final report

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Ex ante benefit cost analysis of 3.1 productivity on farm

Part 1: Data to estimate KPIs
Part 2: Benefit cost analysis

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Executive summary

MLA business plan '3.1 Increasing productivity on-farm' has a vision of delivering new knowledge, tools and technologies that support producers to become more productive and efficient. The business plan targets specific investments in the northern beef, southern beef, feedlot, lamb / sheepmeat and goatmeat sectors.

Twelve case studies from the business plan were developed to provide insight on likely investment returns (Table E1).

Table E1 Case study evaluation results NPV (25 year analysis period, discount rate 7%) and BCR

Case Study	PV Costs	PV Benefits	NPV ($' million)	Benefit Cost Ratio (BCR)
Improving reproduction rates in ewes	4.54	62.22	57.68	13.69
Increasing compliance in southern beef	2.10	15.16	13.06	7.21
Reproductive performance northern beef-	5.15	30.80	25.65	5.98
Ensuring goat performance through genetics	0.14	0.33	0.19	2.28
New pasture and forage crop breeding methods	2.30	28.30	26.00	12.31
Northern beef supplementary feeding	1.50	12.76	11.26	8.52
Feed grain efficiency in feedlots	4.12	21.06	16.94	5.11
Pasture variety testing	3.64	32.53	28.89	8.94
Phosphorus on pastures	3.26	21.70	18.44	6.66
Individual animal management in sheep	4.08	35.56	31.48	8.73
Goat program communication and extension	0.21	0.31	0.10	1.44
Feedlot program communication and extension	0.09	0.36	0.27	3.92
Total	**31.13**	**261.09**	**227.22**	

A subset of case studies were also analysed using a separate approach – the Rendell-McGuckian model. Results achieved by AgEconPlus are comparable to those delivered with the Rendell-McGuckian model.

Returns from the case studies were also compared to overall business plan investment costs. A total business case investment of present value $85.5 million will produce total case study benefits of present value $261.09 million. Return on investment from the case studies, which account for 36% of total planned investment, is sufficient to justify delivery of the total business plan.

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Abbreviations and Glossary

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ABS	Australian Bureau of Statistics
ALFA	Australian Lot Feeders Association
AMPC	Australian Meat Processor Corporation
BCA	Benefit Cost Analysis
BCR	Benefit Cost Ratio
BIN	Beef Information Nucleus
CRRDC	Council of Rural Research and Development Corporations
CWT	Carcase Weight
DPI	Department of Primary Industries
DSE	Dry Sheep Equivalent
DSS	Decision support system
FIP	Feedbase Investment Plan
GICA	Goat Industry Council of Australia
KPI	Key Performance Indicator
LMY	Lean Meat Yield
MDC	MLA Donor Company
MLA	Meat and Livestock Australia
MSA	Meat Standards Australia
NPV	Net Present Value
PV	Present Value
R&D	Research & Development
RD&E	Research, Development & Extension
RMIC	Red Meat Co-Investment Committee
SISP	Sheepmeat Industry Strategic Plan
WAMMCO	Western Australian Meat Marketing Cooperative Limited

1 Introduction

1.1 Study purpose

This document is a benefit cost analysis of Meat and Livestock Australia (MLA) business plan '3.1 Increasing Productivity On-Farm'. The analysis was completed by AgEconPlus and MLA between April 2012 and January 2013.

1.2 Project background

Producers operate complex businesses in an environment characterised by highly variable seasons and markets. It is essential that research and development (R&D) delivers new tools and technologies that support producers and enable them to be more productive and efficient. The livestock industries have experienced a long term decline in terms of trade.

The key drivers of farm profitability are:

- A business approach to running farm enterprises
- Increasing pasture utilisation rates (particularly in southern systems)
- Reducing breeder mortality (particularly in extensive systems)
- Increasing sale weight and/or reducing age at sale
- Increasing weaning rate
- Increasing price per unit sold
- Reducing feed costs per unit gain/sold

R&D investments described in '3.1 Increasing Productivity On-Farm' address these drivers. The business plan covers MLA investments in R&D projects that are specific to the northern beef, southern beef, feedlot, lamb/sheepmeat and goatmeat sectors. The vision for the business plan is:

> R&D that delivers new knowledge, tools and technologies that support producers to become more productive and efficient.

The business plan is structured around four key strategies:

3.1.1 Enhanced rates of genetic improvement in flock, herd and feedbase performance

3.1.2 Optimise productivity in grazing and feedlot systems

3.1.3 Develop and implement information, resource and precision livestock management technologies

3.1.4 Producer participatory R&D to develop and evaluate new technologies.

Analysis addresses each business plan strategy.

1.3 Analysis Approach

The study required review of the draft business plan and selection of twelve case studies for benefit cost analysis; completion of benefit cost analysis of case studies; sensitivity testing the major benefit driver in each case study; threshold analysis of the program and cross checking of a subset of results with those achieved using the Rendell-McGuckian model.

Case study benefit cost analysis was completed using the principles detailed in the CRRDC Guidelines (2009), included a 25 year analysis period and a 7% real discount rate. Case study analysis included suggestions on data that could be collected to measure key performance indicators (KPIs) and draws on previous economic evaluation results completed for MLA investments in sheepmeat, beef, goatmeat, the Feedbase Investment Program (FIP) and the Lamb Supply Chain & Animal Information RD&E Plan. Each case study investment includes MLA costs, matching co-contributor funding as well as the costs of adoption on farm. Where actual outputs associated with the investment were uncertain, such as those relating to programs of extension in the goat and feedlot sectors, the attribution factor was adjusted to allow for possible on farm costs.

Sensitivity analysis was applied to the major benefit driver for each case study. This allowed the reporting of both a 'most likely' result along with a 'worst case' scenario.

Threshold analysis was used to test whether returns from the twelve case studies exceed total business plan investment cost. Conclusions were drawn on the total value of the planned '3.1 Increasing Productivity' business plan.

1.4 Case study selection and proposed MLA investment

To provide insight on the returns that might be expected from investment in '3.1 Increasing Productivity On-Farm' the business plan was reviewed with MLA and twelve case studies selected to represent the scope, but not the entirety, of planned investment.

Case studies were selected using stratified random sampling:

- So that at least one analysis was completed for each business plan's four strategies
- There was representation for each of the red meat industries.

In the case of goats (improved genetics and communication/extension) and feedbase (traits / technologies and variety testing) results were available from previous analyses and these were referenced in this study. Where results from previous analyses were used, a 'mid-point' example was selected rather than high end 'cherry-picking'.

Case studies selected and proposed MLA budget is summarised in Table 1.1.

Table 1.1 Case studies evaluated and proposed MLA investment

Business Plan Strategies and associated Case Studies	**MLA Budget***
1.Enhanced rates of genetic improvement in flock, herd and feedbase performance	
Improving reproduction rate by 10% in 25% of the Australian ewe flock • Nutrition to improve ovulation rates • Protein levels and embryo loss • Tactical management • Restrictions on adopting life time ewe management	$2.65 million over 3 years ($1 million in 2013, $1.5 million in 2014 and $150,000 in 2015)
Improving beef compliance in southern production systems • Improve beef compliance by 5% through using Beefspecs • Improve sale description of frame score, fat score, muscle score • Improved compliance with 4 & 5 star requirements eg age at sale	$1.30 million over 3 years ($300,000 in 2013, $500,000 million in 2014 and 2015)
Management and genetic strategies able to increase reproductive performance in northern beef herds by 5% • Genetic research for the Australian beef industry • Reproduction traits of tropical composites	$0.80 million per annum for 3 years
Ensuring the performance of goats through improved genetics • Increasing the value and use of KIDPLAN • Genetic evaluation trials	$0.20 million per annum for 5 years
New breeding methods to improve pasture and forage crop productivity, quality and persistence • Traits and new technologies	$0.60 million per annum for 5 years
2.Optimise productivity in grazing and feedlot systems	
Northern beef supplementary feeding • Improved supplementation	$0.31 million per annum for 3 years
Feed grain efficiency in feedlots • Priority requirements in feed grain R&D • Net feed intake testing in BIN animals[1] • Grain devitalisation 2	$0.80 million per annum for 3 years
Pasture variety testing • Pasture species evaluation • Existing and active breeding programs • New and novel species	$0.95 million per annum for 5 years
Phosphorus on pastures • Phosphorus reactions and fluxes in pasture • Phosphorus efficient legume pasture systems • An assessment and benchmarking of phosphorus	$0.85 million per annum for 5 years
3.Develop and implement information, resource and precision livestock management technologies	

[1] Beef Information Nucleus is an MLA benchmarking program among elite sires of particular breeds and their progeny whereby a range of data has been collated i.e. carcase traits, meat quality, calving etc. It uses DNA sampling so has been a valuable database for gene marker work.

Precision livestock management techniques • Individual animal management in sheep	$0.65 million per annum for 4 years
4.Producer participatory R&D to develop and evaluate new technologies	
Goat program communication and extension • Analysis and planning • Producer engagement	$0.06 million per annum for 5 years
Feedlot program communication and extension • Feedlot program support costs	$0.02 million per annum for 3 years

* Assumes MLA meets 50% of total project cost, balance met by co-investors. On farm adoption costs are in addition to these estimates.

Chapter 2 provides a benefit cost analysis for each of the twelve case studies. Each case study includes a description of the proposed case study and data to populate target KPIs; benefit identification; and analysis results.

2 Case study analysis

2.1 Improving reproduction rates in the Australian ewe flock

Case study description and target KPIs

Delivery of this investment will improve the reproduction rate of Australian ewes by 10% in 25% of the Australian ewe flock 10 years after plan completion in 2025.

This program of research will include:

- Research into nutritional strategies that improve ovulation rates, ewe condition at mating, and conception rate.
- Quantifying the loss of embryos in early pregnancy (pre and post implantation), including the impact of high protein levels during joining on embryo loss. Developing recommended nutrition profiles for pregnancy and lactation for adult Merino, crossbred and Dorper ewes through evaluation of live weight profiles.
- Research into tactical management strategies including feed type, timing of feed additives and ewe numbers at lambing that improve ewe and lamb survival, particularly with a focus on dystocia (difficult labour) and twin lamb survival.
- Research into barriers currently restricting adoption of life time ewe management specifically targeting labour requirements and benefit cost of better labour management.

Australian breeding ewe numbers and their reproduction rate are shown in Table 2.1

Table 2.1 Australian ewe numbers and reproduction rate

Year	Breeding Ewes ('000)#	Reproduction Rate (%)^
2001	47,012	91
2002	45,813	93
2003	43,741	94
2004	43,772	87
2005	46,147	92
2006	48,605	84
2007	46,431	85
2008	45,411	86
2009	40,867	87
2010	42,265	88
Average	**45,000**	**89**

Source:
ABS Agricultural Commodities Australia Catalogue number 7121.0 (various editions)
^ ABARES June 2011, ABARES similar publications 2010 to 2001

Target KPIs for this program are:

- Reproductive rate of 98% (10% increase in the long term national average shown in Table 2.1); or
- Reproductive rate of 99% (10% increase in the long term average of 'large' and 'very large' lamb producers i.e. those most likely to adopt business plan outputs as shown in ABARES 2011 Table 3 page 11).

These data are available from published sources and no cost will be incurred in their collection.

Benefit estimation

Assumptions used to estimate returns from investing in 'improving reproduction rate in the Australian ewe flock' are shown in the table.

Table 2.2 Summary of assumptions – Ewe reproduction

Variable	Assumption	Source
Australian ewe population	45 million head	ABS Agricultural Commodities data 10 year average
Number of ewes relevant to this strategy	11.25 million head	25% of 45 million in accordance with the description of the case study
Additional lambs weaned	1.01 million head	11.25 million ewes joined with an increase in reproductive rate from 89% to 98% (see above KPI)
Value of additional lambs weaned at sale	$40/head	Estimated using ABARES 2011 Table 5 page 11 of $87 head less production costs of $47 head.
Year when benefit first realised	2025	Consultant estimate of 10 years after plan completion
Year when benefit decays to zero	No decay anticipated	Consultant estimate after consideration of the strategy
Probability of research success	50%	Consultant estimate

Results

Benefit cost analysis results associated with realisation of this program of research are summarised in Table 2.3 for the 'most likely' and 'worst case' scenarios. The 'worst case' scenario assumes a halving of the forecast increase in reproductive rate.

Table 2.3 Benefit cost analysis results (discount rate 7%, 25 years)

Criterion	'Most Likely'	'Worst Case'
Present value of benefits ($' million)	62.22	31.11
Present value of costs ($' million)	4.54	4.54
Net present value ($' million)	57.68	26.57
Benefit cost ratio	13.69	6.85
Internal rate of return (%)	25.80	20.4
Modified Internal Rate of Return (%)	15.31	13.05

This initial analysis results in a favourable Benefit Cost Ratio (BCR). A favourable BCR is defined in this study as being greater than 11:1. A BCR greater than 11:1 has been shown to be at the 'upper end' of returns from rural R&D across industries and over time. BCRs less than 3:1 are at the 'lower end' of investment expectations (consultant observation).

2.2 Increasing beef compliance in southern production systems

Case study description and target KPIs

Delivery of this investment will:

- Improve prediction of beef compliance by 5% through utilisation of Beefspecs.
- Improve point of sale description of frame score, fat score and muscle score by 10%.
- Increase compliance with 4 and 5 star requirements through improvements in age at sale, ossification and marbling.

Target KPI for this investment is:

- A reduction in the current cost of non-compliance of beef carcases against agreed specifications.
- The current cost to the beef production sector is an estimated $63 million per annum or $9.60 per head slaughtered across 6.6 million head graded (ProAnd Associates 2012).
- The KPI associated with this strategy is a 5% reduction in cost.

The ProAnd Associates data was established through processor survey and this survey would need to be repeated to establish progress made. The ProAnd estimate of non-compliance cost is national and will need to be adjusted for the Southern production system focus of this investment.

Benefit estimation

Assumptions used to estimate returns from investing in ‘improving beef compliance in Southern production systems’ are shown in the table.

Table 2.4 Summary of assumptions – Southern beef compliance

Variable	Assumption	Source
Australian cattle slaughtered and carcase graded	6.6 million head	ProAnd Associates 2012
Southern production system slaughtered and carcase graded	3 million head	Consultant estimate after discussions with ProAnd
Cost per head of non-compliance	$9.60/head	ProAnd Associates 2012
Reduction in non-compliance rates associated with this strategy	15%	Consultant estimate after reviewing the strategy
Year when benefit first realised	2018	Consultant estimate after reviewing the strategy
Year when benefit decays to zero	2028	Consultant estimate after reviewing the strategy – benefit is likely to decay as processors adjust their price grids
Probability of research success	75%	Consultant estimate

Results

Benefit cost analysis results associated with realising this program of research are summarised in Table 2.5. The 'worst case' scenario assumes a halving of the reduction in the non-compliance rates associated with this strategy.

Table 2.5 Benefit cost analysis results (discount rate 7%, 25 years)

Criterion	'Most Likely'	'Worst Case'
Present value of benefits ($' million)	15.16	7.58
Present value of costs ($' million)	2.10	2.10
Net present value ($' million)	13.06	5.48
Benefit cost ratio	7.21	3.60
Internal rate of return (%)	42.50	27.80
Modified Internal Rate of Return (%)	13.21	10.99

This initial analysis results in a favourable BCR.

2.3 Reproductive performance northern beef – Management and genetics

Case study description and target KPIs

Delivery of this investment will improve the reproductive performance of 25% of northern beef herds by 5% ten years after plan completion in 2025.

This investment will include:

- Genetic research for the Australian beef industry
- Analysis of the reproduction rates of tropical composites
- Analysis of beef herd management strategies in northern Australia.

In the absence of northern Australian breeding cattle numbers ABS data on 'cows and heifers one year and over' for Queensland, Western Australia (WA) and the Northern Territory has been used to complete the analysis. The data overstates breeding cattle numbers as it includes southern WA.

Reproductive rate, reported as branding rate is published annually by ABARES and is provided for northern Australia (see ABARES June 2012 page 7). ABARES do not publish branding rate for different types of northern beef enterprise and this may be needed for a more targeted KPI e.g. larger or better performing properties may be more likely to adopt research outputs. More targeted branding rate data should be available to MLA from ABARES on request.

Table 2.6 Northern cattle breeding numbers and reproduction rate (2010 – 11)

Year	Breeding Cattle ('000)#				Reproduction Rate (%)^
	Queensland	Western Australia	Northern Territory	Total Northern Australia	
2002	5,762	1,013	1,069	7,844	71
2011	6,001	1,062	1,188	8,251	71
Average				**8,048**	**71**

Source: ^ ABARES June 2012
ABS Agricultural Commodities Australia Catalogue number 7121.0 (various editions) – defined as cows and heifers one year and over
NB: Total northern cattle population was 13.1 million head in 2010 (ABS data sourced via the Rendell-McGuckian model). An estimate of 8 million breeders therefore seems reasonable.

Target KPI for this case study is:

- Reproductive rate of 76% (5% increase in the long term northern Australian average) in 25% of herds by 2025.

Benefit estimation

Assumptions used to estimate returns from investing in 'reproductive performance in northern beef – management and genetics' are shown in the table.

Table 2.7 Summary of assumptions – Northern beef management and genetics

Variable	Assumption	Source
Northern Australian breeding cattle population	8 million head	ABS Agricultural Commodities data 10 year average
Number of cows for breeding relevant to this strategy	2 million head	25% of 8 million head in accordance with the description of the case study
Additional calves branded	100,000 head	2 million cows joined with an increase in reproductive rate from 71% to 76% (see above KPI)
Value of additional calves branded	$200/head	Consultant estimate assuming sale price of $450/head and production costs of $250/head.
Year when benefit first realised	2025	Consultant estimate of 10 years after plan completion
Year when benefit decays to zero	No decay anticipated	Consultant estimate after consideration of the strategy
Probability of research success	50%	Consultant estimate

Results

Benefit cost analysis results associated with realisation of the research are summarised in Table 2.8. The 'worst case' scenario assumes a halving of additional calves branded.

Table 2.8 Benefit cost analysis results (discount rate 7%, 25 years)

Criterion	'Most Likely'	'Worst Case'
Present value of benefits ($' million)	30.80	15.40
Present value of costs ($' million)	5.15	5.15
Net present value ($' million)	25.65	10.25
Benefit cost ratio	5.98	2.99
Internal rate of return (%)	19.50	14.4
Modified Internal Rate of Return (%)	12.61	10.40

This initial analysis results in a BCR that is typical of successful rural R&D investments.

2.4 Ensuring the performance of goats through improved genetics

Case study description and target KPIs

Investment in genetics will improve the productivity of the of the Australian goatmeat industry and deliver additional goatmeat production. Benefits are applicable to farmed goats and managed rangeland enterprises.

This investment will include:

- KIDPLAN – increasing the value and use of KIDPLAN, or other equivalent systems, to improve the genetics of goats in Australia, though breeding and selection.
- Genetic evaluation trials – generating and entering genetics data for analysis and reporting.

Outputs from implementing this investment will include 'more breeders using KIDPLAN' and an increase in the 'number of evaluation trials and enterprises involved'.

There is very little published Australian goatmeat data. AgEconPlus (2012) used data compiled by Swain (2010) and this is reproduced in the table below.

Table 2.9 Australian goat industry production and profitability data

	Rangeland	Agricultural Production	Source
Goat population (head)	2.6 to 4.0 million	0.4 million	Swain 2010
Annual turnoff (head)	1.6 million	0.2 million	Adapted from ABS data reported in Swain 2010
Income ($/head)	$37.74	$46.03	Adapted from DPI NSW (2006a and 2006b)
Variable Costs ($/head)	$2.22	$4.63	Adapted from DPI NSW (2006a and 2006b)
Gross margin ($/head)	$35.52	$41.40	Adapted from DPI NSW (2006a and 2006b)
Gross Value of Production – farm gate	$56.8 million (gross margin X turnoff)	$8.3 million	Consultant analysis of the above data

Source: AgEconPlus 2012

Target KPI for this case study is:

- Increase annual goat turnoff from rangeland and agricultural production situations of 1.8 million by 0.5% by 2025.

Benefit Estimation

Assumptions used to estimate returns from investing in 'ensuring the performance of goats through improved genetics' are shown in the table.

Table 2.10 Summary of assumptions – Goat genetics

Variable	Assumption	Source
Australian goat turnoff for slaughter	1.8 million head	Swain 2010
Additional goats turned off	9,000 head	0.5% increase in current goat turnoff (see above KPI)
Value of additional goats sold	$38.46/head	See table above – average of rangeland and agricultural production returns.
Year when benefit first realised	2025	Consultant estimate of 10 years after plan completion
Year when benefit decays to zero	No decay anticipated	Consultant estimate after consideration of the strategy
Probability of research success	50%	Consultant estimate

Source: MLA Goatmeat Strategy Benefit Cost Analysis 2012

Results

Benefit cost analysis results associated with 'ensuring the performance of goats through improved genetics' are summarised in Table 2.11. The 'worst case' scenario assumes a halving of additional goat turnoff.

Table 2.11 Benefit Cost Analysis Results (discount rate 7%, 25 years)

Criterion	'Most Likely'	'Worst Case'
Present value of benefits ($' million)	0.33	0.16
Present value of costs ($' million)	0.14	0.14
Net present value ($' million)	0.19	0.02
Benefit cost ratio	2.28	1.14
Internal rate of return (%)	11.80	7.74
Modified Internal Rate of Return (%)	9.35	7.37

This initial analysis results in a BCR at the lower end of what is generally considered to be acceptable.

2.5 New pasture and forage crop breeding methods

Case Study Description and Target KPIs

The purpose of this investment is to accelerate both discovery and delivery of new breeding methods to improve pasture and forage crop productivity, quality and

persistence. The investment addresses the development of traits and tools to greatly enhance the rate of genetic gain in forage species. The focus of MLA investment will be on pre-breeding in southern pasture systems. When delivered Australian red meat producers in southern Australia will be able to increase productivity and profitability by at least 15% through the incorporation of greatly improved cultivars into their feedbase (MLA Feedbase Investment Program 2011).

Delivery of this investment will result in tools that allow:

- Demonstrated pasture genetic improvement technologies with the potential to increase rate of genetic gain in annual pastures and phalaris by at least 15%

The target KPI for this investment is:

- 20% increase in red meat enterprise profitability which currently stands at $4.46/DSE for those southern producers adopting new pasture and forage crops.

The KPI for this case study is expressed in terms of dry sheep equivalents (DSE) given that investment in pasture will benefit southern sheep, goat and beef enterprises. The KPI was developed with MLA Feedbase Investment Program managers in 2011.

Benefit estimation

Assumptions used to estimate returns from investing in the 'new breeding methods to improve pasture and forage crop productivity, quality and persistence' are shown in the table. The case study draws on analysis completed by AgEconPlus for the MLA Fodder Investment Program.

Table 2.12 Summary of assumptions – Pasture and forage trait breeding

Variable	Assumption	Source
Maximum livestock DSE that will adopt research outcomes	78.45 million DSE	Consultant assumption following discussion with MLA Feedbase Investment Program managers
Current red meat enterprise profitability ($/DSE)	$4.46/DSE	Holmes Sackett 2010
Increase in red meat enterprise profit adopting outputs from pasture and forage trait breeding	20%	As per Feedbase Investment Program Benefit Cost Analysis
Year when benefit first realised	2025	Consultant estimate of 10 years after plan completion
Year when benefit decays to zero	2035	Consultant assumption following discussion with MLA Feedbase Investment Program managers
Probability of research success	50%	Consultant estimate

Source: FIP Benefit Cost Analysis 2011

Results

Benefit cost analysis results associated with 'new pasture and forage breeding methods' are summarised in Table 2.13. The 'worst case' scenario assumes a halving of maximum livestock DSE that will adopt research outcomes.

Table 2.13 Benefit cost analysis results (discount rate 7%, 25 years)

Criterion	'Most Likely'	'Worst Case'
Present value of benefits ($' million)	28.30	14.15
Present value of costs ($' million)	2.30	2.30
Net present value ($' million)	26.00	11.85
Benefit cost ratio	12.31	6.15
Internal rate of return (%)	24.82	19.54
Modified Internal Rate of Return (%)	14.31	12.24

This initial analysis results in a favourable BCR.

2.6 Northern beef supplementary feeding

Case study description and target KPIs

Delivery of this investment will address:

- Development of new supplements / new products which are more cost effective, improving existing supplement strategies for growing and breeding cattle in northern Australia (improving timing and effectiveness); and developing better delivery methods which are more cost effective, more reliable and may include the use of remote management technologies (MLA draft 3.1 Business Plan).

Target KPI for this investment is:

- A 10% reduction in the three year average cost of fodder on an average northern beef farm. Three year average required to at least partially negate the impact of drought.

Table 2.14 Cost of fodder northern beef industry average farm

Farm Cash Costs – Fodder	$
2010	24,634
2011	12,650
2012	11,200
Average	**16,161**

Source: ABARES June 2012, Table 4 page 12

Benefit Estimation

Assumptions used to estimate returns from investing in 'northern beef supplementary feeding' are shown in the table.

Table 2.15 Summary of assumptions – Northern beef supplementary feeding

Variable	Assumption	Source
Number of beef cattle farms in northern Australia	9,225 farms	ABARES data (ABARES 2012 Table 2, page 4).
Percentage of northern beef farms adopting research outcomes	25%	Consultant estimate
Average cost of fodder per northern Australian beef farm	$16,161/farm	See table above
Reduction in the cost of supplementary feeding as a result of adopting outputs from this investment	10%	Consultant estimate
Year when benefit first realised	2025	Consultant estimate of 10 years after plan completion
Year when benefit decays to zero	No decay anticipated	Consultant estimate after consideration of the strategy
Probability of research success	50%	Consultant estimate

Results

Benefit cost analysis results associated with 'northern beef supplementary feeding' are summarised in Table 2.16. The 'worst case' scenario assumes a halving of the adoption rate.

Table 2.16 Benefit cost analysis results (discount rate 7%, 25 years)

Criterion	'Most Likely'	'Worst Case'
Present value of benefits ($' million)	12.76	6.38
Present value of costs ($' million)	1.50	1.50
Net present value ($' million)	11.26	4.88
Benefit cost ratio	8.52	4.26
Internal rate of return (%)	21.26	16.25
Modified Internal Rate of Return (%)	13.21	11.16

This initial analysis results in an acceptable BCR.

2.7 Feed grain efficiency in feedlots

Case Study Description and Target KPIs

This investment will include:

- Priority requirements for feed grain R&D
- Net feed intake testing in Beef Information Nucleus animals
- Further investment in grain devitalisation.

The MLA Feedlot Program RD&E Strategic Plan 2011 – 2016 (MLA 2010) sets these investments within priorities that include 'ability to assign a value to weather damaged grain based on true energy value', 'ability to assess the nutritive value of

grain and mixed rations', 'improved nutrients to ruminants from specific grains' and 'improved cereal grin varieties'.

Target KPI for this investment is:

- A 5% reduction in the long term average cost of grain at large and progressive feedlots (consultant estimate). Long term average cost of grain required to at least partially negate the impact of drought on grain prices.

Benefit estimation

Assumptions used to estimate returns from investing in 'feed grain efficiency in feedlots' are shown in the table.

Table 2.17 Summary of assumptions – Feed grain efficiency in feedlots

Variable	Assumption	Source
Capacity of Australian feedlots over 10,000 head – large feedlots who are likely to be in a position adopt research outputs	647,488 head	ALFA / MLA Feedlot Survey August 2012.
Expenditure on grain by those who will adopt research outputs	$246 million	Consultant data based on average expenditure on grain of $9.5 million for a feedlot with capacity of 25,000 head
Saving in grain cost resulting from successful research	5%	Estimate based on the above KPI
Year when benefit first realised	2025	Consultant estimate of 10 years after plan completion
Year when benefit decays to zero	No decay anticipated	Consultant estimate after consideration of the strategy
Probability of research success	50%	Consultant estimate

Results

Benefit cost analysis results associated with 'feed grain efficiency in feedlots' are summarised in Table 2.18. The 'worst case' scenario assumes a halving of the assumed grain cost saving.

Table 2.18 Benefit cost analysis results (discount rate 7%, 25 years)

Criterion	'Most Likely'	'Worst Case'
Present value of benefits ($' million)	21.06	10.53
Present value of costs ($' million)	4.12	4.12
Net present value ($' million)	16.94	6.41
Benefit cost ratio	5.11	2.56
Internal rate of return (%)	15.50	12.52
Modified Internal Rate of Return (%)	11.69	9.67

This initial analysis results in an acceptable BCR.

2.8 Pasture variety testing

Case study description and target KPIs

This investment will include (MLA Feedbase Investment Program 2011):

- Pasture species evaluation - when delivered Australian meat producers will be able to increase productivity and profitability by 10% through making informed choices on pasture technologies based on robust and accurate description of these technologies against key drivers of profitability and productivity.
- Existing and active breeding programs - when delivered Australian meat producers will be able to increase productivity and profitability by 15% through the more rapid breeding of cultivars and the incorporation of novel traits and attributes into these cultivars.
- New and novel pasture species - when delivered Australian meat producers will be able to increase productivity and profitability by greater than 15% in certain parts of their business through the incorporation of novel species into their feedbase.

The KPI for this case study is expressed in terms of DSE given that investment in pasture will benefit southern sheep, goat and beef enterprises. The case study draws on analysis completed by AgEconPlus for the MLA Fodder Investment Program.

Benefit estimation

Assumptions used to estimate returns from investing in ‘pasture variety testing’ are shown in the table.

Table 2.19 Summary of assumptions – Pasture variety testing

Variable	Assumptions for Species Evaluation	Assumptions for Existing and Active Breeding Programs	Assumptions for New and Novel Pasture Species	Source
Maximum livestock DSE that will adopt research outcomes	81.64 million DSE	78.45 million DSE	52.89 million DSE	Consultant assumption following discussion with MLA Feedbase Investment Program (FIP) managers
Current red meat enterprise profitability ($/DSE)	$4.46/DSE	$4.46/DSE	$4.46/DSE	Holmes Sackett 2010
Increase in red meat enterprise profit attributable to investment success	10%	15%	20%	As per Feedbase Investment Program Benefit Cost Analysis
Year when benefit first realised	2025	2025	2030 (new species take longer to commercialise)	Consultant estimate used in the FIP
Year when benefit decays to zero	2035	2035	2050	Consultant estimate used in the FIP
Probability of research success	50%	50%	30% (more risk associated with new species)	Consultant estimate

Source: FIP Benefit Cost Analysis 2011

Results

Benefit cost analysis results associated with 'pasture variety testing' are summarised in Table 2.20. Under the 'worst case' scenario the increase in red meat enterprise profit attributable to investment success is halved.

Table 2.20 Benefit cost analysis results (discount rate 7%, 25 years)

Criterion	'Most Likely'	'Worst Case'
Present value of benefits ($' million)	32.53	16.27
Present value of costs ($' million)	3.64	3.64
Net present value ($' million)	28.89	12.63
Benefit cost ratio	8.94	4.47
Internal rate of return (%)	21.60	16.63
Modified Internal Rate of Return (%)	13.35	11.30

This initial analysis results in an acceptable BCR.

2.9 Phosphorus on pastures

Case study description and target KPIs

Delivery of this investment will address:

- Phosphorus reactions and fluxes in pasture
- Phosphorus efficient legume pasture systems (i.e. clovers and lucerne)
- An assessment and benchmarking of phosphorus.

This group of investments will identify the factors which limit the supply and use of soil phosphorus and provide resolutions which will allow the more effective, efficient and economic use of phosphorus for pasture production. The investment will also deliver phosphorus efficient pasture systems.

Target KPI for this investment is:

- Phosphorus efficient pasture legumes in highly productive temperate pastures using up to 30% less phosphorus fertiliser (MLA 3.1 On Farm Productivity Business Plan).

The case study draws on analysis completed by AgEconPlus for the MLA Fodder Investment Program.

Benefit estimation

Assumptions used to estimate returns from investing in 'phosphorus on pastures' are shown in the table.

Table 2.21 Summary of assumptions – Phosphorus on pastures

Variable	Assumption	Source
Maximum livestock DSE that will adopt research outcomes	90.25 million DSE	Consultant assumption following discussion with MLA Feedbase Investment Program managers
Current red meat enterprise profitability ($/DSE)	$4.46/DSE	Holmes Sackett 2010
Increase in red meat enterprise profit adopting outputs from pasture and forage trait breeding	20%	As per Feedbase Investment Program Benefit Cost Analysis
Year when benefit first realised	2025	Consultant estimate of 10 years after plan completion
Year when benefit decays to zero	2035	Consultant assumption following discussion with MLA Feedbase Investment Program managers
Probability of research success	50%	Consultant estimate

Source: FIP Benefit Cost Analysis 2011

Results

Benefit cost analysis results associated with 'phosphorus on pastures' are summarised in Table 2.22. Under the 'worst case' scenario the increase in red meat enterprise profit attributable to investment success is halved.

Table 2.22 Benefit cost analysis results (discount rate 7%, 25 years)

Criterion	'Most Likely'	'Worst Case'
Present value of benefits ($' million)	21.70	10.85
Present value of costs ($' million)	3.26	3.26
Net present value ($' million)	18.44	7.59
Benefit cost ratio	6.66	3.33
Internal rate of return (%)	20.13	15.10
Modified Internal Rate of Return (%)	12.33	10.35

This initial analysis results in an acceptable BCR.

2.10 Individual animal management in sheep

Case study description and target KPIs

Delivery of this investment will address individual animal identification and management in sheep. CED Consulting (April 2012) identified strong industry support for the role of individual animal identification and management with benefits including:

- Improved information delivering increased productivity and efficiency – an economic benefit realised by lamb producers and the supply chain.

- Improved market access – economic benefit realised by lamb producers and the supply chain and associated with individual animal traceability.
- Increased biosecurity – including improved capacity to manage endemic and exotic disease within flocks.

This case study draws on analysis completed by AgEconPlus for the MLA Red Meat Co-Investment Partners: Lamb Supply Chain & Animal Information RD&E Plan for which the following analysis framework was developed:

Table 2.23 Benefits for industry – Individual animal management in sheep

Benefit Type	Industry Impact
Improved information delivering increased productivity and efficiency	• Additional sales at premium prices • Production cost savings
Improved market access	• Additional sales at premium prices
Increased biosecurity	• Avoided losses associated with exotic disease events (additional sales) • Production cost savings

Source: MLA Red Meat Co-Investment Partners: Lamb Supply Chain & Animal Information RD&E Plan

Additional lamb sales at premium prices dominate expected industry impacts and this benefit is quantified in the case study.

Benefit estimation

Assumptions used to estimate returns from investing in 'individual animal management in sheep' are shown in the table.

Table 2.24 Summary of assumptions – Individual animal management in sheep

Variable	Assumption	Source
Price premium paid to lamb producers as a result of better information on individuals and meeting processor specifications	$0.22/kg	WAMMCO Western Australia data provided by MLA. The premium is the actual payment made to lamb producers for complying stock.
Average slaughter weight of Australian lambs	21.8kg/head	ABARES 2011 – average carcase weight 2005 to 2010.
Per head gross benefit of adopting investment outcomes	$4.80/head	Premium per kg ($0.22/kg) X average slaughter weight (21.8 kg).
Cost per lamb graded	$1.50/head	Consultant estimate
Australian lamb kill	19.6 million head	ABARES 2011 – average of turnoff for slaughter 2005 to 2010
Percentage of the Australian lamb kill adopting investment outcomes and receiving the price premium	15%	Consultant assumption
Year when benefit first realised	2018	Consultant estimate of 5 years after plan completion – benefit communicated and new systems adopted
Year when benefit decays to zero	2031	Consultant estimate after consideration of the strategy
Probability of research success	80%	Consultant estimate

Source: MLA Red Meat Co-Investment Partners: Lamb Supply Chain & Animal Information RD&E Plan

Results

Benefit cost analysis results are summarised in the table. Under the 'worst case' scenario the percentage of the Australian lamb kill adopting investment outcomes and receiving the price premium is halved.

Table 2.25 Benefit cost analysis results (discount rate 7%, 25 years)

Criterion	'Most Likely'	'Worst Case'
Present value of benefits ($' million)	35.56	17.78
Present value of costs ($' million)	4.08	4.08
Net present value ($' million)	31.49	13.70
Benefit cost ratio	8.73	4.36
Internal rate of return (%)	33.22	23.32
Modified Internal Rate of Return (%)	13.83	11.60

This initial analysis results in an acceptable BCR.

2.11 Goat program communication and extension

Case study description and target KPIs

This investment is about sharing information and ideas with current and potential goat producers and will include:

- Analysis and planning – understanding the needs and views of current and potential producers to ensure communication is effective
- Producer engagement – maintaining the interest of producers and developing two-way communication channels.

Outcomes from implementation of this strategy will include 'favourably evaluated communications plans and case studies' (MLA Goatmeat Industry RD&E Strategy 2012). The benefit cost analysis draws on AgEconPlus's evaluation of the MLA Goatmeat Strategy August 2012.

Benefit estimation

Assumptions used to estimate returns from investing in 'goat program communications and extension' are shown in the table.

Table 2.26 Summary of assumptions – Goat program communications and extension

Variable	Assumption	Source
Australian goat turnoff for slaughter	1.8 million head	Swain 2010
Increase in turnoff attributable to communication and extension program success	0.5% (9,000 head)	Consultant estimate after review of the two key elements of this investment and the budget available. Estimate confirmed through goat industry consultation in July 2012
Current goatmeat enterprise gross margin	$38.46/head	See Table 2.9 above – average of rangeland and agricultural production returns.
Attribution of the improvement to MLA's investment	85%	Based on proposed share of budget by MLA and partners detailed in the Australian Goatmeat Industry RD&E Strategy.
Likely research adoption rate	25%	Consultant estimate after goat industry consultation in July 2012
Year when benefit first realised	2014	Consultant estimate after review of strategy description
Year in which maximum adoption achieved	2017	Consultant estimate after review of strategy description
Year when benefit decays to zero	2024	Consultant estimate after consideration of the strategy
Probability of research success	50%	Consultant estimate

Source: MLA Goatmeat Strategy Benefit Cost Analysis 2012

Results

Benefit cost analysis results associated with 'goat program communications and extension' are summarised in Table 2.27. Under the 'worst case' scenario the Increase in turnoff attributable to communication and extension program success is halved.

Table 2.27 Benefit cost analysis results (discount rate 7%, 25 years)

Criterion	'Most Likely'	'Worst Case'
Present value of benefits ($' million)	0.31	0.15
Present value of costs ($' million)	0.21	0.21
Net present value ($' million)	0.10	(0.60)
Benefit cost ratio	1.44	0.72
Internal rate of return (%)	15.98	0.19
Modified Internal rate of return (%)	8.55	5.80

This initial analysis results in a modest positive BCR under the 'Most likely' scenario.

2.12 Feedlot program communication and extension

Case study description and target KPIs

This investment addresses the Feedlot Program RD&E Strategic Plan 2011 – 2016 strategy MLA 2010):

- 4.3.1 Increasing adoption of innovation – in addition to established industry communication and extension channels the feedlot industry will distribute research report summaries via email and webinars, provide enhanced information via the MLA website, demonstrate research outcomes at Tullimba and Gatton, prepare and distribute best management practice handbooks, and demonstrate the returns from R&D through economic evaluation (Feedlot Program RD&E Strategy 2011-2016).

Delivered this strategy is expected to lower feedlot industry cost of production by 0.05% (consultant assumption).

Benefit estimation

Assumptions used to estimate returns from investing in 'feedlot program communication and extension'' are shown in the table.

Table 2.28 Summary of assumptions – Feedlot communications and extension

Variable	Assumption	Source
Capacity of Australian feedlots over 10,000 head – large feedlots who are likely to adopt research outputs	647,488 head	ALFA / MLA Feedlot Survey August 2012.
Total cost of production of feedlots who will adopt communication and extension outputs	$1,173 million	Consultant data based on average total cost of $45.3 million for a feedlot with capacity of 25,000 head
Saving in cost of production resulting from successful uptake of innovation through communication and extension	0.05%	Consultant assumption i.e. that successful investment in MLA Feedlot RD&E communication and extension between 2011 and 2016 will decrease the long term average cost of feedlot production by 0.05%
Attribution of the improvement to MLA's investment	50%	Based on proposed share of investment i.e. 50% MLA and 50% co-contributor funding
Likely research adoption rate	50%	Consultant estimate based on comprehensive nature of proposed communication and extension program
Year when benefit first realised	2012	Consultant estimate after reviewing the strategy that commenced investment in 2011
Year maximum adoption achieved	2017	Consultant estimate – five years after commencement of investment and one year after completion.
Year when benefit decays to zero	2022	Consultant estimate
Probability of research success	50%	Consultant estimate

Results

Benefit cost analysis results associated with 'feedlot program communications and extension' are summarised in Table 2.29. Under the 'worst case' scenario the saving in cost of production is halved.

Table 2.29 Benefit cost analysis results (discount rate 7%, 25 years)

Criterion	'Most Likely'	'Worst Case'
Present value of benefits ($' million)	0.36	0.18
Present value of costs ($' million)	0.09	0.09
Net present value ($' million)	0.27	0.09
Benefit cost ratio	3.92	1.96
Internal rate of return (%)	66.53	27.07
Modified Internal Rate of Return (%)	13.09	9.41

This initial analysis results in an acceptable BCR.

2.13 Cross check with Rendell – McGuckian model

To provide an additional measure of confidence in the results obtained from the case study analysis, a subset of case studies was analysed using the MLA-AWI Rendell McGuckian model. The subset was selected to include a sheepmeat, a southern beef and a northern beef example. Results achieved from the two modelling approaches are summarised in Table 2.30.

Table 2.30 Cross check of case study results with Rendell-McGuckian model results

Case Study	AgEconPlus Analysis	Rendell-McGuckian Model
Improving reproduction rates in the Australian ewe flock		
Net present value ($' million)	57.68	60.70
Benefit cost ratio	13.69	13.66
Internal rate of return (%)	25.80	22.00
Modified Internal rate of return (%)	15.31	N/a
Increasing beef compliance in southern production systems		
Net present value ($' million)	13.06	9.82
Benefit cost ratio	7.21	5.36
Internal rate of return (%)	42.50	17.00
Modified Internal rate of return (%)	13.21	N/a
Northern beef supplementary feeding		
Net present value ($' million)	11.26	30.01
Benefit cost ratio	8.52	8.15
Internal rate of return (%)	21.26	21.00
Modified Internal rate of return (%)	13.21	N/a

There is no appreciable difference in results achieved using the two approaches for the 'Improving reproduction rates in the Australian ewe flock' case study.

Differences in the 'Increasing beef compliance in southern production systems' are due to the use of a more sophisticated adoption profile in the Rendell-McGuckian model compared to that adopted by AgEconPlus. The AgEconPlus approach is based on a ProAnd Associates (2012) analysis prepared in consultation with the Australian red meat processing sector.

Differences in analysis results for 'Northern beef supplementary feeding' are due to the use of different data sources. The Rendell-McGuckian model works off a fixed enterprise based gross margin while AgEconPlus has used ABARES whole farm survey data.

Results achieved by AgEconPlus are comparable to those delivered with the Rendell-McGuckian model.

3 Whole program evaluation and conclusions

3.1 Threshold analysis

The twelve case studies analysed in Chapter 2 provide insight on whether benefits exceed costs for a range of proposed business plan investments. The purpose of the threshold analysis is to test whether returns from the twelve case studies exceed total business plan investment costs.

Total business plan investment costs are summarised in Table 3.1. Co-contributions are assumed to double MLA's proposed investment.

Table 3.1 Proposed MLA and total investment in '3.1 increasing productivity on-farm'

Strategy	2012-13	2013-14	2014-15	PV
3.1.1 Enhanced rates of genetic improvement in flock, herd and feedbase performance	5,951,000	5,951,000	5,951,000	15,617,305
3.1.2 Optimise productivity in grazing and feedlot systems	7,645,000	7,645,000	7,645,000	20,062,896
3.1.3 Develop and implement information, resource and precision livestock management technologies	1,631,000	1,631,000	1,631,000	4,280,259
3.1.4 Producer participatory R&D to develop and evaluate new technologies.	1,068,000	1,068,000	1,068,000	2,802,770
MLA Total Cost	**16,295,000**	**16,295,000**	**16,295,000**	**42,763,230**
Anticipated co-contributions	**16,295,000**	**16,295,000**	**16,295,000**	**42,763,230**
Grand Total Cost	**32,590,000**	**32,590,000**	**32,590,000**	**85,526,460**

Source: MLA June 2012

Using a discount rate of 7%, total proposed investment in the 3.1 business case has a present value cost of $85.5 million.

The present value benefit generated from the twelve case studies analysed in Chapter 2 is $254.7 million and is shown in Table 3.2.

Table 3.2 Summary of case study costs and benefits ($ million present value)

Case Study	Costs (PV)	Benefits (PV)
Improving reproduction rates in the Australian ewe flock	4.54	62.22
Increasing beef compliance in southern production systems	2.10	15.16
Reproductive performance northern beef-genetics & management	5.15	30.80
Ensuring goat performance through genetics	0.14	0.33
New pasture and forage crop breeding methods	2.30	28.30
Northern beef supplementary feeding	1.50	12.76
Feed grain efficiency in feedlots	4.12	21.06
Pasture variety testing	3.64	32.53
Phosphorus on pastures	3.26	21.70
Individual animal management in sheep	4.08	35.56
Goat program communication and extension	0.21	0.31
Feedlot program communication and extension	0.09	0.36
Case Study Total	**31.13**	**261.09**

From the above tables it can be seen that forecast case study benefits ($261.09 million) exceed total business plan investment costs ($85.5 million) by more than $175 million.

Furthermore, total MLA and co-contributor investment in the case studies of $31.13 million meaning that returns from a further $54 million, some 64% of the total, are outside the scope of the case study analysis and will reasonably be expected to add to total industry benefit delivered as a result of business plan investment.

3.2 Study conclusions

The purpose of this study was to complete a benefit cost analysis of MLA 3.1 increasing productivity on-farm. The project was delivered by selecting twelve case studies from across the scope of the business plan. The twelve case studies accounted for approximately 36% of total planned investment. Returns from this 36% of total planned investment are sufficient to justify delivery of the total business plan.

Benefit cost analysis results are summarised in Table 3.3.

Table 3.3 Benefit cost analysis results – 12 case studies (discount rate 7%, 25 years)

Criterion	'Most Likely'
Present value of benefits ($' million)	254.71
Present value of costs ($' million)	31.13
Net present value ($' million)	223.58
Benefit cost ratio	8.18
Internal rate of return (%)	23.76
Modified Internal rate of return (%)	12.93

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