

final report

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Benefit Cost Analysis (BCA) of the MLA Majority Market Programs Making More from Sheep and More Beef from Pastures

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EXECUTIVE SUMMARY

The following report presents an analysis of the benefits and costs of investment by MLA, AWI and state agencies in phase II of the MLA Majority Markets Program (MMP). The investment period included the three financial years from 2010/2011 to 2012/2013, and the time horizon for future expected benefits was 25 years from the final year of investment.

The benefits of investment under a 'with investment' scenario were assessed in terms of the dollar benefits as a result of expected adoption of nominated intended and unintended practice changes by farmers attending MMfS and MBfP events as reported in the MMP MLA event databases. The dollar benefits for these practice changes were based on per head benefits calculated for 50 actual farm case study practice changes as part of the MLA 'Assessing the Impact of MLA's Southern Majority Market Programs' project. Dollar per head benefits were then multiplied by the number of livestock per business adopting a practice change.

The stream of expected benefits resulting from adoption of practice changes in the 'with investment' scenario was then compared to the expected benefits of adoption of practice changes in a 'without investment', or counterfactual scenario. The difference between the 'with' and 'without' investment benefit streams was then compared to the investment costs to generate investment criteria results for net present value, benefits cost ratio and internal rate of return.

Preliminary results from the 'Assessing the Impact of MLA's Southern Majority Market Programs' project phone surveys and case study evaluations formed the basis for most of the major adoption assumptions used in the analysis. A sensitivity analysis was undertaken to assess the impact on investment criteria to changes in these adoption assumptions.

The analysis revealed that using a 7% discount rate, over a 25 year time horizon a B:C ratio of 5.0 was generated as result of investment in the MMP as a whole. The B:C ratios for the MMfS and MBfP programs over the same time horizon were 5.6 and 4.7 respectively. Over a 20 year time horizon the B:C for the MMP was 4.7, and for the MMfS and MBfP programs B:C ratio was 5.3 and 4.4 respectively. The NPV generated as a result of investment in the MMP over a 25 year time horizon was \$35.45 million, with \$13.98 million generated from MMfS and \$21.47 million from MBfP. Over a 20 year time horizon the MMP NPV was \$32.98 million, comprising \$13.03 million from MMfS and \$19.95 million from MBfP.

For the MMfS program, the majority of benefits resulted from practice changes made in the area of animal production, which was largely representative of changes relating to ewe nutrition and fertility management, and lamb survival. For the MBfP program over a quarter of benefits resulted from practice changes made in the area of pastures, which included grazing management strategies and pasture improvement, followed by improvements in animal production and genetics.

Approximately half of the benefits resulting from adoption of practices in the MMfS program resulted from farmers attended category B events, with 20% of benefits resulting from attendance at category C events. For the MBfP program almost 60% of benefits were derived from farmers attending category A events and 15% from attendance at category C events.

The sensitivity analysis of major adoption assumptions indicated that adoption under the 'without' investment scenario would need to rise above 75% of the adoption rate in the 'with' investment scenario before negative returns would result. The sensitivity analysis also revealed

that the adoption rate of intended and unintended practice changes would need to fall below about 15% before negative returns on investment were generated.

In addition to quantifying the economic impact of adoption of practice changes, the case study evaluations undertaken as part of the 'Assessing the Impact of MLA's Southern Majority Market Programs' project also identified a range of environmental and management implications associated with adoption of practice changes. The project reported only one producer who reported a negative environmental impact associated with a farm practice change, with the majority reporting no detrimental environmental impacts. Positive environmental impacts reported were mainly improvements in ground cover/less erosion, improved weed management and improved soil health. From a human resource perspective, the case study evaluations revealed mostly positive impacts associated with adoption of practice changes, mainly in the areas of improved skills, knowledge and confidence, reduced stress levels, and improved OH & S.

1.0 INTRODUCTION

Meat and Livestock Australia (MLA) and Australian Wool Innovation (AWI) have developed and funded the delivery of the Majority Markets Program (MMP) with in-kind and co-contribution support from each state to provide best management practice packages of information, tools and learning opportunities for Australian sheep and beef producers to assist them to increase the productivity and profitability of their businesses.

At the completion of the first phase of the project, a benefit cost analysis (BCA) conducted by GHD Hassell in 2009 reported benefit cost ratios of 3.9 for Making More from Sheep (MMfS) and 4.4 for More Beef from Pastures (MBfP) over a 20 year time horizon. The respective programs have now reached the end of the second phase of delivery and thus a second BCA is required to establish the impact of program investment. This BCA aligns well with the 'Assessing the Impact of MLA's Southern Majority Market Programs' project currently underway and most of the major assumption for this analysis are based on preliminary data generated from this project. The following report presents the results of this analysis, including a discussion of environmental and human resource/management impacts and a sensitivity analysis.

2.0 METHODOLOGY

2.1 General Approach

The approach in undertaking this BCA was to evaluate the benefits of phase II of the MMP in terms of expected future productivity of farmers who were participants in MMfS and MBfP events in a 'with investment' scenario, compared to the productivity of the same businesses in a 'without investment', or counterfactual scenario. The costs of the investment were the expenditure from MLA and AWI (MMfS) in addition to state co-investment and in-kind dollars. The time frame for investment was the three financial years 2010/2011 to 2012/2013, and the time-frame for benefits was 25 years from the final year of investment.

The difference between the benefits for the 'with investment' and 'without investment' scenarios were valued over the 25 year period, and this net benefit stream was then matched with annual investment over the period 2010/2011 to 2012/2013.

All past dollars were expressed in 2012/2013 dollar terms using the CPI and all costs and benefits were discounted or compounded to present value terms using a discount rate of 7%. This discount rate was chosen in accordance with the requirements of the MLA board. Results are presented in terms of Net Present Value (NPV), being the difference between the present value of benefits and the present value of costs, Benefit-Cost Ratio (B:C ratio), being the ratio of the present value of benefits to the present value of costs, and Internal Rate of Return (IRR), being the break-even discount rate.

A sensitivity analysis was undertaken to evaluate the sensitivity of these investment criteria to the timeframe for investment and several of the key assumptions.

2.2 Valuing Benefits

For the 'with investment' scenario the benefits of farmer attendance at MMfS and MBfP events has been quantified by multiplying the number of ewes/cows for businesses adopting an identified practice change by a \$ per head benefit of the practice change. The MMfS and MBfS MLA databases containing event data up until the end of March 2013 were used to estimate

number of businesses and relevant number of livestock per business impacted by practice changes. Where a producer did not provide cow/sheep numbers, average number of head per business for the year and state were used. Information regarding events run since the end of March and planned events up until the end of June 2013 was obtained from state co-ordinators and also included in the analysis.

Per Head Benefits of Practice Changes

Intended practice changes recorded in the MLA databases for MMfS and MBfP participants were categorised into broad practice change types based on the details provided by individual participants in the MLA databases. The dollar per head benefits of these practice change categories were the preliminary figures from 50 farm case study practice change evaluations (27 MBfP and 23 MMfS) undertaken as part of the MLA 'Assessing the Impact of MLA's Southern Majority Market Programs' project. The figures are preliminary in that they are based on information and data collected during farm visits, however due to time restrictions final figures have yet to be validated by individual farmers.

The results of these case study practice change evaluations will be reported in detail as part of the 'Assessing the Impact of MLA's Southern Majority Market Programs' project, however in summary the expected productivity benefits of practice changes have been either quantified by the farmers involved, or where there was uncertainty in expected likely productivity impacts from the farmer, research data and/or consultant and expert opinions were utilised.

Five year average beef and sheep prices provided by MLA for a range of livestock categories were used to quantify the income impacts of practice change productivity changes and actual or expected costs of implementing the change were based on farmer inputs provided.

Tables 1 and 2 below present the benefit per head figures used in the analysis for MBfP and MMfS practice change categories respectively.

Table 1: Estimated per head benefits for MBfP practice change categories (2012/2013 \$).

Practice Change Category	\$ per Head Benefit
General/Business Management	\$9.88
Animal Health	\$9.65
Marketing	\$9.39
Genetics	\$8.71
Animal Production	\$12.03
Pastures	\$12.30
Animal Handling	\$7.21

Table 2: Estimated per head benefits for MMfS practice change categories (2012/2013 \$)

Practice Change Category	\$ per Head Benefit
General/Business Management	\$1.93
Animal Health	\$0.95
Genetics	\$1.51
Animal Production	\$2.30
Pastures	\$2.95
Predator Control	\$1.93
Marketing	\$1.93

No farm case study figures were available for MMfS marketing or predator control practice changes so average benefit per head was used.

Table 3 below provides a summary of the most common types of practice changes represented by each category.

Table 3: Summary of the main types of practice changes represented by each practice change category.

Practice Change Category	Description of Types of Changes
General/Business Management	General - farms who indicated an intention for practice change however provided no details of the type of change intended. Business Management – benchmarking, budgeting, cost of production analysis, assessing farm finances.
Animal Health	Disease management, trace element/mineral deficiencies, worm and lice management.
Genetics	Use of ASBVs/EBVs/indexes for targeted breeder selection to improve identified quality and production outcomes, livestock breed, and culling strategies.
Animal Production	Male and female fertility management, animal nutrition, timing of key events such as lambing/calving/shearing, enterprise mix, lamb survival.
Pastures	Soil health, fertiliser/lime application, grazing management strategies, pasture improvement.
Marketing	Direct marketing, timing of livestock sales, meeting market specifications, EU/MSA accreditation, market intelligence, price risk management (forward selling/contracts).
Predator control (sheep)	Management of wild dog and fox predation.

2.3 Adoption

The MLA MMfS and MBfP event databases (current up to end of March 2013) in addition to information on actual and planned events between end of March and end of June 2013 were used to identify the number of farmers assumed to have made a practice change and the number of cattle/sheep impacted by the change in the ‘with investment’ scenario.

Of the total number of participants who responded ‘Y’ to intended practice change in the databases approximately 65% were included in the analysis, with the others omitted for the following reasons:

- Where more than one person from the same business indicated the same intended practice change only one was included.
- Where an individual indicated the same intended practice change for more than one event only one was included.
- Where the individual had no land area managed and no sheep/beef numbers (non-farmers).
- Where the intended practice change related to continuation/affirmation of an existing management strategy/action.

- Where the intended practice change was considered unlikely to generate significant dollar benefits eg. 'improved safety of vaccination techniques'/'better record keeping'.
- Where the intended practice change was unclear/obscure eg. 'More planning', 'Be more business minded'.
- Where the intended practice change was not action based but rather a comment on the enjoyment of the day and/or new knowledge gained eg. 'Good venue and excellent speaker'.

'With Investment' Scenario

Table 4 below provides a summary of the key adoption assumptions made for the 'with investment' scenario and the basis for the values used.

Table 4: Summary of key 'With Investment' Scenario adoption assumptions.

Assumption	Value	Source
% intended & unintended practice change adoption	85%	'Assessing the Impact of MLA's Southern Majority Market Programs' project phone survey results.
% partial adoption of practice changes	30%	'Assessing the Impact of MLA's Southern Majority Market Programs' project phone survey results.
% adoption for 'Not Sure' responses to intended practice change	5%	Estimate of percentage of 'Not Sure' responses where participant does implement a practice change.
% 'spill over' adoption by farmers not attending MMP events.	5%	Author estimate (see explanation below).
% of producers responding 'Y' to practice change for events where responses were not recorded (including planned events to end of June 2013)	65%	Average 'Y' response rate for recorded events in MMfS and MBfP databases*.
% post implementation benefits attributable to MMP	75%	'Assessing the Impact of MLA's Southern Majority Market Programs' project phone survey results.

*Assumes no practice change intention for blank practice change responses from recorded events.

The results from the 'Assessing the Impact of MLA's Southern Majority Market Programs' project phone survey revealed that 85% of participants surveyed implemented either the intended (76%) or a different 'unintended' (9%) practice change nominated after attending a MMP event. However of these participants, approximately 70% fully adopted the change while the other 30% only partially adopted the change. For this analysis, and in the absence of any detail regarding degree of implementation, it has been conservatively assumed that the 30% of partial adopters received on average half of the potential benefits of a fully implemented practice change, resulting in an overall intended and unintended adoption rate of 70%.

The 'spill over' adoption benefits represent additional adoption that is likely to occur due to skills and knowledge gained by farm advisors, extension staff, agribusiness providers and

farmers attending MMP events that pass on advice/experiences to farmers not attending MMP events.

Results from the ‘Assessing the Impact of MLA’s Southern Majority Market Programs’ project phone survey indicated that there is a gap between the knowledge, skills, and motivation that results in a decision or intention to make a stated practice change, and the knowledge and skills required to effectively implement that change.

The survey found that “for a lot of farmers the event provided motivation, inspiration and reinforced views that the change was necessary”, however 9% of these farmers stated that the event did not provide the knowledge and skills needed to implement the change, and 29% responded that it only partly provided the required skills/knowledge for effective implementation. Thus these farmers had to seek additional advice/knowledge/skills from other sources in order to effectively implement their intended practice change. These other reported sources mainly included consultants/farm advisors, government extension staff, agribusiness service providers and other farmers.

The percentage of post implementation benefits attributable to the MMP assumption represents this gap between the knowledge/skills and motivation provided by attendance at MMP events resulting in a decision to make an intended practice change, and the skills/knowledge provided by attendance at the MMP event relative to what was/is required to effectively implement that change post event. Assuming 50% of the required skills/knowledge was gained by the 29% of respondents reporting ‘partial’ gain of required skills/knowledge for implementation from MMP event, plus the 62% who gained 100% of required knowledge/skills for implementation, the overall % post implementation benefits attributable to MMP was estimated at 75%.

The assumptions regarding the timing of adoption and dis-adoption of intended/unintended practice changes for the ‘with investment’ scenario are provided in table 5 below:

Table 5: Summary of key assumptions regarding timing of adoption and dis-adoption for the ‘With Investment’ scenario.

Assumption	Value	Source
% of changes where implementation of change commences in 1 st year after event attended with remainder in year 2.	50%	Estimate based on ‘Assessing the Impact of MLA’s Southern Majority Market Programs’ project phone survey and case study results.
% of farmers dis-adopting one year after implementation.	9%	Finding from ‘Assessing the Impact of MLA’s Southern Majority Market Programs’ project results.
% of farmers receiving full benefits of practice change in year of implementation.	20%	Estimate based on type of practice changes in MMP databases.
% of farmers receiving full benefits of practice change in year 2 after implementation.	20%	Estimate based on type of practice changes in MMP databases.
% of farmers receiving full benefits of practice change in year 3 after implementation.	30% MMfS 20% MBfP	Estimate based on type of practice changes in MMP databases.
% of farmers receiving full	30% MMfS	Estimate based on type of practice

benefits of practice change in year 5 after implementation.	40% MBfP	changes in MMP databases.
Annual dis-adoption after year 10	3.5%	Estimate resulting in 50% of farmers still utilising practice change in year 25.

Results from the 'Assessing the Impact of MLA's Southern Majority Market Programs' project phone survey revealed that 7% of producers who initially adopted a practice change later decided to dis-adopt, while a further 4% were unsure whether they would continue with implementation at the time of interview. Assuming half of those unsure producers decide to dis-adopt, a figure of 9% dis-adoption one year after implementation was utilised for this study.

Dis-adoption after year 10 represents the fact that farmers will begin to cease adopted management practices over time due to factors such as retirement (case study results to date indicate average farmer age range of 55-60), selling the farm, and replacing these practice changes with new and better ones over time. Other producers may simply decrease the intensity with which they utilise practice change management strategies due to winding back as they get older.

Counterfactual Scenario

For the counterfactual or 'without investment' scenario the following assumptions have been made:

- 30% of farmers who adopted a practice change in the 'with investment' scenario would have done so anyway if they hadn't attended the MLA event(s), however the lag for adoption would have been 2 years later.
- Same assumptions regarding dis-adoption and timing of benefits as described above also apply to the counterfactual scenario.

2.4 Investment Costs

Investment in the MMP program included MLA, and AWI for MMfS on a dollar for dollar basis, and state in kind/co-contribution dollars for delivery, co-ordination, planning and monitoring/evaluation. Tables 6 and 7 present the investment breakdown by source and financial year for MMfS and MBfP respectively.

Table 6: Investment in phase II of MMfS by source and financial year (nominal \$)

Source	2010/2011	2011/2012	2012/2013*
NSW	\$41,315	\$46,000	\$42,890
VIC	\$124,550	\$194,663	\$160,190
SA	\$36,664	\$107,144	\$8,0291
WA	\$9,216	\$6,912	\$18,432
QLD	\$14,000	\$73,094	\$223,062
TAS	\$11,844	\$3,644	\$10,022
Total State	\$237,589	\$431,457	\$534,887
MLA	\$161,113	\$370,232	\$268,137
AWI	\$161,113	\$370,232	\$268137
TOTAL ANNUAL	\$559,815	\$1,171,921	\$1,071,160

* Includes estimated expenditure to June 30th 2013.

Source: MLA and MMfS State Co-ordinators.

Table 7: Investment in phase II of MBfP by source and financial year (nominal \$)

Source	2010/2011	2011/2012	2012/2013*
NSW	\$72,971	\$118,469	\$61,349
VIC	\$600,000	\$600,000	\$600,000
SA	\$50,265	\$84,807	\$121,265
WA	\$147,360	\$217,680	\$161,120
TAS	\$31,300	\$37,650	\$38,000
Total State	\$901,895	\$1,058,606	\$981,734
MLA	\$908,899	\$714,941	\$771,410
TOTAL ANNUAL	\$1,810,794	\$1,773,547	\$1,753,143

* Includes estimated expenditure to June 30th 2013.

Source: MLA and MBfP State Co-ordinators.

3.0 RESULTS

Results are presented for the total investment in the MMP, and then for MMfS and MBfP separately. Results are also presented for total investment and for MLA investment alone. The attribution of the total benefits stream is based on the proportion of total costs in 2012/13 \$ terms contributed by MLA.

3.1 Majority Markets Program

Table 8 presents the return on total investment in the MMP and for MLA investment alone over 15, 20 and 25 year time horizons. MLA investment represented approximately 39% of total investment in the program.

Table 8: Investment criteria results for the MMP for MLA and total investment (7% discount rate)

Investment Return	NPV	B:C Ratio	IRR
15 Years			
Total Investment	\$28.31 M	4.2	37.0%
MLA Investment Only	\$11.18 M	4.2	36.5%
20 Years			
Total Investment	\$32.98 M	4.7	37.2%
MLA Investment Only	\$13.02 M	4.7	36.7%
25 Years			
Total Investment	\$35.45 M	5.0	37.3%
MLA Investment Only	\$14.00 M	5.0	36.8%

3.2 Making More from Sheep

Table 9 presents the investment returns from MMfS for total investment and MLA investment (29%) over three time horizons (7% discount rate).

Table 9: Investment criteria results from MMfS for MLA and total investment (7% discount rate)

Investment Return	NPV	B:C Ratio	IRR
15 Years			
Total Investment	\$11.25 M	4.7	42.9%
MLA Investment Only	\$3.22 M	4.7	42.5%
20 Years			
Total Investment	\$13.03 M	5.3	43.1%
MLA Investment Only	\$3.73 M	5.3	42.7%
25 Years			
Total Investment	\$13.98 M	5.6	43.1%
MLA Investment Only	\$4.00 M	5.6	42.7%

Figure 1 below reveals that animal production type practice changes represented over half of the benefits attributable to the MMfS program. Most of these type of changes related to ewe fertility management and lamb survival.

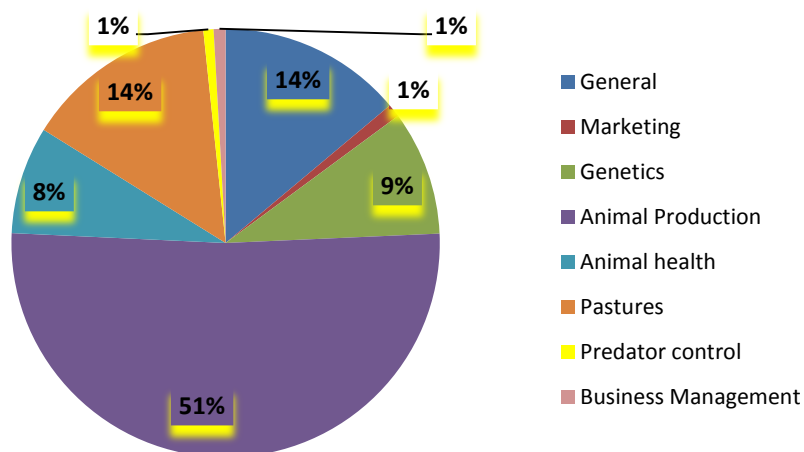


Figure 1: Percentage of benefits attributable to each practice change category.

General, or unspecified types of changes, and pasture related improvements together accounted for almost another third of benefits, followed by 10% from genetics and 7% from animal health.

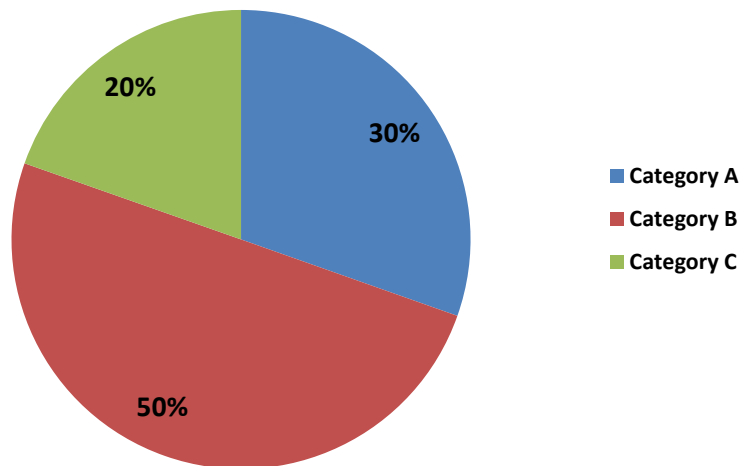


Figure 2: Percentage of practice change benefits attributable to MMfS event categories.

Figure 2 above reveals that 30% of benefits were derived from farmers attending category A events, 50% from attending category B events, and 20% from attending category C events.

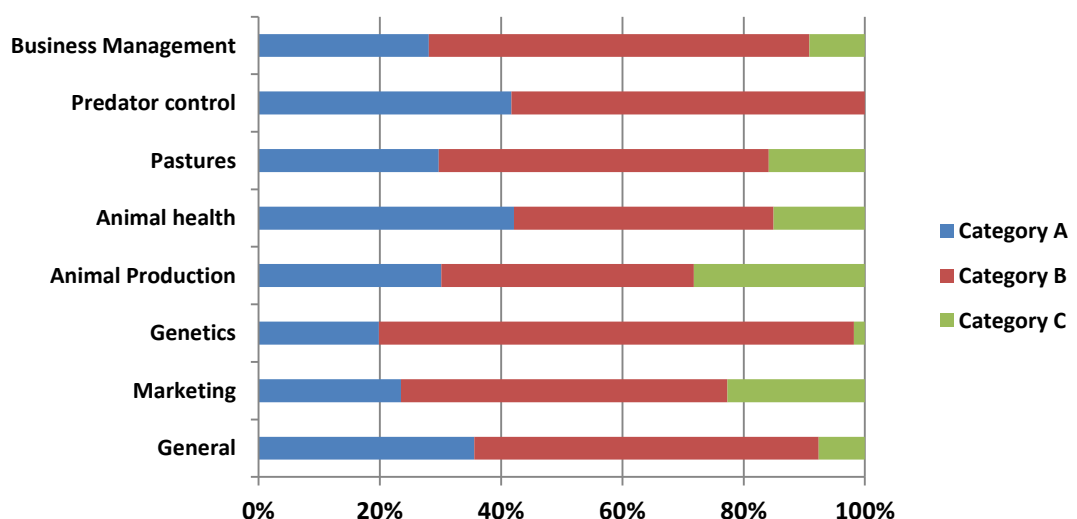


Figure 3: Percentage practice change benefits for practice change types by MMfS event category.

Figure 3 above presents the percentage benefits from each type of practice change attributable to category A, B and C events. Around 40% of benefits from both predator control and animal health practice changes resulted from category A events followed by around 35% from general category changes. The majority of predator control, business management, genetics and general type practice change benefits were attributable to category B events. Category C events represented relatively large proportions of benefits from the higher value practice change categories of animal production and pastures, in addition to benefits from marketing and animal health related practice changes.

3.3 More Beef from Pastures

Table 10 below presents the investment returns from MBfP for total investment and MLA investment (45%) over three time horizons (7% discount rate).

Table 10: Investment criteria results from MBfP for MLA and total investment (7% discount rate)

Investment Criteria	NPV	B:C Ratio	IRR
15 Years			
Total Investment	\$17.07 M	3.9	34.2%
MLA Investment Only	\$7.69 M	3.9	33.9%
20 Years			
Total Investment	\$19.95 M	4.4	34.4%
MLA Investment Only	\$8.99 M	4.4	34.1%
25 Years			
Total Investment	\$21.47 M	4.7	34.5%
MLA Investment Only	\$9.67 M	4.7	34.2%

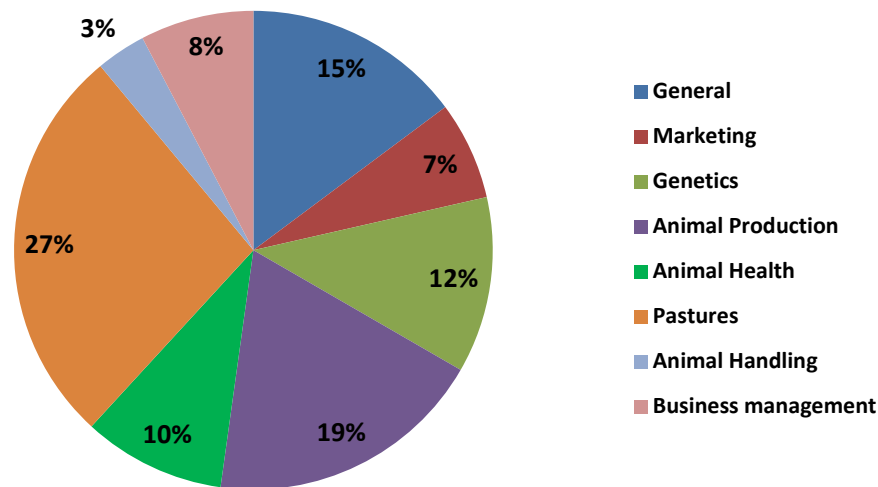


Figure 4: Percentage of benefits attributable to each practice change category.

Figure 4 above reveals that pasture based practice changes represented over a quarter of the benefits attributable to the MBfP program and animal production changes accounted for about one fifth of benefits. General, or unspecified type of changes, accounted for 15 percent of benefits, followed by 12% from genetics and 10% from animal health.

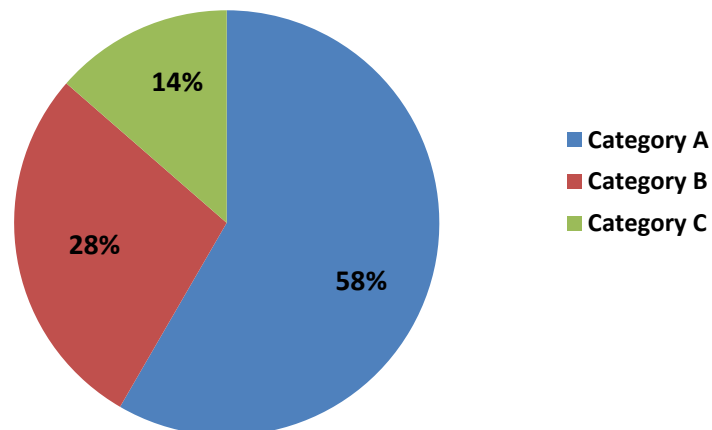


Figure 5: Percentage of practice change benefits attributable to MBfP event categories.

Figure 5 presents the relative benefits generated by different categories of events for each state. In total, approximately 58% of benefits were derived from farmers attending category A events, 28% from attending category B events, and 14% from attending category C events.

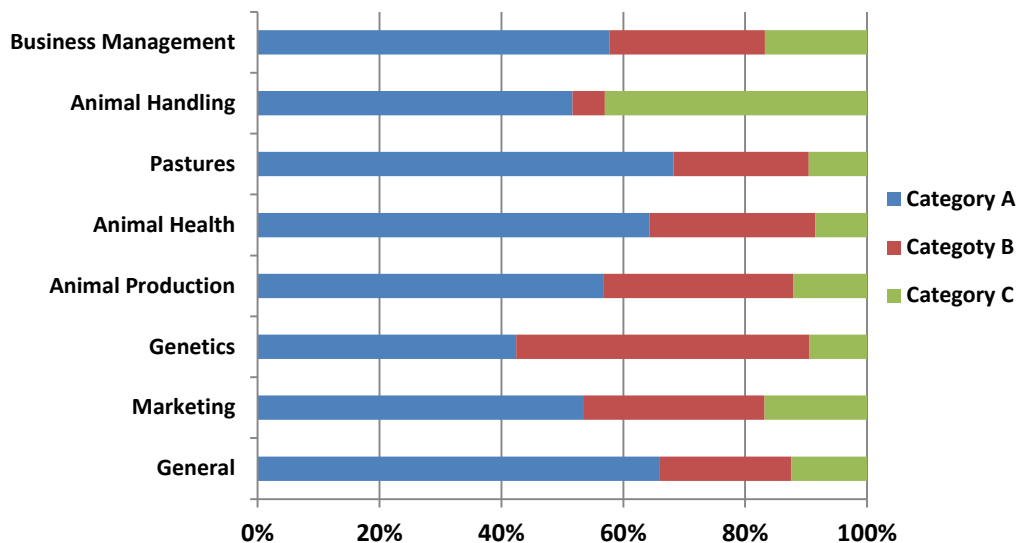


Figure 6: Percentage practice change benefits for practice change types by MBfP event category.

Figure 6 above presents the percentage benefits from each type of practice change attributable to category A, B and C events. Category A events accounted for over half of the benefits generated from all practice change categories except genetics. The largest percentage benefits from Category B events came from genetics and animal production type changes. Category C events represented relatively large proportions of benefits from animal handling, marketing, and business management related practice changes.

3.4 Non-Monetary Impacts of Investment in the MMP

While most of the dollar benefits generated as a result of implementation of on-farm practice changes are private in nature and flow directly to farmers, there are some public benefits in terms of positive environmental, animal welfare and OH & S outcomes. However due to the difficulty in accurately quantifying these types of public benefits in dollar terms they have not been included in this analysis.

The 'Assessing the Impact of MLA's Southern Majority Market Programs' project preliminary case study results have revealed that a major non-monetary benefit of implementing many practice changes is reduced stress levels due to lower risk (both price and production risk), and more confidence in management decision making resulting in potentially higher profits. Many farmers also noted decreased stress levels due to lower expected livestock deaths resulting from implementation of practice changes.

Figures 7 and 8 present a summary of the preliminary findings from the study to date where farmers have ranked the degree of impact of their practice change on a range of management variables on a scale from -3 negative impact up to +3 positive impact.

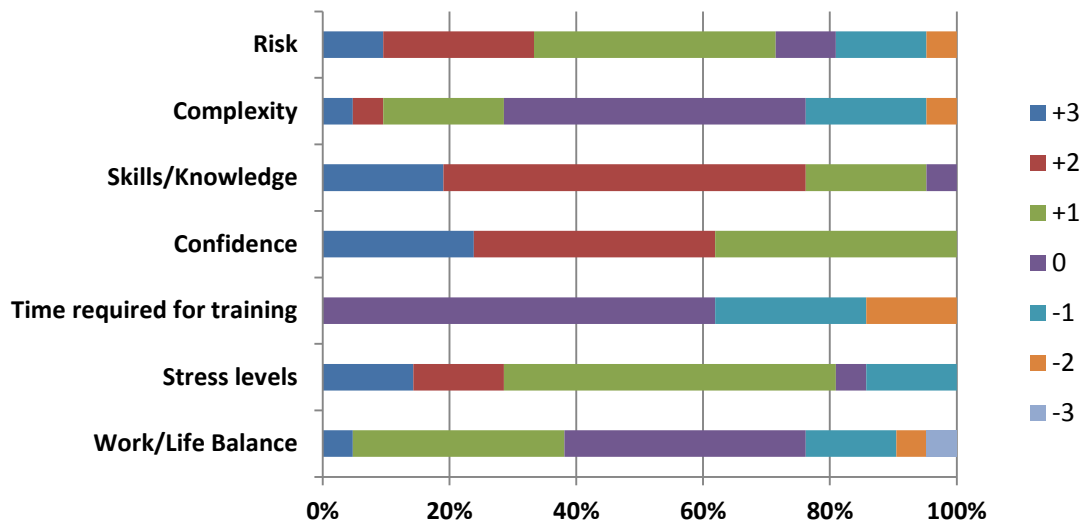


Figure 7: Scale of actual/expected impact of practice change on key management variables for MMfS farm case studies ('Assessing the Impact of MLA's Southern Majority Market Programs' project)

Around 13% of MMfS and 4% of MBfP case study farms reported increased stress levels as a result of the practice change. This result was primarily due to the stress associated with initial large capital outlays associated with implementation of the practice change and the unknown impact that the change may have on the business.

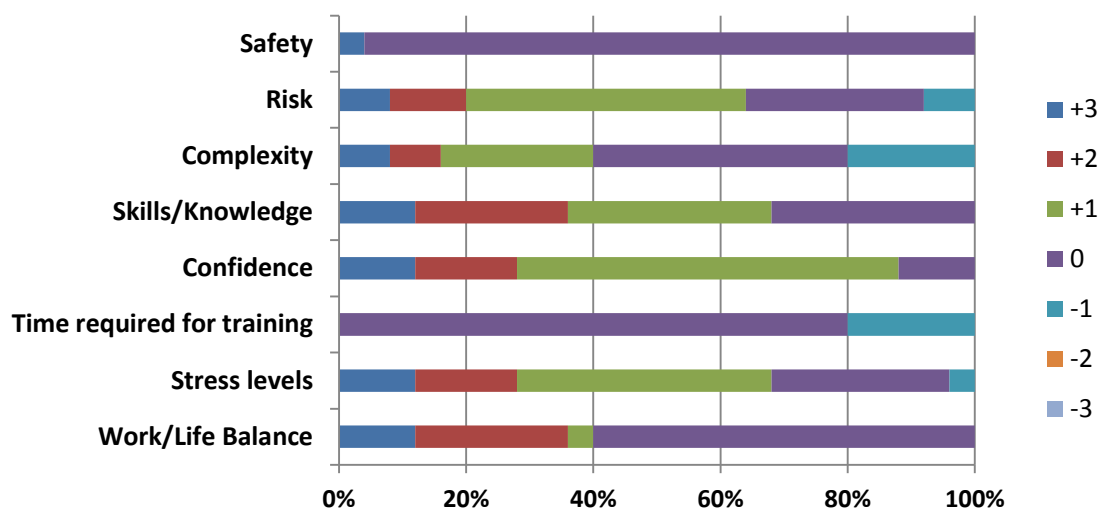


Figure 8: Scale of actual/expected impact of practice change on key management variables for MBfP farm case studies ('Assessing the Impact of MLA's Southern Majority Market Programs' project).

The two factors most negatively impacted by implementation of practice changes were complexity of the business and time required for further training. The time required for extra training in order to effectively implement the change is consistent with the phone survey finding that the information provided at the MMP event(s) on its own was often not sufficient for the farmer to implement the change effectively.

All farmers reported an actual or expected increase in skills, knowledge and confidence as a result of implementing the intended practice change.

Figures 9 and 10 below present a summary of the degree of actual/expected impact of practice changes on a range of environmental/animal welfare variables, again on a scale from -3 negative impact up to +3 positive impact.

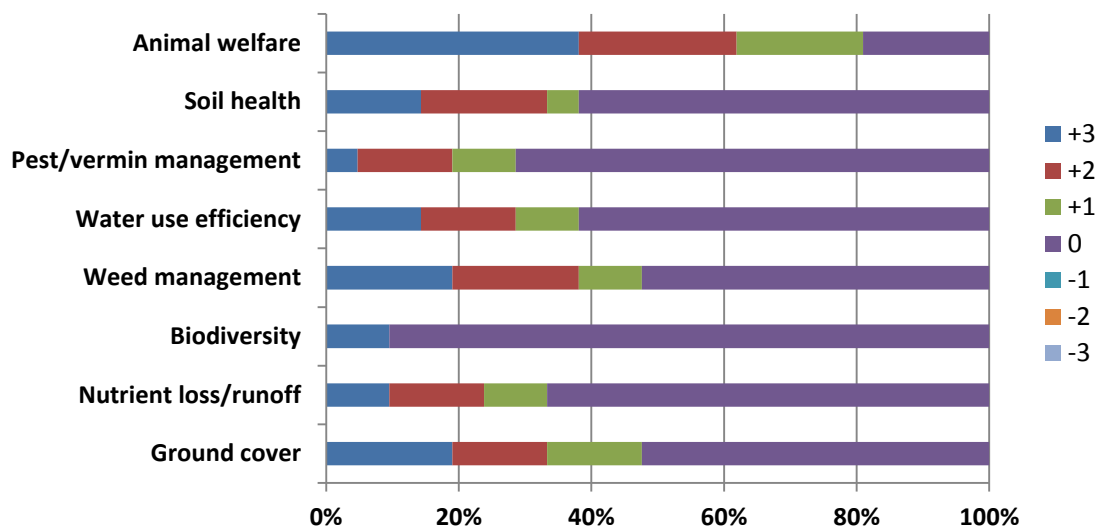


Figure 9: Scale of actual/expected impact of practice change on key environmental/animal welfare variables for MMfS farm case studies ('Assessing the Impact of MLA's Southern Majority Market Programs' project).

In a very positive outcome, only one MBfP producer reported a slightly negative environmental impact of the practice change relating to weed management. More than half of producers reported no impact of their practice change on environmental outcomes, while the most positive impacts were achieved in the areas of improved ground cover/less erosion, improved weed management, and improved soil health.

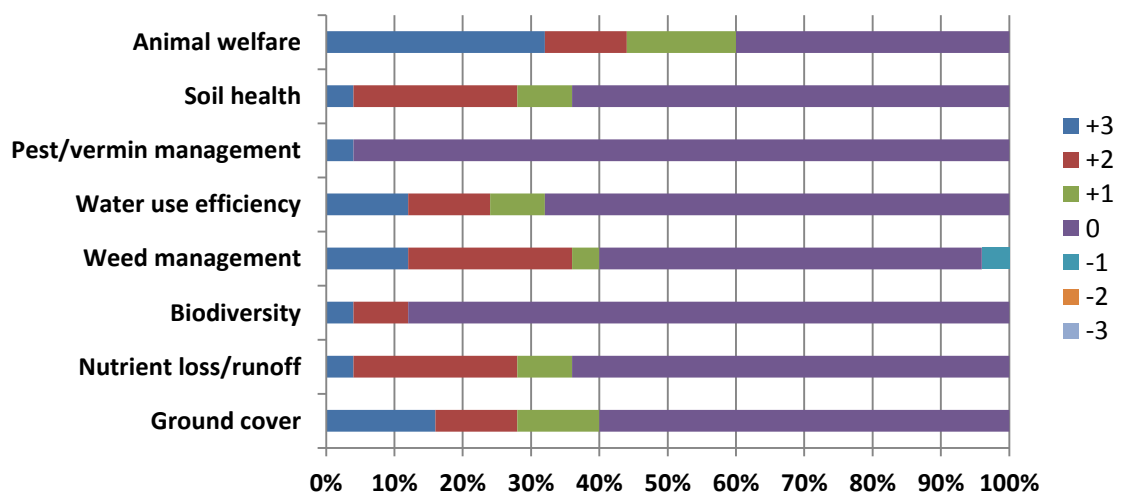


Figure 10: Scale of actual/expected impact of practice change on key environmental/animal welfare variables for MBfP farm case studies ('Assessing the Impact of MLA's Southern Majority Market Programs' project)

In terms of animal welfare outcomes, more than 80% of MMfS and 60% of MBfP producers reported positive impacts of their practice changes on animal welfare, with 38% of MMfS and 32% of MBfP producers reporting a very high expected animal welfare benefit. Unlike the

environmental benefits of practice changes, the dollar value of these on-farm animal welfare impacts have been captured in this analysis.

4.0 SENSITIVITY ANALYSIS

Sensitivity analyses were carried out on a selection of key variables to determine the degree of impact on investment results. All sensitivity analyses were performed using a 7% discount rate for total investment over a 25 year time horizon. All other variables remained at their base scenario values.

4.1 Making More from Sheep

Tables 11 to 14 below present the results of the sensitivity analysis for the MMfS investment. Table 11 presents the sensitivity of investment criteria to the variable of percentage producers adopting a practice change under the counterfactual scenario.

Table 11: Sensitivity of investment returns to % producers who would still have adopted practice change under counterfactual scenario.

Investment Criteria	High Scenario (10%)	Base Scenario (30%)	Low Scenario (50%)
NPV	\$19.86 M	\$13.98 M	\$8.09 M
B:C Ratio	7.6	5.6	3.7
IRR	48.1%	43.1%	36.6%

More than 77 percent of producers who adopted a practice change in the 'with investment' scenario would still need to adopt that practice change in the 'without investment' scenario before the investment would return a loss.

Table 12 presents the sensitivity of investment criteria to the value of \$ benefits per head as a result of practice changes.

Table 12: Sensitivity of investment returns to 20% change in \$ benefits per head for each practice change category.

Investment Criteria	High Scenario (+20%)	Base Scenario	Low Scenario (-20%)
NPV	\$17.38 M	\$13.98 M	\$10.58 M
B:C Ratio	6.8	5.6	4.5
IRR	49.8%	43.1%	35.9%

The high scenario is also likely to carry higher risk as producers would be required to push the system harder to achieve higher returns.

Table 13 presents the sensitivity of investment criteria to the % actual intended/unintended adoption rate relative to intention to adopt in the 'with investment' scenario.

Table 13: Sensitivity of investment returns to % adoption rate in the 'with investment' scenario.

Investment Criteria	High Scenario (90%)	Base Scenario (70%)	Low Scenario (50%)
NPV	\$18.81 M	\$13.98 M	\$9.14 M
B:C Ratio	7.2	5.6	4.0
IRR	52.5%	43.1%	32.7%

Total adoption as a percentage of intention to adopt would need to fall below 12 percent before negative returns would result.

Table 14 presents the sensitivity of investment criteria to the % implementation benefits attributable to MMfS in the 'with investment' scenario.

Table 14: Sensitivity of investment returns to % implementation benefit to MMfS.

Investment Criteria	High Scenario (85%)	Base Scenario (75%)	Low Scenario (65%)
NPV	\$17.42 M	\$13.98 M	\$10.53 M
B:C Ratio	6.8	5.6	4.5
IRR	48.6%	43.1%	37.8%

Implementation benefits attributable to the MMfS would need to fall below 34% before a negative return on investment is achieved.

4.2 More Beef from Pastures

Tables 15 to 18 present the results of the sensitivity analysis for the MBfP investment. Table 15 presents the sensitivity of investment criteria to the variable of percentage producers adopting a practice change under the counterfactual scenario.

Table 15: Sensitivity of investment returns to % producers who would still have adopted practice change under counterfactual scenario.

Investment Criteria	High Scenario (10%)	Base Scenario (30%)	Low Scenario (50%)
NPV	\$30.94 M	\$21.47 M	\$12.01 M
B:C Ratio	6.3	4.7	3.1
IRR	39.0%	34.5%	28.4%

More than 75 percent of producers who adopted a practice change in the 'with investment' scenario would still need to adopt that practice change in the 'without investment' scenario before the investment would return a loss.

Table 16 presents the sensitivity of investment criteria to the value of \$ benefits per head as a result of practice changes.

Table 16: Sensitivity of investment returns to 20% change in \$ benefits per head for each practice change category.

Investment Criteria	High Scenario (+20%)	Base Scenario	Low Scenario (-20%)
NPV	\$26.94 M	\$21.47 M	\$16.01 M
B:C Ratio	5.6	4.7	3.7
IRR	39.6%	34.5%	28.8%

Again, as with MMfS, the high scenario is also likely to carry higher risk as producers would be required to push the system harder to achieve higher returns.

Table 17 presents the sensitivity of investment criteria to the % actual adoption rate relative to intention to adopt in the 'with investment' scenario.

Table 17: Sensitivity of investment returns to % adoption rate in the 'with investment' scenario.

Investment Criteria	High Scenario (90%)	Base Scenario (70%)	Low Scenario (50%)
NPV	\$29.27 M	\$21.47 M	\$13.68 M
B:C Ratio	6.0	4.7	3.3
IRR	41.7%	34.5%	26.3%

Total adoption as a percentage of intention to adopt would need to fall below 15 percent before negative returns would result.

Table 18 presents the sensitivity of investment criteria to the % implementation benefits attributable to MBfP in the 'with investment' scenario.

Table 18: Sensitivity of investment returns to % implementation benefit to MBfP.

Investment Criteria	High Scenario (85%)	Base Scenario (75%)	Low Scenario (65%)
NPV	\$27.01 M	\$21.47 M	\$15.94 M
B:C Ratio	5.6	4.7	3.7
IRR	38.8%	34.5%	29.6%

Implementation benefits attributable to MBfP would need to fall below 36% before a negative return on investment is achieved.

5.0 CONCLUSION

This BCA has estimated the return on MLA/AWI and other state based investment in phase II of the MMP during the period 2010/2011 to 2012/2013. The analysis has compared investment during this period to the expected stream of benefits over a 25 year time horizon as a result of practice changes adopted by farmers under 'with investment' and 'without investment' counterfactual scenarios.

Actual MLA/AWI expenditure, with estimated June 2013 expenditure, and actual state industry co-investment and estimated in-kind investment were used to determine total investment in the MMP in each of the 2010/2011, 2011/2012 and 2012/2013 financial years.

Actual farm case study data was used to estimate dollar benefits per head for beef and sheep enterprises adopting practice changes. Adoption assumptions, including percentage adoption and adoption lags, were primarily made on the basis of actual data collected from the 'Assessing the Impact of MLA's Southern Majority Market Programs' project. A sensitivity analysis of the impact of changes to key adoption and dollar per head benefit assumptions was made.

Using these assumptions the analysis revealed that investment in phase II of the MMP is expected to generate strong returns to producers over the next 25 years, in addition to benefits in terms of improved environmental, animal welfare, and OH & S outcomes. With a 25 year time horizon, the NPV from investment in the MMfS program at a 7% discount rate was estimated at \$13.98 million, with a B:C ratio of 5.6. Over a 20 year time horizon, the NPV from investment in the MMfS program at a 7% discount rate was estimated at \$13.03 million, with a B:C ratio of 5.3.

With a 25 year time horizon, the NPV from investment in the MBfP program at a 7% discount rate was estimated at \$21.47 million, with a B:C ratio of 4.7. Over a 20 year time horizon, the NPV from investment in the MBfP program at a 7% discount rate was estimated at \$19.95 million, with a B:C ratio of 4.4. The overall NPV for the MMP over a 25 year time horizon was \$35.45 million, with a B:C ratio of 5.0. The overall NPV for investment in the MMP over a 20 year time horizon was \$32.98 million, with a B:C ratio of 4.7.

The sensitivity analysis suggested that all other variables being equal, more than 75% of farmers who adopted a practice change in the 'with investment' scenario would still have to adopt the

change in the 'without investment' scenario before the investment returns become negative. Again, all other variables remaining unchanged, the breakeven percentage of farmers who actually fully adopted an intended practice change would have to fall below about 15% before the investment returns become negative.

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