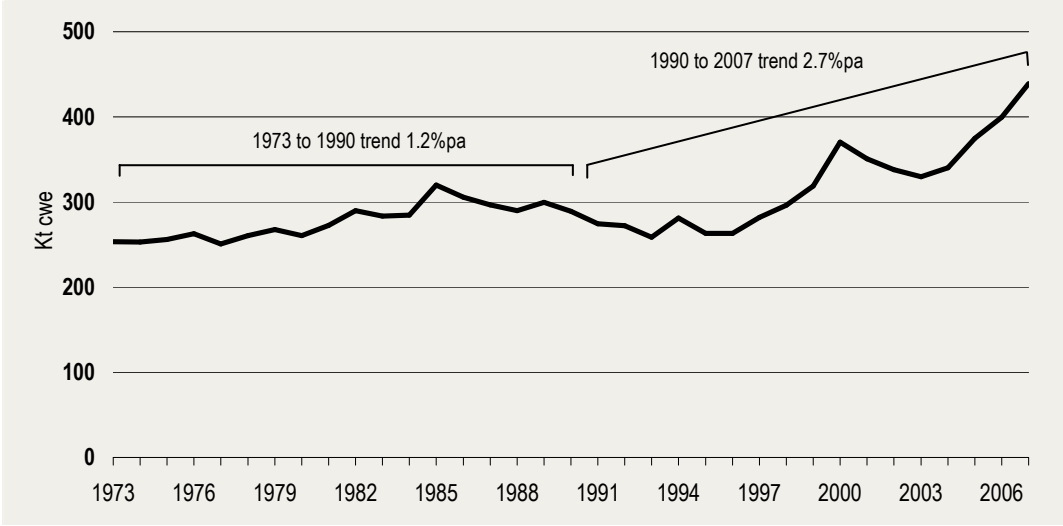
Chart 4.3 shows that growth in average carcass weights across Australia has accelerated significantly since 1990. The underlying historical trend prior to 1990 was around 0.3 per cent per year, while, since 1990, average growth of 1.1 per cent has been achieved. There are a number of drivers of this growth, namely:

- demand from the United States market for larger carcasses (through FARL, FAPL etc.);
- on-farm research, development and extension programs; and
- processor rationalisation — greater efficiency, lower unit costs etc.

It is also likely that there has been a shift towards larger carcasses on the domestic market, but the main shift has clearly been towards *leaner* lambs not necessarily larger lambs. Supermarket and butcher trade is still focused on lighter lambs — particularly trade lambs in the 18-22kg weight range.

Chart 4.4 shows lamb production between 1973 and 2007.

4.4 **Australian lamb production**



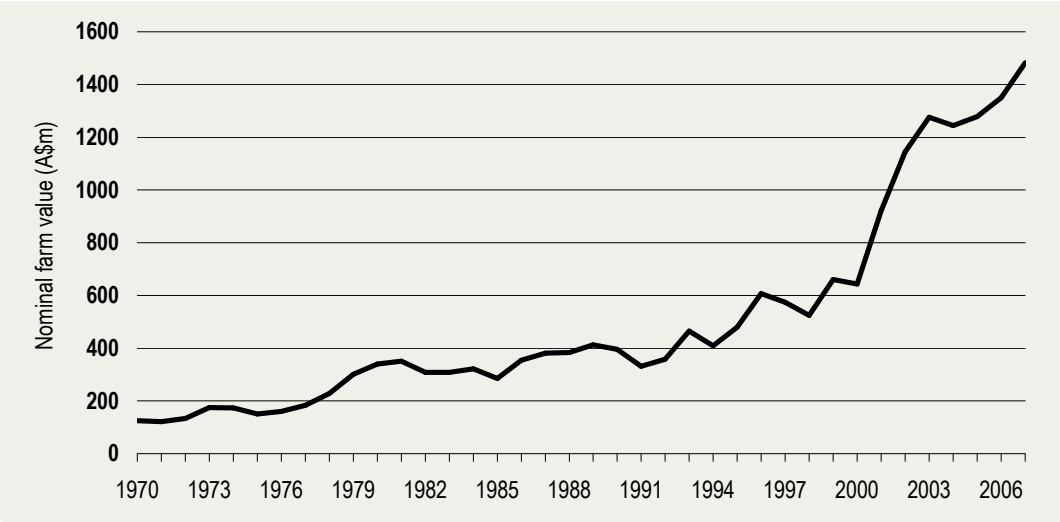
Data source: ABS, GMI database.

The combination of relatively steady lamb slaughter (increasing over the past 10-years) and increasing slaughter weights has led to strong lamb production growth since 1990. During the 1970s and 1980s, lamb production grew by just over 1 per cent annually. Between 1990 and 2007, the growth in lamb production increased to 2.7 per cent. This growth has been particularly marked since 1996, coinciding with strong growth in both lamb slaughter and average carcass weights.

The other aspect of the lamb industry performance is how industry value has increased. Chart 4.5 shows nominal farm value for lamb since 1970, while chart 4.6 shows real farm value over this period in 2007 dollars. A few points stand out:

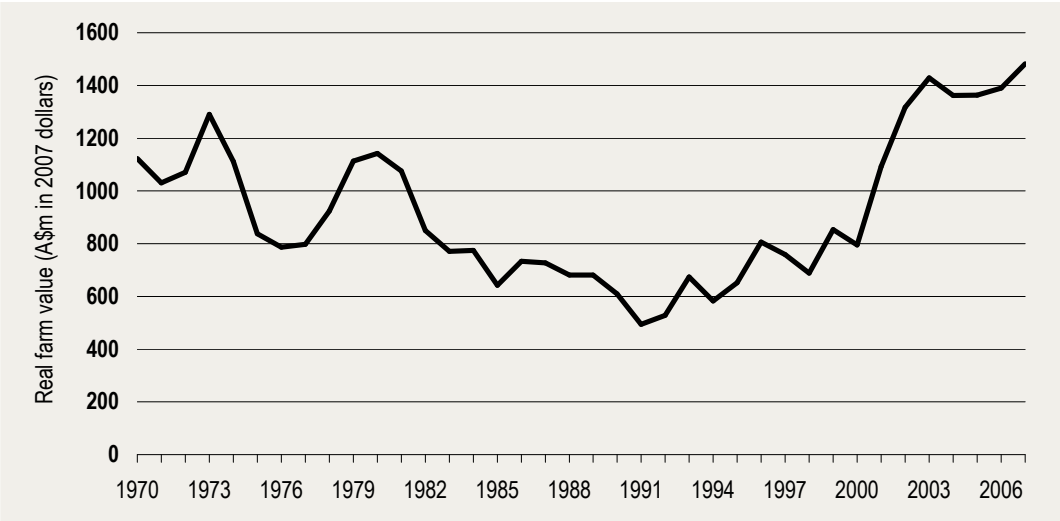
- Between 1970 and 2007, the nominal farm value of the Australian lamb industry has increased from around $125 million to almost $1.5 billion.

4.5 Nominal farmgate value of lamb production



Data source: GMI database, CIE calculations.

4.6 Real farmgate value of lamb production



Data source: GMI database, CIE calculations.

- Between 1970 and 1990, nominal farm value increased at a relatively slow rate (around 6.5 per cent annually). Since 1990, this rate has accelerated rapidly to around 10 per cent per year.
- The real farmgate value of the lamb industry experienced a significant decline during the 1980s (over 5 per cent per year — chart 4.6).
- The recovery in real value since the early 1990s as been significant: between 1990 and 2007, the real farm value of the lamb industry increased at an average rate of around 7 per cent.

Total factor productivity (TFP) is a good summary measure of overall industry performance in the lamb industry. Table 4.7 shows that net productivity in the

4.7 **TFP for slaughter lamb and beef industries** 1977-78 to 2006-07

	TFP growth	*Output growth*	*Input growth*
	%	%	%
Slaughter lamb	0.22	2.99	2.77
Northern beef	1.05	0.71	0.34
Southern beef	1.16	0.48	-0.69

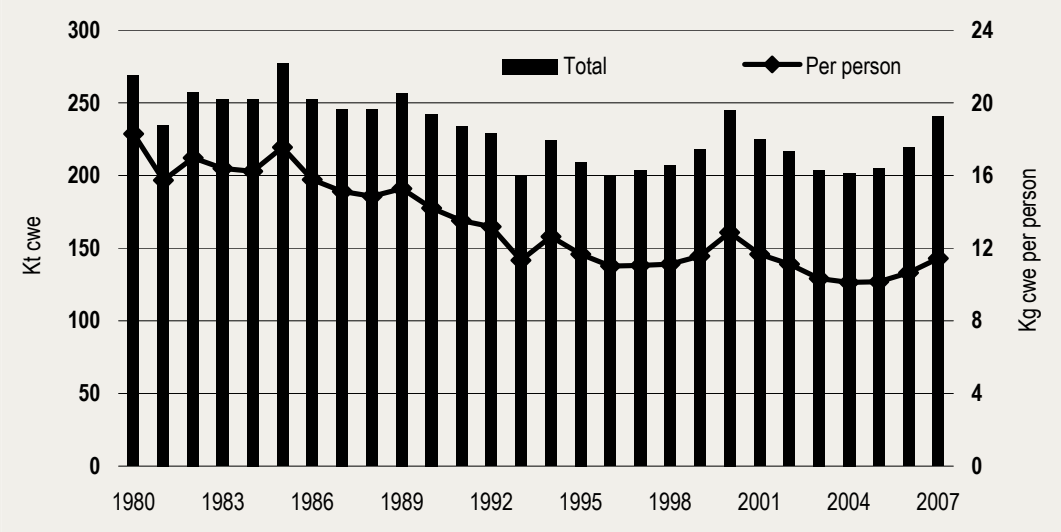
Source: ABARE (2008)

slaughter lamb industries was significantly lower than for beef – as strong growth on the output side also was matched by the greater use of inputs.

Chart 4.8 shows historical domestic consumption of lamb (measured as domestic disappearance. The key points include the following.

- Overall, total consumption of lamb in Australia has been in a slight long term decline of around 0.8 per cent per year.
- In per person terms, this decline has averaged around 2 per cent per year since 1980. This decline has slowed marginally, averaging around 1.4 per cent since 1990 compared with 1.8 per cent between 1980 and 1990.

4.8 **Consumption of lamb in Australia**



Data source: GMI database.

A baseline for the lamb industry

The previous section outlined the overall performance of the Australian lamb industry over a lengthy period of time. This assists in setting the scene for establishing a baseline for the industry over the period covered by this evaluation (1990-2007). At the top level, we need to establish a baseline for the overall industry performance between 1990 and 2007. As noted earlier, this is to establish the dimensions of the overall outcome or 'impact' of the turnaround and transformation

the industry has achieved over the past 17 years. At the next level, we also need to establish a baseline for the US market over the same period. The baseline serves two primary functions: firstly it provides information and input for the GMI/IF model and secondly it provides a basis for consultation with key stakeholders around the plausibility of the assumptions.

The previous chapter outlined the key drivers of the performance of the Australian lamb industry between 1990 and 2007. The most straightforward way to construct a hypothetical baseline is to assume historic trends (pre-1990) were to continue. This approach has been used in previous analysis (MLA 2004). There is also the scope to use alternative assumptions where a case can be made.

Here, we look to the key drivers of the improved performance of the lamb industry and some reasonable scenarios around these to construct a baseline. These result in increases of:

- carcass weights
- lamb slaughter
- lamb prices.

The combination of these factors has driven the real growth in industry value highlighted in charts 4.5 and 4.6. To establish a baseline scenario, we need to construct assumptions around the growth path for each of the drivers. Table 4.9 shows a summary of the historical trends.

4.9 **Average trend growth rates for key lamb industry drivers** Per cent per year

	Slaughter	*Carcass weight*	*Production*	*Nominal farm price*	*Nominal farm value*	*Real farm value*
1980-1990	0.50	0.35	0.96	1.40	2.38	-5.14
1990-2007[a]	1.53	1.12	2.66	6.88	9.72	7.00

[a] Actual.

Source: GMI database, CIE calculations.

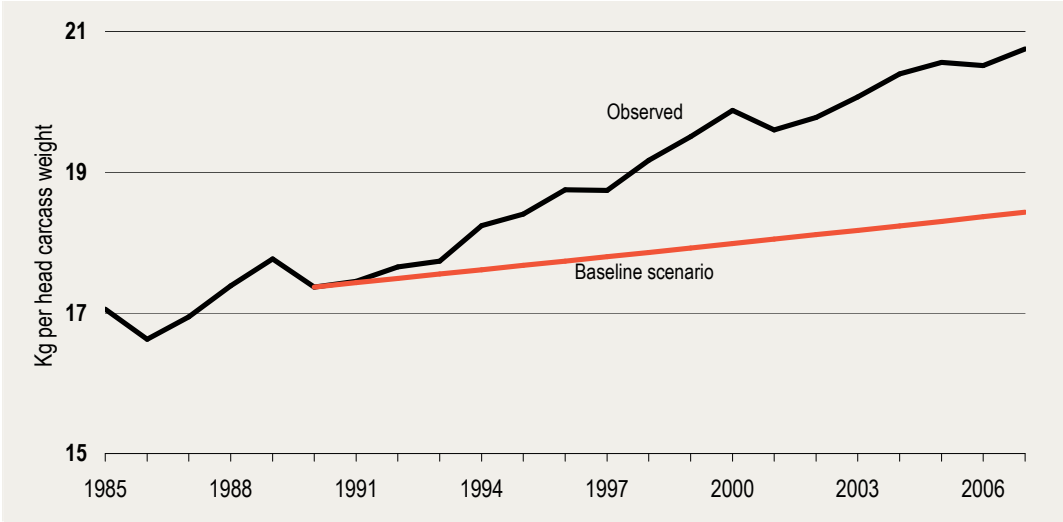
Carcass weights

Change in carcass weights is a convenient proxy for a range of complex and inter-related developments on the supply-side. Chart 4.3 illustrated lamb carcass weights over time. There is a strong argument that developments that occurred after 1990, particularly the demand from the United States for larger cuts and carcass weights drove much of the observed increase in average carcass weights. A reasonable baseline assumption would appear to be that the underlying pre-1990 growth rate in carcasses would have continued (0.35 per cent). Chart 4.10 shows the baseline scenario for carcass weights compared with the actual scenario.

External factors, particularly drought, clearly have an impact on carcass weights. Availability of supplementary feed and quality of pasture fall during a drought and producers are more likely to turnoff lambs at a lower weight.

In chart 4.10, we haven't adjusted the trend for drought or any other external factors — such as the run of good seasons in the late 1980's but simply extended out a flat genetic rate during the 1980s. That is, we use a constant trend to construct the baseline scenario. It is possible to do otherwise, however it would not make a substantial difference to the overall results.

4.10 **Baseline scenario for carcass weights**



Data source: GMI database, ABS, CIE calculations.

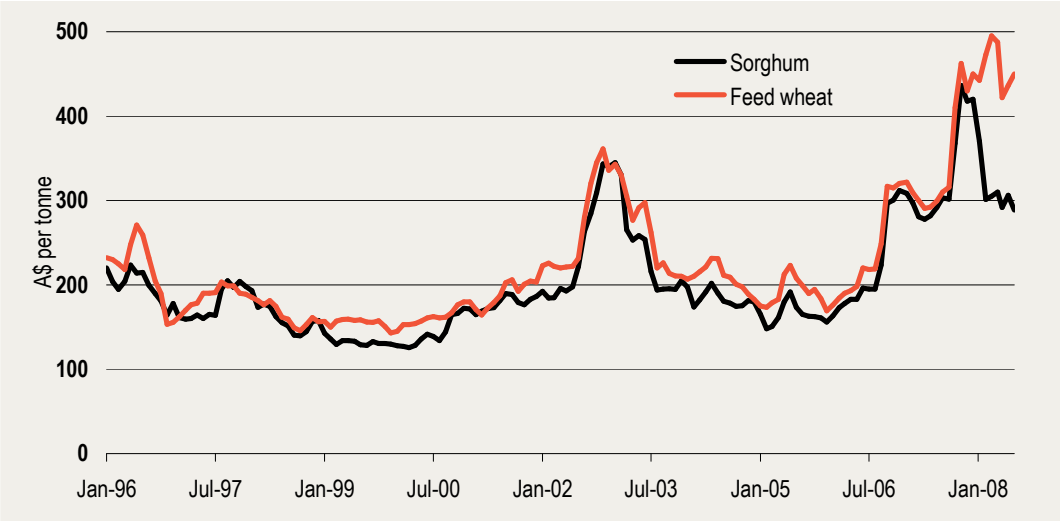
Lamb slaughter

Growth in lamb slaughter has increased since 1990. Chart 4.2 illustrated lamb slaughter over time. There was a long period of decline in lamb slaughter, from the mid-1980s to the mid-1990s. This was closely linked to the spike in wool prices and build up in sheep flock that happened in the late 1980s. The decline in the sheep flock in early 1990s was significant. It is difficult to say what a reasonable baseline assumption is for lamb slaughter, particularly during the period where developments in the wool industry were playing such a large role.

It is likely that in the event that lamb continued to be largely a by-product of the wool industry and the absence of a dedicated prime lamb industry, lamb slaughter would have been lower than what was observed. But how much lower is difficult to say. The decline in the wool industry meant that many wool producers had to look towards other activities. The options available to producers varied by region, but for a proportion, there were limited options other than lamb or cattle. Given that the decline in the wool industry is assumed to happen regardless, we need to make an assumption on how it affects lamb slaughter in the baseline.

Another factor to consider is grain prices and how they interact with lamb and wool production in a mixed farming environment. For sheep and lamb producers in the sheep-cereal zone, the profitability of their enterprise is closely linked to market conditions for grain. Holmes Sackett & Associates (2003) estimate that 55 per cent of the Australian sheep flock is run in the sheep-cereal zone and the remaining 45 per cent in specialist grazing areas. Clearly producers in the sheep-cereal zone have more scope to adjust the mix between sheep/wool, sheepmeat (mutton and lamb) and grains in response to relative prices. Chart 4.11 illustrates grain price movements (feed wheat and sorghum) over the past 12 years. The obvious point to be made is that drought has a significant impact on grain prices, with the 2002-03 drought corresponding to a significant spike in prices and the current drought resulting in an even bigger increase in price. The complication here is that although these price increases are significant, they are largely supply driven and as such the ability to switch into additional land to grain is limited.

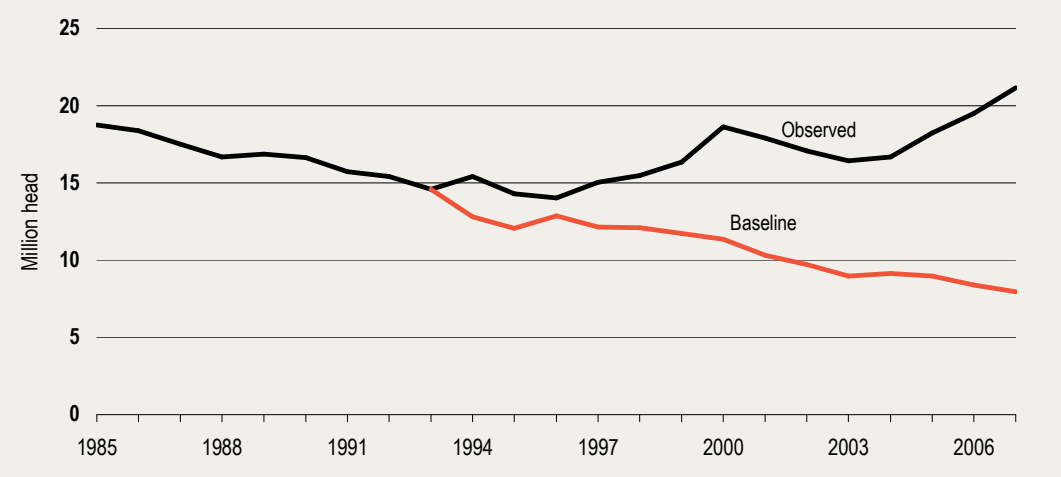
4.11 **Grain price movements**



Data source: ABARE.

In the mid-1990s, lamb slaughter picked-up slightly from a declining trend. In the baseline, we assume that lamb slaughter would have declined between 1994 and 1997 relative to the observed case at a rate equivalent to the trend that occurred from the mid 1980s to 1993 (2.7 per cent per year). From 1998 onwards, lamb slaughter has grown at an increasing rate. Reflecting that the fact that up to the 1990's, lamb production was largely driven by wool production — we have assumed that without concerted action, lamb slaughter would have followed the same trajectory as wool production over the same period. Chart 4.12 shows the baseline scenario for lamb slaughter.

4.12 **Baseline for lamb slaughter**

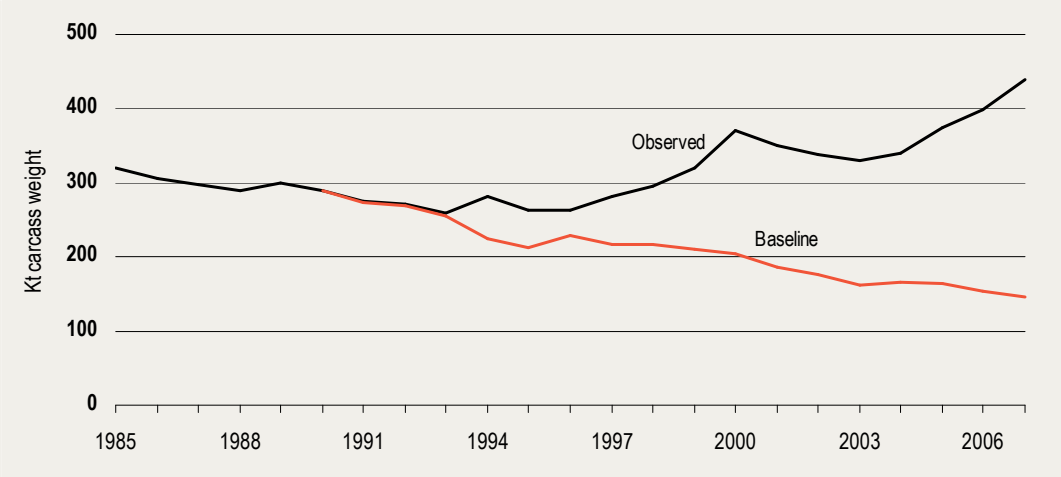


Data source: GMI database, ABS, CIE calculations.

Lamb production

Using the assumptions for carcass weights and lamb slaughter outlined above, chart 4.13 shows the baseline scenario for lamb production.

4.13 **Baseline for lamb production**



Data source: GMI database, ABS, CIE calculations.

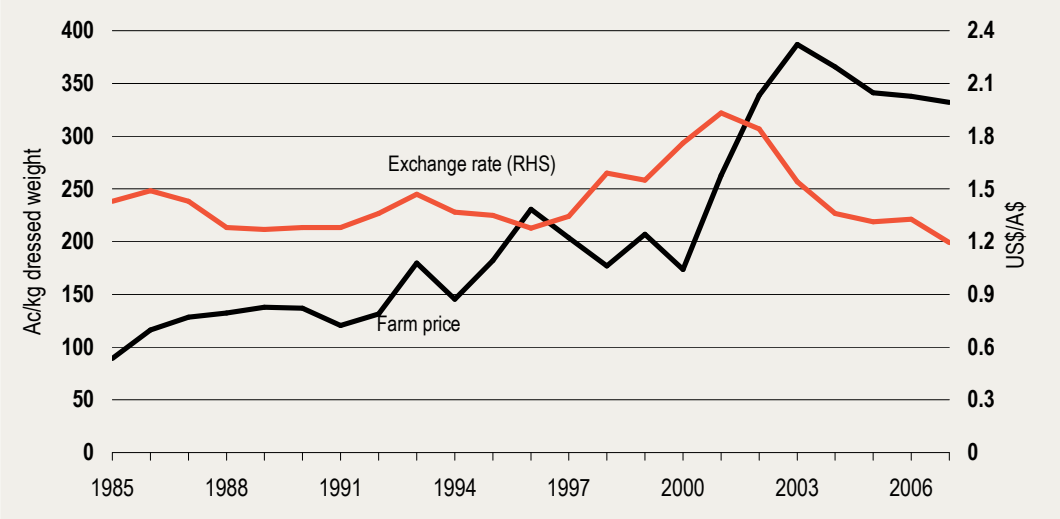
Lamb prices

The third key parameter that we need to define a baseline scenario for is lamb farm prices. Growth in nominal farm prices has been significantly higher since 1990 than that experienced in the 1980s (6.8 per cent against 1.4 per cent). The key question for this analysis is: what is a reasonable assumption for price growth in the baseline? This is difficult to answer — it is likely that price growth would have been significantly lower in the absence of the turnaround in the industry that has been

achieved. The underlying growth observed in the 1980s implies a long term decline in real prices.

The growth in prices experienced since 1990 is reflective of strong demand growth in key markets — especially the United States and domestic markets. Two additional factors in the early 2000's that impacted on price growth were supply shortages and the sharp decline in the exchange rate. The exchange rate movement and average farm price are shown in chart 4.14. It is difficult to say how these would have affected prices under an alternate scenario for the industry. Given that in the next section we assume some export growth to the United States in the baseline, it is likely that the exchange rate would have had an impact on prices.

4.14 **Historical lamb price and exchange rate movements**

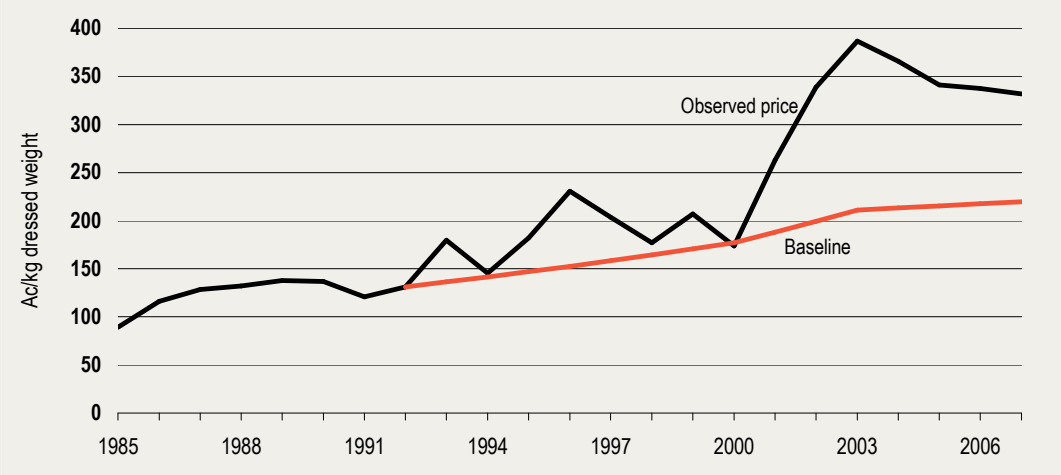


Data source: GMI database.

In the baseline, we assume that from 1993 onwards, average price growth observed in the late 1980s and early 1990s prevails (3.8 per cent per year). From 2000, we increase this growth to 6 per cent, taking account of the external factors that influenced price over this period, whilst from 2004 onwards we assume this growth moderates to just 1 per cent per year. Chart 4.15 illustrates the price baseline.

A component of the assumptions behind the baseline scenario for lamb was the price path of competing meats especially chicken — which where declining or flat in nominal terms up until the drought of 2003-04. The price path for lamb in the baseline represents an average trend growth rate similar to that observed for these competing meats.

4.15 **Baseline scenario for farm prices**

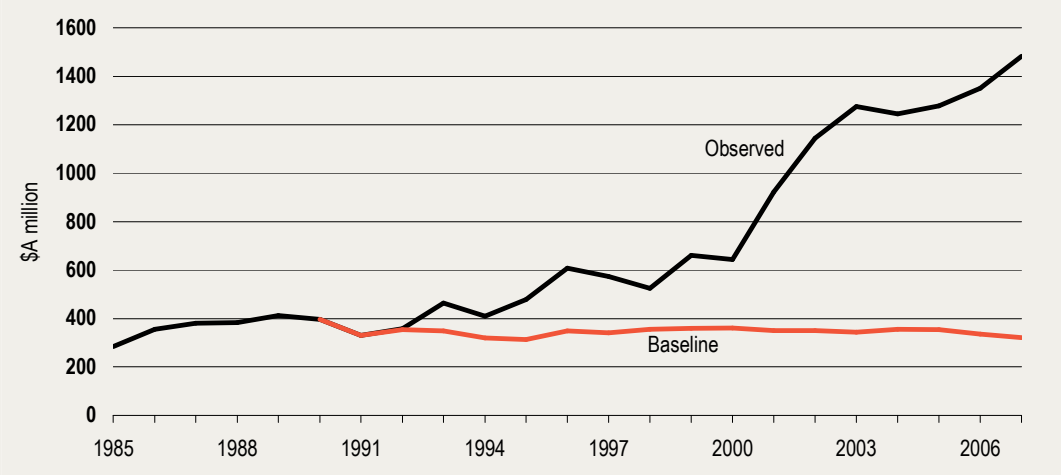


Data source: GMI database, CIE calculations.

Farm GVP

Given the three scenarios outlined in the above charts, the overall scenario for nominal farm GVP is shown in chart 4.16.

4.16 **Baseline farm GVP scenario**



Data source: CIE calculations.

5 *Estimating the impact of the lamb on-farm program*

Chapter 4 summarises what the Australian lamb industry may have looked like if it had been unable to *transform* itself into what the industry looks like now. As already identified, it is very difficult to determine the relative contribution of each of the industry stakeholder groups to this overall outcome.

The objective of this chapter is to estimate the benefits to lamb industry as a result of these outcomes that can be attributed back to MLA. To estimate the impact of MLA's lamb on-farm programs, a series of assumptions must be made in-line with the 'tops-down' approach set out in chapter 3.

Evaluation approach

A starting point is to re-iterate what is included and what is not considered as part of this evaluation. The program evaluation framework developed by the CIE (2005) identifies three types of benefits - as part of a triple-bottom-line approach:

- economic
- environmental
- social.

The MLA lamb on-farm programs are largely targeted at improving productivity in the lamb industry. This means that the benefits generated by the programs would be largely economic, although it is acknowledged that programs targeted at improving profitability in the lamb industry are likely to generate flow-on benefits to regional communities that are more social in nature. However, due to the difficulty in explicitly identifying the nature and magnitude of these impacts, we make no attempt to identify or quantify flow-on benefits resulting from these programs.

As part of the MLA's evaluation process, other programs that have contributed to overall lamb industry performance should have be accounted for. To avoid double-counting this evaluation should exclude the impacts of the following MLA programs:

- eating quality
- food safety
- market access.

As already identified, the contribution of MLA on-farm programs relating to RD&E, in concert with ongoing programs conducted by the state DPI's has also been substantial.

MLA's program for domestic and US lamb marketing is the subject of a separate but concurrent evaluation. The attribution of benefits from this program will also have to be accounted for in this evaluation.

Other factors

In relation to evaluation of other MLA programs that use a 'bottoms-up' approach, two key factors in the calculation of program benefits would be:

- any program outcomes that are omitted from the analysis because they cannot be quantified or the inability of the evaluation framework to accommodate them because of lack of detail or coverage; and
- adoption rate of program outputs.

Because of the 'tops-down' approach and the high-degree of inter-connectedness between MLA programs and the actions of other industry:

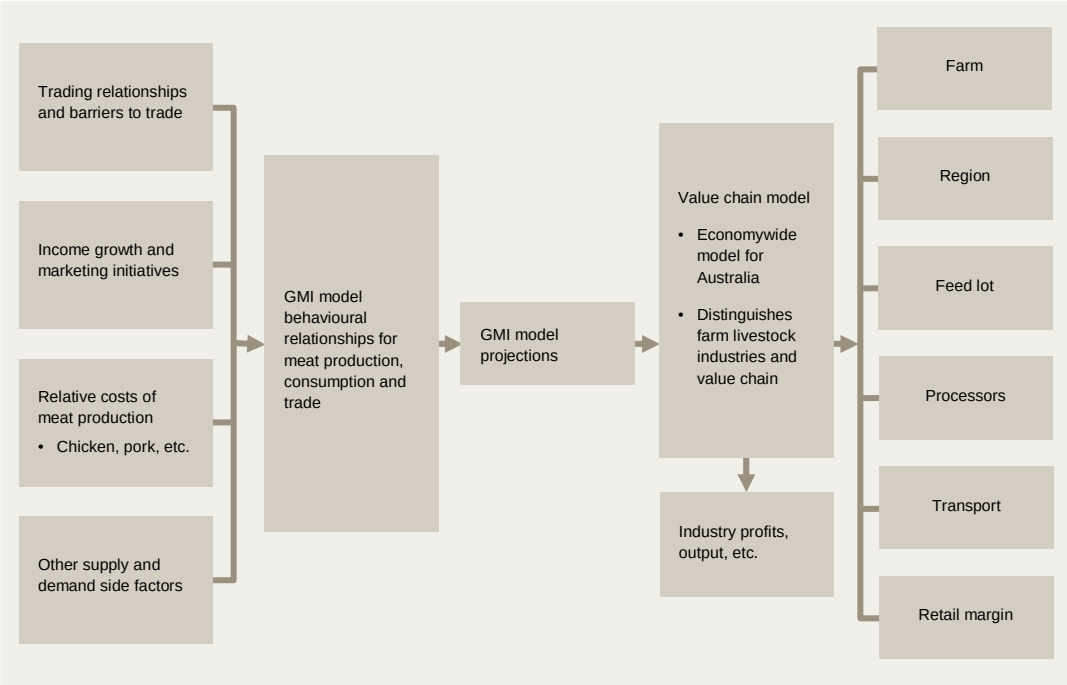
- all economic outcomes impacting on Australian lamb producers have been (implicitly) summarised in the development of the baseline; and
- the baseline also makes an implicit judgement about adoption rates. This applies both to consumers' response to promotional activities and producer's take-up of research and extension in addition to their response to market signals from the chain about larger-leaner lambs.

Integrated Framework (IF)

The results presented in this chapter are generated according to the guidelines provided in economic module of the evaluation framework. This module provides a set of 'rules of thumb' for estimating industry benefits arising from changes in demand and supply. However, the economic module only distinguishes between domestic and export markets. Because of this, the GMI model is linked with the IF to estimate the benefits to the industry. This approach is illustrated in chart 5.1.

The GMI model provides a global representation of production, consumption, trade and prices at the bilateral level for meat (beef, sheepmeat, pigmeat and poultry) and live animals (cattle and sheep). It measures payoffs to Australian beef and sheepmeat producers in terms of changes in prices, production and gross value of production at an aggregate industry level. But the GMI model is purely a meat industry model and as such, it does not measure effects on other industries or the economy as a whole.

5.1 **Linked GMI and Integrated framework**



Data source: TheCIE.

The IF is a model of the Australian economy. It captures interactions between the red meat value chain and other sectors of the economy. These interactions include purchased input use at the farm level and value adding factors such as capital and labour. In terms of red meat sector coverage, the IF includes farm production, feedlots, processing, wholesaling, retailing, domestic consumption and exports. The IF measures the effect of changes on each industry (in terms of output, prices, net income etc.) and the economy as a whole (in terms of GDP, employment, consumption, trade balance etc.). The linked GMI/IF system as shown in chart 5.1 then links the outcomes in specific global markets with details at the domestic industry level and broader economy.

Timeframe of program benefits

This analysis has considered the transformation of the lamb industry over the period 1990 to 2007. During this time, considerable investments were made with the benefits — as represented by the baseline in chapter 4 — confined to that same period.

To explore the impact of total investment we need to make another series of assumptions regarding the time profile of those benefits. That is, we ask the question: what would the benefits look like beyond 2007 if the funding of these programs were stopped now. This profile depends on the rate of decay of the benefits of each contributing sub-component to the overall lamb approach. Here we explore two scenarios:

- where all benefits are evaluated against expenditures over the period 1990 to 2007:

  - that is, the decay of programs is assumed to be immediate - there are no flow-on benefits into the years following 2007; and
- that some benefits from the program persist for at least five years (without further funding) — realistically this decay period depends on the type of sub-program:
  - programs involving infrastructure activities in market development such as development of new products, strategic alliances or underlying R&D are examples where decay would be expected to be slow; and
  - programs involving promotion through media and at point-of-sale would be expected to have a higher decay rate.

Attribution

Another consideration for program outcomes is the extent to which MLA activities have contributed to the overall outcome. As noted, the outcomes and impacts we see today generally represent a concerted effort by a range of stakeholders. The intertwining nature of many issues means that it is difficult to logically separate the contribution of each stakeholder in many cases, a point that was noted during consultations. This was the underlying logic behind the approach in this report.

However, it is not possible to do a meaningful evaluation of MLA's programs without attribution. One guide would be to allocate the attribution of benefits on the basis of program costs:

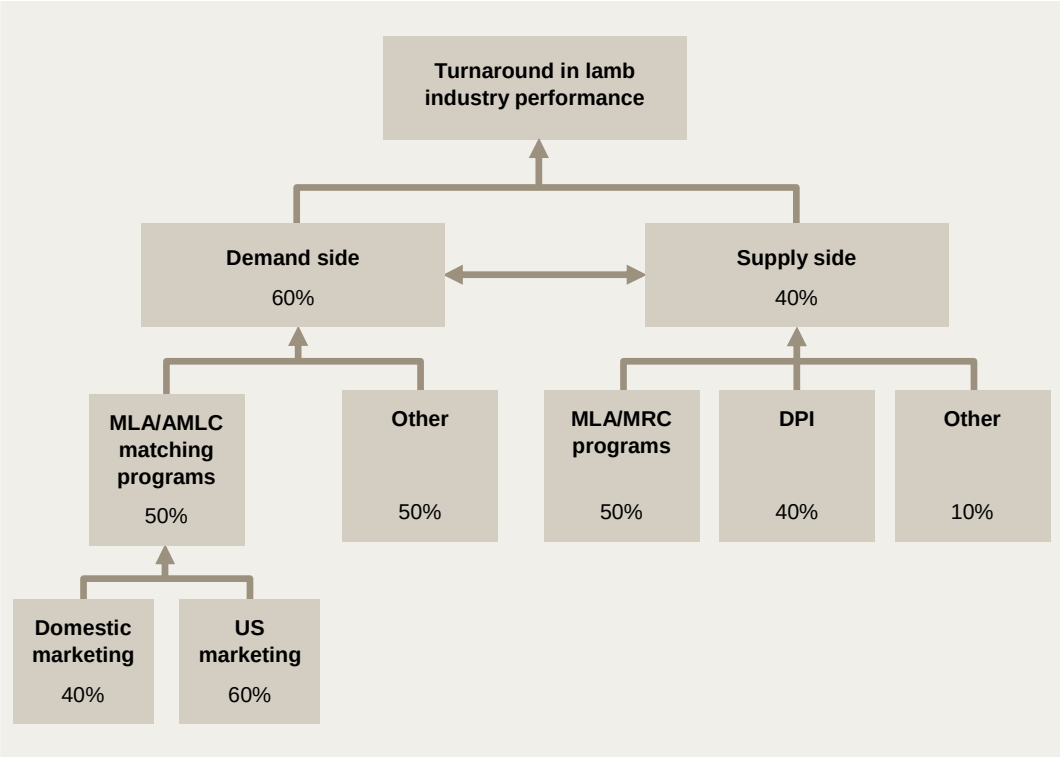
- the implicit assumption being that the benefit-cost ratio for each of the contributors would be the same; and
- expenditure on relevant MLA programs are known as well as contributions by some other sources — principally DPIs.

The constraints with such an approach are that it doesn't recognise the contribution:

- by the wider industry such as processors and traders in the development of markets, including the requisite investment in infrastructure and development of supporting products and brands; and
- of in-kind services provided by stakeholders in the industry to the overall outcome.

Chart 5.2 illustrates the broad assumptions used in attributing the total benefits. These assumptions were informed by an extensive consultation process with key stakeholders as part of this evaluation and the concurrent evaluation of the MLA US and domestic promotion programs.

5.2 Key assumption around attribution of total benefits



Data source: TheCIE.

Table 5.3 sets out the assumed attribution percentages used in the 'tops-down' analysis over the period 1990 to 2007. These are derived from the figures in the chart above and reflect a subjective assessment of the relative contribution of each of stakeholder groups towards to aggregate outcome.

5.3 Attribution of total benefits to the lamb industry

Contributor	*Attribution of benefits*
	%
Off-farm	
MLA domestic promotion	12.0
MLA US promotion	18.0
Other contributors[a]	30.0
On-farm	
MLA on-farm research and extension	20.0
DPI on-farm research and extension	16.0
Other contributors[a]	4.0
Total	100.0

[a] Other contributors include MLA programs (Eating quality, Food Safety and Market Access) and a range of activities by industry.

Source: CIE assumptions.

Logic for attribution

Chapter 2 detailed the program phases of the total on-farm investment in the lamb industry, while chapter 4 looks at the 'without' program case focusing on the supply side. But the attribution illustrated in chart 5.2 must be the same as that used for the evaluation of the MLA US and domestic promotion programs - because of the high level of interdependency between the programs.

A characteristic of the evolution of the industry was the feed back - feed forward interaction of each phase of the supply and demand side programs in response to changing market circumstances. An example of these inter-relationships was the promotion of product in both the US and domestic markets during the early to mid 1990's. While promotion was successful at building demand, shortfalls in product availability left many consumers disappointed. This forced industry to re-focus attention back to the supply side and — after a period of consolidation — justified further expansion of marketing effort.

For these reasons, many stakeholders consulted during this evaluation were reluctant to commit to attribution back to contributors. But overall, a key message was the importance of the emergence of the US market as a trigger for the transformation of the Australian lamb industry. Many consulted acknowledged that the US market provided the incentives for the Australian industry to transform itself by providing the growth potential and more importantly the premiums for better-specified high-quality lamb products. This largely resulted in the significant behavioural changes observed, particularly the:

- shift away from a trade based on frozen carcasses to one more-focused on high-quality fresh or chilled cuts; and
- recognition by the farm and processing sectors for the need to supply lamb to specification throughout the year.

The influence of the US market program explains the logic of chart 5.2 and table 5.3:

- 60 and 40 per cent attribution between the demand and the supply side; and
- 40 and 60 per cent attribution shares between the MLA matching programs on the domestic and the US markets.

On the supply side, consultation with stakeholders on the relative contribution between MLA and the DPIs indicated that each contributed to the overall supply side result in proportion to their respective funding contribution. In addition, there was also a provision for other contributors — primarily other MLA program activities — of 10 per cent. Over the period 1990 to 2007, in real terms, MLA contributed around 55 per cent of total expenditure towards on-farm programs. Therefore, we have assumed no additional leverage from the MLA expenditures.

Putting the programs in perspective

To put this evaluation in context, table 5.4 compares the total investments made by MLA and the DPI's relative to industry GVP. It shows that the total investment was very high — especially during the early 1990s — compared to the size of the industry. That is, the total investment represented around 5 per cent of GVP (compared to 1 to 2 per cent of GVP for other agricultural industries).

5.4 Total investment, GVP and payoff to industry farm value-added[a]

		MLA and DPI investment		*Payoffs from MLA and other contributors[b]*	
	Observed GVP	*Total*	*Share of GVP*	*GVP*	*Farm value-added*
	$m	$m	%	$m	$m
1990-91	396	21.1	5.3	0	0
1991-92	331	21.5	6.5	0	0
1992-93	358	20.7	5.8	3	1
1993-94	465	20.6	4.4	116	30
1994-95	409	22.7	5.5	90	24
1995-96	479	19.0	4.0	166	44
1996-97	607	18.4	3.0	259	69
1997-98	574	20.3	3.5	232	62
1998-99	525	17.6	3.4	169	45
1999-00	660	18.4	2.8	302	81
2000-01	643	20.2	3.1	281	76
2001-02	922	32.5	3.5	571	154
2002-03	1 145	37.8	3.3	795	216
2003-04	1 276	31.7	2.5	932	254
2004-05	1 244	33.6	2.7	889	243
2005-06	1 279	34.2	2.7	925	254
2006-07	1 350	29.5	2.2	1 015	280
2007-08	1 482	27.7	1.9	1 160	299

[a] In nominal terms. [b] Difference between observed and baseline GVP and value-added from MLA and DPI program and industry actions.

Source: MLA and State DPIs and CIE calculations.

This level of investment is one indicator of the success of MLA and its predecessors in leveraging its investment against those made by the DPIs.

From 2001-02 to 2005-06 there was a surge in MLA investment in on-farm activities where total annual expenditure increased by $10 million per year from previous levels. By 2007, total expenditure by MLA and DPIs had declined to around 2 per cent of GVP because:

- total investment had increased marginally from the early 1990's in real terms; but
- there had been substantial growth in observed lamb industry GVP.

This is consistent with that calculated by Mullen (2007) who showed that R&D expenditure average around 2 per cent of GVP across all Australian agriculture after 2000.

Table 5.4 also summarises the flow of benefits implied by the difference between observed industry GVP and the baseline identified in chapter 4. By 2007-08, annual industry GVP could be $1.1 billion higher than was the case without all MLA and DPI programs and actions by industry. Put another way, industry GVP would have been around 20 per cent of its 2007-08 value. This increased GVP translates to industry value-added that is $299 million higher than otherwise the case (box 5.5 contains the key assumptions).

5.5 GVP translation to farm value-added

An important variable in table 5.4 and the following benefit–cost calculations is lamb industry value-added. One consistent source of information on farm value-added is from the MLA/ABARE Farm Survey, which spans the period since 1990. From this source, farm value-added is defined as the difference between total receipts and total cash costs, but including wages to hired labour.

- This data recognises the fact that lamb is produced on farms with multiple enterprises that share common or fixed costs. However, it is not known with certainty if the 'profitability' of the average lamb enterprise is higher or lower relative to all other farm enterprises.
- Therefore, to be conservative, we have used the average share of value-added across all enterprises as representative of the typical lamb enterprise.

Over the period 1990 to 2007, the surveys reported that farm value-added represented between 25 and 28 per cent of total farm receipts on average.

We have used this number to translate estimated changes in lamb industry GVP back to changes in value-added — from which program benefits are calculated. Given that the farm-level industry has changed significantly, it may be reasonable to expect that the share of value-added may have increased over time (and so with it program benefits). But many of the on-farm improvements that facilitated the transformation of the industry — such as improved feeding — represent additional costs that offset higher farm-gate return. Overall, this measure of farm value-added is a good representation of the benefits from the industry programs in this evaluation.

Table 5.6 shows the summary results of the lamb evaluation — using the flow of total benefits from table 5.5 and using an assessment of the attribution of these benefits to each of the contributing groups.

5.6 **MLA lamb program results summary — baseline[a]**

Contributor	*Attribution of benefits*	*Total benefits*	*Total costs*	*Benefit–cost ratio*	*Internal rate of return*
	%	$m	$m		%
MLA domestic promotion	12	573	263	2.2	16
MLA US promotion	18	859	120	7.2	34
MLA on-farm	**20**	**955**	**256**	**3.7**	**29**
DPI on-farm	**16**	**764**	**225**	**3.4**	**26**
MLA/DPI on-farm	**36**	**1 719**	**481**	**3.6**	**28**
Total MLA/DPI programs	66	2 564	864	3.0	22
Other industry	34	1 623	na	na	na
All stakeholders	100	4 775	na	na	na

[a] Net present values calculated over the period 1990 to 2015 with a discount rate of 5 per cent, 2007-08 dollar equivalents.
na Not applicable.
Source: Integrated Framework and CIE calculations.

A key influence on these results is the significant investments that were made throughout the 1990s, while many of the benefits were realised after 2000. This time profile of benefits and costs affects the calculation of net present values. In present value terms, 70 per cent of MLA and DPI investments were made up to 2000-01. While the corresponding period delivered 20 per cent of the benefits in terms of farm value-added. This profile reflects the time lags from the research and the implementation of those outputs made by the marketing chain that were required to deliver the stream of benefits.

Overall, the benefit-cost ratio for MLA lamb programs varies between 2.2:1 for domestic promotion to 7.2:1 for US promotion. These results indicate the attribution of total benefits to the MLA US program from chart 5.2, relative to other programs and contributors, to transformation of the Australian lamb industry.

Sensitivity analysis

In this section we undertake a sensitivity analysis on the basis of the key assumptions made above. The objective is to illustrate how sensitive the results are to changes in these key assumptions. This helps determine how robust or otherwise the results are to changes in uncertain variables and assumptions.

A key feature of chapter 4 was establishing the baseline that would have happened without the involvement of MLA and industry partners. The chapter identified that there was a significant amount of uncertainty about the response of lamb producers in the baseline and so the supply of lamb. A key unknown is how producers would have responded to lower lamb profitability in the 'without MLA' case. This response is in the context of choices within complex multi-product enterprises. Characteristics of enterprises we observe today suggest that producers would have adjusted away from lamb production because lamb:

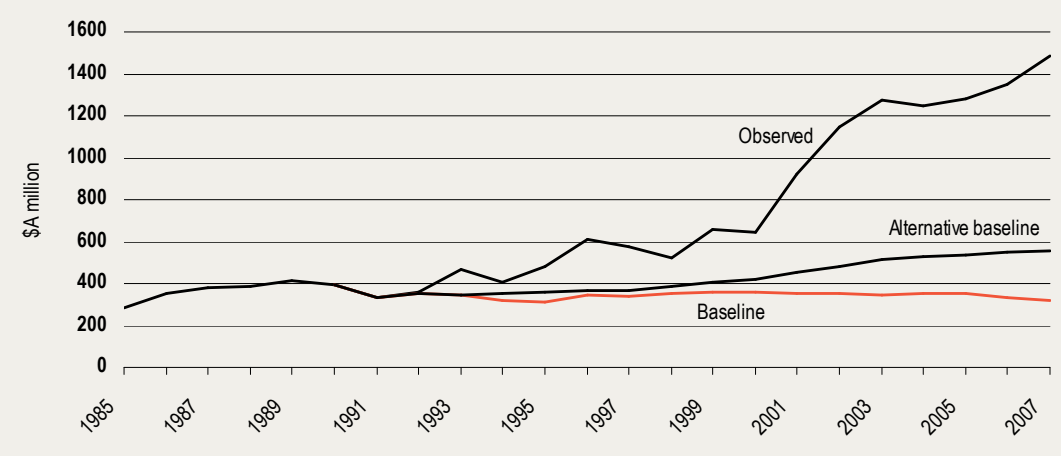
- represents only a small part of total receipts (on average 15 per cent); and
- lamb is relatively labour intensive compared particularly to cropping activities which puts it at a disadvantage in a high-wage environment

That said, there are still some areas were the farm's resource mix, particularly suitable land, would not allow other enterprise options outside of wool and lambs.

As a sensitivity test, we identify an alternative trajectory for farm level lamb production and GVP which is higher than for the baseline. This alternative baseline is based on the assumption that lamb production would have continued-on at levels observed in the early 1990's in the absence of MLA or DPI programs. The logic behind this assessment depends on the capacity of farms to switch into other enterprises in response to relative prices. As identified in chapter 4, a proportion of lamb producers have limited options to change their enterprise mix.

Chart 5.7 compares observed GVP with baseline scenario and an alternative baseline, where we have assumed a marginal growth rate (0.5 per cent per year) in the slaughter numbers, which is equivalent to the average observed during the 1980s. By 2007, under this alternative baseline annual lamb industry GVP may have been $230 million or 72 per cent higher than the baseline.

5.7 **Alternative baseline for lamb GVP**



Data source: CIE estimates,

The results summary, based on the same attribution as used for the headline analysis is shown in table 5.8. This sensitivity test shows that the headline result remains robust delivering positive benefit-cost ratios across all program components.

Another key proposition of an ex-post analysis for the evaluation of MLA programs is the flow of benefits from expenditures made over the period 1990 to 2007. As a check on the headline results, program payoffs were also calculated by considering only benefits from the corresponding period investment. This asks the question: what would be the payoff if the MLA and other investments had to pay for themselves over the period from 1990 to 2007?

5.8 **MLA lamb program results summary — alternative baseline[a]**

Contributor	*Attribution of benefits*	*Total benefits*	*Total costs*	*Benefit–cost ratio*	*Internal rate of return*
	%	$m	$m		%
MLA domestic promotion	12	466	263	1.8	13
MLA US promotion	18	699	120	5.8	30
MLA on-farm	**20**	**777**	**256**	**3.0**	**25**
DPI on-farm	**16**	**622**	**225**	**2.8**	**22**
MLA/DPI on-farm	**36**	**1 398**	**481**	**2.9**	**24**
Total MLA/DPI programs	66	2 564	864	3.0	22
Other industry	34	1 321	na	na	na
All stakeholders	100	3 885	na	na	na

[a] Net present values calculated over the period 1990 to 2015 with a discount rate of 5 per cent, 2007-08 dollar equivalents.
na Not applicable.
Source: Integrated Framework and CIE calculations.

Table 5.9 shows that under this scenario — based on the same attribution as the headline analysis — the payoff to MLA expenditures remain positive but significantly reduced relative to the headline analysis. Overall, these results show that the headline results are relatively robust — demonstrating clearly that the MLA programs have delivered net benefits to levy payers.

5.9 **Benefits confined to period 1990 to 2007 — baseline[a]**

Contributor	*Attribution of benefits*	*Total benefits*	*Total costs*	*Benefit–cost ratio*	*Internal rate of return*
	%	$m	$m		%
MLA domestic promotion	12	365	263	1.4	12
MLA US promotion	18	547	120	4.6	33
MLA on-farm	**20**	**608**	**256**	**2.4**	**27**
DPI on-farm	**16**	**486**	**225**	**2.2**	**24**
MLA/DPI on-farm	**36**	**1 095**	**481**	**2.3**	**26**
Total MLA/DPI programs	66	2 007	864	2.3	24
Other industry	34	851	na	na	na
All stakeholders	100	3 040	na	na	na

[a] Net present values calculated over the period 1990 to 2007 with a discount rate of 5 per cent, 2007-08 dollar equivalents.
na Not applicable.
Source: Integrated Framework and CIE calculations.

As noted earlier, the other variable around which there is some sensitivity is the multiplier used to calculate total investment by state DPI's in on-farm lamb programs. This multiplier reflects the fact that significant overhead costs are incurred by DPIs that aren't explicitly budgeted for within individual programs. State DPI's maintain a significant amount of R&D infrastructure such as research stations. The question for this evaluation is: to what degree should these costs be incorporated into total program costs which rely on that infrastructure (such as MLA)? The base analysis uses a multiplier of 1.25. This reflects some allowance for distributing fixed infrastructure costs across lamb research. For the sensitivity analysis we use a low

value of 1 and a high value of 2.5. The low value assumes no cost recovery for R&D infrastructure, while the high value reflects fully costed R&D infrastructure.

There is also an argument that without proper funding of supporting R&D infrastructure, the delivery and achievement of R&D outputs and outcomes would be significantly more difficult, potentially reducing payoffs. These effects have not been considered in the analysis below — it is simply a representation of a range of cost bases depending on the level of cost recovery for R&D infrastructure.

Tables 5.10 and 5.11 shows the results of this analysis using the original baseline.

5.10 **MLA lamb program results summary — low end DPI costs[a]**

Contributor	*Attribution of benefits*	*Total benefits*	*Total costs*	*Benefit–cost ratio*	*Internal rate of return*
	%	$m	$m		%
MLA Domestic promotion	12	573	263	2.2	16
MLA US promotion	18	859	120	7.2	34
MLA on-farm	**22**	**1 034**	**256**	**4.0**	**30**
DPI on-farm	**14**	**685**	**180**	**3.8**	**27**
MLA + DPI on-farm	**36**	**1 719**	**436**	**3.9**	**28**
Other industry	34	1 623	na	na	na
All stakeholders	100	4 775	na	na	na

[a] Net present values calculated over the period 1990 to 2015 with a discount rate of 5 per cent, 2007-08 dollar equivalents.
na Not applicable.
Source: Integrated Framework and CIE calculations.

5.11 **MLA lamb program results summary — high end DPI costs[a]**

Contributor	*Attribution of benefits*	*Total benefits*	*Total costs*	*Benefit–cost ratio*	*Internal rate of return*
	%	$m	$m		%
MLA domestic promotion	12	573	263	2.2	16
MLA US promotion	18	859	120	7.2	34
MLA on-farm	**14**	**647**	**256**	**2.5**	**18**
DPI on-farm	**22**	**1072**	**451**	**2.4**	**15**
MLA + DPI on-farm	**36**	**1719**	**706**	**2.4**	**16**
Other industry	34	1623	na	na	na
All stakeholders	157	4775	na	na	na

[a] Net present values calculated over the period 1990 to 2015 with a discount rate of 5 per cent, 2007-08 dollar equivalents.
na Not applicable.
Source: Integrated Framework and CIE calculations.

Breakeven analysis

Another test to highlight the robustness of the results presented earlier is to examine the 'breakeven' point at which the MLA and DPI on-farm programs pay for themselves. In practice, this point can be expressed in terms of any of the key variables involved in an evaluation. In the case of this evaluation, due to the tops-

down approach that has been adopted, the most sensible breakeven analysis is around the attribution. The complication is that as chart 5.2 shows, there are a number of levels of attribution. At the top level, there is the split between total (MLA and non-MLA) demand and supply outcomes. On the supply side there is also the split between MLA and DPI on-farm programs. However the split between MLA and DPI is calculated on the relative size of the investment over the period

The simplest way to determine the breakeven attribution for each of the MLA and DPI on-farm programs is at the most detailed level. That is, what share of the total benefits outlined in table 5.6 does each of the programs need to have contributed to pay for the total investment in net present value terms?

Based on total discounted benefits of $4.775 billion between 1990 and 2015 (table 5.6), table 5.12 shows the estimated breakeven total attribution for MLA and DPI on-farm programs.

5.12 **Breakeven share of total benefits for MLA and DPI on-farm programs**

Program	*Discounted costs*	*Baseline attribution of total benefits*	*Breakeven share of benefits required*
	$m	%	%
MLA on-farm	256	20	5.4
DPI on-farm	225	16	4.7

Source: Integrated Framework and CIE calculations.

In terms of a comparison with the attribution used in the base results, the breakeven suggests that the attribution for the MLA on-farm program could be as low as 5.4 per cent for the program to break-even (compared to 20 per cent in the baseline). For the DPI on-farm program, this figure is 4.7 per cent (compared to 16 per cent in the baseline).

These results also suggest that assuming the top level split of 40 per cent for supply-side outcomes, MLA would only have had to contribute around 13.5 per cent to the total supply side benefits through its on-farm activities for them to generate a positive return.

Supporting evidence

In addition to sensitivity analysis, information from other studies can be used as a cross-check to the headline result of this evaluation while recognising key differences in approaches. The research by Agtrans (2008), summarised in table 5.13, contains information on the payoffs to the lamb industry of:

- the integrated MLA and DPI approach since 1990 using another 'tops-down' approach; and
- individual case studies for on-farm programs based on a 'bottoms-up' approach.

The results for the 'tops-down' analysis of MLA and DPI investment indicates a benefit-cost ratio of 6.6:1. The analysis recognises that the integrated nature of both on-farm and off-farm investments were vital to recent industry success and that without investment in one-side of the equation — the total payoffs would have been significantly less. Also, the underlying approach used by Agtrans is quite different from that used in this report as it is based on differential rates of total factor productivity growth in the farm-level industry with and without MLA and DPI on-farm investments. In addition, the Agtrans analysis doesn't directly account for the investments made on the demand-side — therefore the aggregate results presented in table 5.13 could be thought of as the maximum payoff to on-farm investments. Even so, this result is not significantly different from that obtained from — and so supports the headline analysis given the differences in approaches.

5.13 **Selected other on-farm evaluation results for lamb programs**[a]

	Total benefits	*Total costs*	*Benefit–cost ratio*	*Internal rate of return*
	$m	$m		%
Lamb production RD&E[b]	3 665	559	6.6	32.9
Individual case studies[c]				
MLA Prime Time Campaign	14	2.3	6.1	26
Grain and Graze	179	31.6	5.7	27
Delivery of Biological Control Agents for Broad-leaved weeds in the temperate zone	1 000	60	16.7	15
Evergraze	90	14.5	6.2	20
EDGEnetwork	59	14.7	4.0	12
Sustainable grazing on Saline Land	60	28	2.1	12

[a] Net present values calculated using 25 year benefit horizon and 5 per cent discount rate. [b] In 2007-08 dollar equivalents. [c] In 2005-06 dollar equivalents.

Source: Agrtrans Research 2008.

The results from the individual case studies show benefit-cost ratios of that range between 2 and 16.7. If the result of the Biological Control Agents project is excluded, the weighted average benefit cost ratio is 4.4 which is supports the result from the headline analysis.

Analysis for Sheep CRC

Another point of comparison is a mid-term assessment of the various programs in the first Sheep CRC conducted by Vere et al (2005).

The results shown in table 5.14 for 'meat supply' relate to the same types of R&D investments covered in this report. Although 'with-CRC' and 'without-CRC' don't correspond exactly with 'with-MLA' and 'without-MLA', and a different methodology was used, the estimated benefit-cost ratios are mostly in the same range of 1.5 to 5.5.

5.14 **Benefit cost outcomes for Sheep CRC research in Programs 1 and 2[a]**

	With Sheep CRC				*Without Sheep CRC*			
Program area	***PV benefits***	***PV costs***	***NPV***	***BCR***	***PV benefits***	***PV costs***	***NPV***	***BCR***
	$m	$m	$m		$m	$m	$m	
Genetics								
Wool supply	78.303	6.087	72.216	12.9	25.901	3.587	22.314	7.2
Meat supply	**14.475**	**2.609**	**11.866**	**5.5**	**7.762**	**1.575**	**3.187**	**3.0**
Wool science								
Wool supply	23.149	5.087	18.062	4.6	8.621	2.645	5.976	3.3
Wool demand	33.694	3.357	30.337	10.0	15.556	1.756	13.800	8.8
Meat supply	3.483	1.729	1.754	2.0	1.099	0.900	0.199	1.2
Meat science								
Meat supply	20.985	5.780	15.205	3.6	7.263	2.839	4.424	2.6
Meat demand	**37.336**	**5.870**	**31.556**	**6.5**	**15.641**	**2.839**	**12.801**	**5.5**
Parasites								
Wool supply	54.521	6.420	48.101	8.5	16.516	3.555	12.961	4.6
Wool demand	5.800	0.332	5.468	17.5	2.140	0.184	1.956	11.6
Meat supply	**15.871**	**4.317**	**11.554**	**3.7**	**5.394**	**2.390**	**3.004**	**2.3**
Nutrition								
Wool supply	5.911	1.637	4.273	3.6	2.027	0.999	1.028	2.0
Meat supply	**10.343**	**6.551**	**3.792**	**1.6**	**3.571**	**3.995**	**-0.424**	**0.9**
IAM								
Wool supply	20.544	5.849	14.695	3.5	4.493	3.416	4.594	1.3
Meat supply	**9.255**	**5.811**	**3.444**	**1.6**	**2.283**	**3.555**	**-1.272**	**0.64**

[a] Benefits and costs are discounted at 5 per cent real over 20 years using the DREAM model.

Source: Vere et al (2005)

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