final report

[INSERT CATEGORY]

Project code:	**B.COM.1001**
Prepared by:	**Peter Chudleigh and Sarah Simpson Agtrans Research**
Date published:	**15 April 2008**
ISBN:	**[MLA to provide]**

PUBLISHED BY
Meat & Livestock Australia Limited
Locked Bag 991
NORTH SYDNEY NSW 2059

Pooled Sample: Feedlot Cluster

partner
logo

Contents

Page

Summary and Overview of the Cluster..3

Reducing the Heat Load for the Australian Feedlot Industry......................10

Grainfed Investment in Beef CRC II...23

Summary and Overview of the Cluster

Introduction

The set of analyses reported here for the Feedlot cluster builds on a set of economic evaluations carried out by Agtrans Research for Meat and Livestock Australia (MLA) in 2006.

The 2006 Analysis

The 2006 analysis was effected by randomly selecting a representative sample of 50 projects funded by Livestock Production Innovation (LPI) that received funding over the five years from July 2001 to June 2006. Each of these projects was described in terms of their objectives, outputs, outcomes and economic, environmental and social benefits they had produced.

Thirty of the fifty projects were selected for quantitative economic evaluation and their benefits valued in monetary terms. The value of benefits for each project was then compared to the investment made in each project. As all projects were selected at random across a stratified population of projects, this allowed the aggregate performance of the sampled projects to be extrapolated to the entire population of projects funded by LPI.

The Pooled Sample Approach

The pooled sample approach requires evaluation of a set of research area clusters that covers the RDC portfolio (or in MLA's case, the LPI part of the portfolio). Seven LPI clusters were submitted by MLA to ACIL Tasman who subsequently randomly chose three clusters to be evaluated. These were Lamb and Sheepmeat, Feedlots, and Environment clusters.

The 2006 evaluations have now been modified according to the ACIL Tasman guidelines and requirements. This report covers the Feedlot cluster.

Summary of the Results for Each Individual Investment

The two individual investments where benefits were quantified were:

- Reducing the Heat Load for the Australian Feedlot Industry
- Grainfed Investment in Beef CRC II

For each of these two investments, all past costs and benefits were expressed in 2006/07 dollar terms using the CPI. All benefits after 2006/07 were expressed in 2006/07 dollar terms. All costs and benefits were discounted or compounded to 2006/07 using a discount rate of 5%. All analyses ran for the length of the investment period plus different periods from the last year of investment, up to a maximum period of 25 years. The results specific to each of the two analyses are reported in the next two sections.

Investment criteria were estimated for both total investment and for the MLA investment alone. The investment criteria for each of the four analyses for the 25 year period are reported in Tables 1 and 2. Table 1 summarises the results for investment from all sources including the MLA funding while Table 2 summarise results for the MLA investment alone.

Table 1: Investment Criteria for Total Investment and Total Benefits
(discount rate 5%, 25 years)

Criterion	Heat Loads in Feedlots	Grainfed Investment in Beef CRC II
Present value of benefits (m$)	4.84	316.39
Present value of costs (m$)	1.79	50.25
Net present value (m$)	3.06	266.14
Benefit cost ratio	2.71	6.3
Internal rate of return (%)	15.9	19.8

Table 2: Investment Criteria for MLA Investment and MLA Benefits
(discount rate 5%)

Criterion	Heat Loads in Feedlots	Grainfed Investment in Beef CRC II
Present value of benefits (m$)	4.09	5.36
Present value of costs (m$)	1.51	0.82
Net present value (m$)	2.58	4.53
Benefit cost ratio	2.70	6.5
Internal rate of return (%)	15.8	21.1

Results for Aggregate Investment

Tables 3 and 4 show the investment criteria for the two investments combined for different benefit periods and for both the total and MLA investment.

Table 3: Aggregate Investment Criteria for Total Investment
(discount rate 5%)

Criterion	0 years	5 years	10 years	15 years	20 years	25 years
Present value of benefits (m$)	0.62	46.61	142.01	216.77	275.34	321.23
Present value of costs (m$)	52.0	52.0	52.0	52.0	52.0	52.0
Net present value (m$)	-51.4	-5.4	90.0	164.7	223.3	269.2
Benefit cost ratio	0.01	0.90	2.73	4.17	5.29	6.17
Internal rate of return (%)	negative	3.5	16.0	18.6	19.4	19.7

Table 4: Aggregate Investment Criteria for MLA Investment
(discount rate 5%)

Criterion	0 years	5 years	10 years	15 years	20 years	25 years
Present value of benefits (m$)	0.52	2.37	4.83	6.75	8.26	9.45
Present value of costs (m$)	2.17	2.17	2.17	2.17	2.17	2.17
Net present value (m$)	-1.65	0.20	2.66	4.58	6.09	7.27
Benefit cost ratio	0.24	1.09	2.23	4.17	5.29	6.17
Internal rate of return (%)	Negative	6.7	16.1	18.3	19.0	19.3

There were 32 projects in the population of the Feedlot cluster. Five of these were directly drawn in the sample. Three of the five were analysed quantitatively. Two of the three were analysed with another 10 projects associated with heat stress in feedlots to which the two projects were closely linked. Thirteen projects were therefore analysed in the two quantitative analyses. Each of the other two projects was analysed qualitatively.

Table 5 shows the aggregate investment criteria for the MLA investment when the benefits from the two investments (13 projects) are placed against the total costs of all Feedlot projects drawn in the sample (15 projects).

Table 5: Aggregate Investment Criteria for MLA Benefits from the Two Investments Compared with the MLA Investment in All Feedlot Projects Drawn in the Sample
(discount rate 5%, 25 year benefit period)

Present value of benefits (m$)	9.45
Present value of costs (m$)	2.88
Net present value (m$)	6.57
Benefit cost ratio	3.28
Internal rate of return (%)	16.3

The population of projects from which the extended sample of 15 Feedlot projects was drawn numbered 32. On a nominal cost basis the sample total investment was $2.3 million from a population of $5.2 million.

Benefit Types

A summary of the benefits produced by projects analysed in the Feedlot cluster is presented in Table 6. This shows the nature of the benefits produced (economic, environmental and social) from the 15 projects.

Table 6: Summary of Principal Benefits for the Sampled Projects

Project	Economic benefits	Environmental benefits	Social benefits
Feedstuff Supply Variability (1 project)	Likelihood of strategies that will reduce the supply variability of feedgrains to end users Integration of climatic and economic models to generate more timely and accurate predictions of grain supply outlook Greater cognizance of market failure and the need to look for solutions beyond the micro scale Development of a structurally sound industry that will be sustainable over the long term A larger intensive animal industry with correspondingly larger dividends for operators and associated communities	The natural environment will be 'saved' during drought events to the extent that feedlots and intensive feeding generally remain economic because of less price variability and a more rapid supply-side response to the needs of the livestock feeding industry. Cattle will move quicker to intensive feeding and thereby save pasture and reduce soil degradation	Scope for industry expansion leading to flow-on benefits to regional communities especially jobs Job and income security for people working directly in the feed processing and delivery industry Animal welfare during drought events due to greater confidence that intensive feeding will be relatively durable in the face of drought Enhancement of industry's understanding of how markets work to address severe events
Heat Load in feedlots (12 projects)	Lowered mortality rates in feedlots, particularly from extreme events Lowered probability of uneconomic mandatory regulations industry (e.g. to increase shade in feedlots to 100% capacity without any significant risk improvement) with a higher probability of a lower cost risk management approach to addressing heat stress events	Reduced odours emanating from feedlots via reduced cattle concentrations and improved pad management	Delivery of a higher level of animal welfare by feedlot managers resulting in reduced loss of animal life and stress
Devitalisation of imported feed grain (1 project)	Ability to import feed grain during supply shortages will provide confidence and continuity to intensive animal industries and lower input prices. This could lead to potentially larger intensive animal industries. Any financial benefit needs to be offset against any losses imposed on the Australian feed grains producing sector Potentially a reduced risk to	Reduced risk to the environment from superior phytosanitary standards applying to imported feedstuffs – due to the superiority of devitalisation over QA practices such as inspection and random audits The natural	Scope for industry expansion leading to flow-on benefits to regional communities especially jobs Job and income security for people working directly in the feed processing and delivery industry Improved animal welfare during drought events

	agricultural industries of weed seeds and diseases entering Australia through imported feedstuffs Development of structurally sound intensive animal industries which are sustainable over the long term	environment will be 'saved' during drought events to the extent that feedlots and intensive feeding generally remain economic because of less price variability and a more rapid supply-side response to the needs of the livestock feeding industry. Cattle will move quicker to intensive feeding and thereby save pasture and reduce soil degradation	due to greater confidence that intensive feeding will be relatively durable in the face of drought
Grainfed Investment in CRC II (1 project)	Increased productivity of beef production systems through increased rate of genetic gain Product enhancement to better meet market demand and consumer requirements	Improved effectiveness of feed utilisation with a lowering of methane outputs	Delivery and training initiatives have enhanced the capacity of the industry

Public versus Private Benefits

The benefits identified from most of the investments analysed are predominantly private industry benefits in the form of productivity improvements. The predominant initial beneficiaries of the research are feedlot operators but a large proportion of the benefits will ultimately accrue to cattle producers and beef consumers. Consumers will also benefit from improved beef quality. There will be substantial public spillover benefits in the form of enhanced animal welfare gains for the heat stress investments as well as some environmental benefits from reduced odour, enhanced biosecurity and reduced soil degradation.

Additionality

If MLA had not received funding (or had received less funding) from the Commonwealth, the heat stress and feed grain security investments most likely would have been funded at a very high level by MLA. This is because the industry was under considerable pressure during 2001 to 2006 from parts of the community to reduce deaths and improve animal welfare associated with heat stress in feedlots. The other major priority at that time for feedlot R&D was that associated with feed grain security.

It is postulated that the level of commitment to this cluster overall could have remained practically unaltered in the event of a small Commonwealth Government reduction in funding to MLA. If the government contribution was removed altogether, there would have been some reduction in funding to the cluster.

National and Rural Research Priorities

The Australian Government's national and rural R&D priorities are reproduced in Table 7.

Table 7: National and Rural R&D Research Priorities 2007-08

Australian Government	
National Research Priorities	**Rural Research Priorities**
1. An environmentally sustainable Australia 2. Promoting and maintaining good health 3. Frontier technologies for building and transforming Australian industries 4. Safeguarding Australia	1. Productivity and adding value 2. Supply chain and markets 3. Natural resource management 4. Climate variability and climate change 5. Biosecurity Supporting the priorities: 1. Innovation skills 2. Technology

The heat stress investment has made a major contribution to Rural Research Priority 1 through its impact of reducing death rates in feedlot cattle. The investment has made a significant contribution to innovation skills and technology for ensuring the sustainability of Australian industries (National Research Priority 3 and Supporting Rural Research priorities).

The grainfed contribution to the CRC has made a major contribution to Rural Research Priority 1 through its impact on the rate of genetic gain. In addition, the investment would have contributed to maintaining or increasing demand by consumers through contributing to meat quality improvements such as marbling (Rural Research Priority 2). The CRC investment has made a significant contribution to the use of frontier technologies and innovation skills and technology for ensuring the sustainability of Australian industries (National Research Priority 3 and Supporting Rural Research priorities).

The two projects analysed qualitatively will contribute to increased productivity (Rural Research Priority 1) through a higher level of security of supply of feedstuffs, as well as National Research Priority 4 and Rural Research Priority 5 through improved phytosanitary standards applying to imported feedstuffs.

The assessment of the relative contribution to each of the five Rural Research Priorities is:
Rural Research Priority 1 (60%)
Rural Research Priority 2 (20%)
Rural Research Priority 3 (10%)
Rural Research Priority 5 (10%)

Conclusion

The investment by MLA in the Feedlot cluster $5.2 million in nominal dollar terms. The MLA investment in the 15 projects included in the sample reported here totalled $2.3 million in nominal dollar terms and had a present value of costs of $2.9 m in 2006/07 dollar terms as of 2006/07. This investment by MLA was estimated to produce a present value of benefits of $9.45 m, giving a benefit-cost ratio of 3.3 to 1 and an internal rate of return of 16% per annum over a 25 year benefit period.

A range of types of benefit was evident. The predominant group of benefits was private in nature and captured predominantly by cattle producers and feedlotters with some benefits being passed along the marketing chain to processors and consumers. Consumers will also benefit from improved beef quality. However, significant social benefits were evident in the form of animal welfare benefits and improved job security for people working directly in the feed processing and delivery industry. Environmental and natural resource management benefits were also captured through reduced soil and pasture degradation and improved biosecurity management.

Reducing the Heat Load for the Australian Feedlot Industry

Introduction

Excess body heat in feedlot cattle can impact on animal welfare and productivity of animals while being managed under feedlot conditions.

In 1991 a number of feedlots in Queensland and northern NSW experienced deaths of feedlot cattle due to a severe and sudden heat wave preceded by rainfall, high humidity, high temperatures and low wind speed. The losses included over 2,000 feedlot cattle near Texas in southern Queensland.

The National Feedlot Accreditation Scheme (NFAS) was established in 1994. NFAS incorporates a feedlot animal welfare code of practice and also requires compliance with the code through maintenance of an animal care statement. Independent third party auditing ensures the integrity of the scheme. NFAS is co-regulated by linkages to State government feedlot approval and licensing legislation and Australian Quarantine and Inspection Service (AQIS) administered export regulations (ALFA, 2005).

In the year 2000 over 1,000 feedlot cattle perished due to heat stress in a number of feedlots in southern NSW. Since 2002 NFAS has included a provision that feedlots notify the Australian Lot Feeders' Association (ALFA) of significant incidents of morbidity or mortality of cattle.

Since this heat stress event in 2000, the Australian lot-feeding industry via MLA has invested significant funding into research to understand the microclimate of the feedlot environment, develop indicators of heat stress and a heat load index, a forecasting system for advising feedlot operators of heat stress, a risk assessment process, and the design of new generations of shade structures (ALFA, 2005; EA Systems, 2004). Most of this research has been undertaken by three organisations: E.A. Systems Pty Limited, The University of Queensland and Katestone Environmental.

Investment Description

The overall investment by MLA into heat stress in feedlots commenced with literature reviews. After funding a set of literature review projects (FLOT.307), MLA funded FLOT.310 which was undertaken in the 2000/01 summer period and measured microclimate variations within two Australian feedlots. The findings from the literature review projects and the final report from FLOT.310 prompted MLA to fund a series of integrated projects that pursued a holistic approach to addressing heat stress issues in the industry:

All of the 16 heat stress projects funded by MLA are identified in Table 1.

Table 1: Feedlot Heat Stress Projects Funded by MLA

MLA project code	Project title
FLOT.307	Heat Load in Feedlot Cattle (series of literature reviews)
FLOT.310	Measuring Microclimate Variations In Two Australian Feedlots
FLOT.312	Risk Assessment of Occurrence of Excessive Heat Load
FLOT.313	Development and Trial of a Weather Forecasting Service for Feedlots
FLOT.314	Investigations of dietary manipulations as mechanism for minimising the impact of excessive heat load events on feedlot cattle
FLOT.315	Applied evaluation of feedlot shade design
FLOT.316	Development of an excessive heat load index for the Australian Feedlot Industry
FLOT.317	Measuring the microclimate of Eastern Australian Feedlots
FLOT.319	Refinement of the Heat Load Index Based on Animal Factors
FLOT.320	Development and Trial Operation of a Website-Based Weather Forecast Service for the Australian Feedlot Industry
FLOT.321	Risk Assessment of the Occurrence of Excessive Heat Load Events for the Major Feedlot Regions of Australia (Phase 2)
FLOT.322	Cooling water for lot-fed cattle
FLOT.324	Refined Website-based Weather Forecast Service for the Australian Feedlot Industry
FLOT.327	Reducing the Risk of Heat Load for the Australian Feedlot Industry
FLOT.329	Cattle Heat Load stress forecasting Summer 2004/2005
FLOT.330	Validation of the Heat Load Index for use in the feedlot industry

Investment Costs

The total investment costs in these projects are shown in Table 2.

Table 2: Resources Invested by Year by MLA in Other Heat Stress Projects (a) (nominal $)

Project	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	Total
FLOT.307 to FLOT.309	30,000	33,624					63,624
FLOT.310	176,082	48,144					224,226
FLOT.312		6,680	38,320				45,000
FLOT.313		20,741	33,400				54,141
FLOT.314					18,000		18,000
FLOT.315		13,400	10,500				23,900
FLOT.316		31,414	15,586				47,000
FLOT 317		134,850	88,606				223,456
FLOT.319			37,700	45,039			82,739

FLOT.320			24,670	14,820			39,490
FLOT.321			84,645				84,645
FLOT.322			30,346	1,134			31,480
FLOT.324				11,000	7,647		18,647
FLOT 327					149,008		149,008
FLOT.329					35,202		35,202
FLOT.330					28,727	21,350	50,077
Total	206,082	288,853	363,773	71,993	238,585	21,350	1,190,635

(a) As most of these projects were undertaken by private companies, the in-kind level of contribution was small. The contribution is assumed in the economic analysis to be 10% of the MLA contribution.

Principal Outputs

One of the earlier projects (FLOT.310) determined that cattle stress events in feedlots were determined by a number of variables including:

- Constant high ambient temperatures
- Significant radiant heat loads
- Low wind speeds
- Elevated ammonia levels

The investment in FLOT.317 confirmed that significant variations occurred between the external and internal microenvironments in the feedlot. Temperature differences in unshaded pens were higher than the external environment. While shade provided a minor reduction in temperature, humidity levels were higher under shade and wind speeds were reduced in shaded pens. Shade structure and overall geographic aspects of the feedlot tempered these conclusions.

Most feedlot weather stations are located outside the feedlot environment so that any stress index calculated from such observations may not be representative of those inside the feedlot. The project demonstrated that stress index equations can be adjusted accordingly so that external data can be used to calculate conditions in both shaded and unshaded areas inside the feedlot. The study also found that the best means of lowering water trough temperatures was to reduce the temperature of the water supply. Recommendations from the study were that the equations used to estimate stress indices should be modified and mechanisms for keeping trough water cooler should be examined.

After this project had been completed, in the summer of 2003/04, further heat stress events occurred in central NSW feedlots. There was some confusion over the new heat load indices, there were some errors detected in the web-advisory system, and some weather stations were not capable of computing the index within the central processor in the data loggers (EA Systems, 2004).

Project FLOT.327 went on to refine and validate the heat stress index. This process was based on a wider range of data sets from both Australia and the USA. The statistical methods used in the revised calculations were validated by an independent expert. The new index took into account the relative humidity, black globe temperature, and wind speed.

A second output from the investment in FLOT.327 was the development of a computer program to assess the risk of high heat load events occurring at individual feedlots. The risk is expressed as the probability of a high risk event and an extreme risk event occurring on a regional basis and includes individual feedlot management variables such as the provision of shade and water troughs. A heat load index calculator has been included in the program to assist feedlot operators to calculate spot measures of the index.

The final objective of FLOT.327 was to conduct a series of workshops to communicate the results of the project to the wider industry. The four workshops were held in November 2004 in Moana, Tamworth, Dalby and Wagga. The workshops covered the refined heat load indices, heat load mitigation measures and a new risk assessment program.

Other projects funded by MLA in the heat stress area focused on shade design, the development of a weather forecasting service for feedlots, and risk assessment process for high stress head load events.

The heat stress projects have contributed to a series of Tips and Tools produced by MLA. These include:

- Managing heat load in feedlot cattle - an overview
- Understanding excessive heat load in feedlot cattle
- Recognising excessive heat load in feedlot cattle
- Summer feeding of feedlot cattle
- Feedlot shade structures
- Weather monitoring in feedlots

These six Tips and Tools have been aggregated into a booklet called “Heat Load in Feedlot Cattle”. The booklet provides a comprehensive guide to understanding, recognising and managing heat load in feedlot cattle. This publication was first printed in 2004, has been reprinted once since then due to high demand and is now being revised and reprinted again in 2006.

Principal Outcomes

A principal outcome of the investment in heat stress R&D has been the raising of awareness of the feedlot operators of the issue. This has led to a higher level of interest and attention to feedlot management practices in summer periods. For example, all larger feedlots have summer management plans in place.

A web-based forecasting service now predicts a heat load index (HLI) and a cumulative heat load out for 6 days ahead. The forecasts are updated daily. The forecasts are specific to a range of regions throughout Australia (see www.katestone.com.au/mla). The service operates from December to the end of March each summer. The development of the service to date has been supported financially by MLA via the projects being evaluated. In future it is likely to cost about $20,000 per annum to continue to operate the service. The service is used by a large number of operators, particularly by the larger feedlot operators (Des Rinehart, pers. comm., June 2006).

Shade structures are now commonly used throughout the industry to alleviate the impacts of hot weather events. A feedlot shade survey conducted in mid calendar 2005 estimated that the feedlot capacity under shade represented about 60% of the total surveyed AUS-MEAT feedlot capacity (ALFA, 2005). This estimate was 124% higher than the capacity under shade in February 2000.

The increase in shade has probably been partly driven by the increased awareness and the recognition of increased shade as a risk management strategy for ameliorating heat stress events. Shade does not make a very large difference to heat stress. However, It does reduce the radiant heat loading and this reduction can be sufficient at times to avoid tipping over into a heat stress event. Even with 100% shade there still will be deaths but the incidence will be less frequent

The increased investment in shade has been in part a reaction to the potential for increased regulation/prosecution that could be implemented by governments.

In a medium sized Australian feedlot (say 15,000 head capacity), most of the losses from a heat stress event would most likely be British breed cattle destined for the export market on a 120-200 days feeding regime. With 60% shade in the feedlots on average most feedlots would be able to manage to shade the cattle that are most likely to be badly affected. The additional 40% of shading that could occur would not likely to be of great value in terms of reducing deaths or producing productivity gains. Brahman cattle or crossbreeds have higher heat thresholds and shade would be of limited benefit. The majority of long fed cattle now have access to shade (Des Rinehart, pers. comm., June 2006).

It has been difficult to show a large cattle productivity response to shade. There has been some recent evidence coming from the USA that suggests there may be some benefits. MLA is planning experiments to asses the impacts of different areas of shade on productivity and costs. Experience in Australia has shown that while feedlot weight gain may drop off for some animals in some circumstances in summer, there can be some compensating weight gains after summer. It is difficult therefore to justify the capital investment in shade on productivity grounds alone.

Apart from the capital investment required, shade does have some negative heat load impacts through generally increasing humidity. Shade generally concentrates cattle together with a build up of manure and urine concentrations creating an artificial humid environment. This can create problems also for maintaining the pad surface and this can be costly.

Key management practice changes being practiced by a large number of operators in summer include (Des Rinehart, pers. comm., June 2006):

- Not handling, moving, drafting or trucking cattle when the heat load index is high or expected to be high
- Introducing additional water troughs
- Changing feed management regimes concerning timing of feeding and composition (less grain and more high quality roughage)
- Maintaining a controlled manure pad to reduce humidity

The larger feedlot operators do have their own weather stations from where they collect information allowing them to calculate their own heat load index. This can then be calibrated against the nearest HLI forecast to provide an indication of expected heat loading in their own feedlot. It is estimated that 50% of all feedlot capacity would be subject to such management at present (Des Rinehart, pers. comm., June 2006).

The 67 feedback sheets from attendees at the four workshops described earlier for FLOT.327 indicated that most thought the workshops were good or very good. The majority of respondents seemed to be willing to integrate the heat load mitigation strategies into their management strategies.

Benefits Associated with the Investment

Benefits from the investment in the 16 heat stress projects are described here as being economic, environmental or social.

Economic

Economic benefits from this investment include a lower probability of a heat load event occurring in future due to the management changes that can be attributed to the R&D investment. Also, productivity improvements could occur. Except for shade, there may be only minimal additional investment required to capture these benefits and these will depend on the specific management changes made.

Environmental

The major environmental implications of this investment are associated with improved pad and manure management resulting in less odour emanating from the feedlots.

Social

The investment has produced a deeper understanding of the heat and humidity environment under which feedlot cattle are raised. It has therefore built capacity among researchers and feedlot managers to manage heat stress. In particular the investment has provided a stronger guard against heat stress events and suitable preparation options for their management. This will improve animal welfare considerably.

A summary of the type of benefits emanating from this investment is given in Table 3.

Table 3: Summary of the Economic, Environmental and Social Benefits from the Investment

Economic	**Environmental**	**Social**
Lowered mortality rates in feedlots, particularly from extreme events	Reduced odours emanating from feedlots via reduced cattle concentrations and improved pad management	Delivery of a higher level of animal welfare by feedlot managers resulting in reduced loss of animal life and stress
Lowered probability of uneconomic mandatory regulations industry (e.g. to increase shade in feedlots to 100% capacity without any significant risk improvement) with a higher probability of a lower costs risk management approach to addressing heat stress events		Enhanced capacity of feedlot managers to understand and react to options of lowering heat load stress.

Public versus Private Benefits

The benefits identified from the investment in the feedlot heat stress projects are a mix of private and community benefits. The majority of the private economic benefits will be captured by cattle producers. However, some of the benefits of the productivity gains will be passed along the supply chain to Australian processors and consumers. Public benefits have been captured through delivery of a higher level of animal welfare by feedlot managers resulting in reduced loss of animal life and stress. Some odour reduction has also been delivered.

Additionality

If MLA had not received funding (or had received less funding) from the Commonwealth, the investments most likely would have been funded at a very high level by MLA. This is because the industry was under considerable pressure during 2001 to 2006 from parts of the community to reduce deaths and improve animal welfare associated with heat stress in feedlots. The other major priority at that time for feedlot R&D was that associated with feed grain security. These two issues dominated R&D associated with the longer term benefits and those with a high risk–high return investment profile (Des Rinehart, pers comm., 2007).

It is postulated that the level of commitment to this investment would have remained practically unaltered in the event of a small Commonwealth Government reduction in funding to MLA. If the government contribution was removed altogether, there probably would have been some reduction in funding to the program. It is estimated that at least 80-90% of the expenditure on the project would still have been made.

Match with National Priorities

The Australian Government's national and rural R&D priorities are reproduced in Table 4.

Table 4: National and Rural R&D Research Priorities 2007-08

Australian Government	
National Research Priorities	**Rural Research Priorities**
1. An environmentally sustainable Australia 2. Promoting and maintaining good health 3. Frontier technologies for building and transforming Australian industries 4. Safeguarding Australia	1. Productivity and adding value 2. Supply chain and markets 3. Natural resource management 4. Climate variability and climate change 5.Biosecurity Supporting the priorities: 1. Innovation skills 2. Technology

The program has made a major contribution to Rural Research Priority 1 through its impact of reducing death rates in feedlot cattle. The investment has made a significant contribution to innovation skills and technology for ensuring the sustainability of Australian industries (National Research Priority 3 and Supporting Rural Research priorities).

Quantification of Benefits

Where there are cattle deaths from heat stress they are usually spectacular in number. Deaths are event driven rather than a linear response to an increasing heat load. The financial costs to the individual feedlot and the animal welfare impacts are serious when such an event occurs but it does not occur to an individual feedlot very often. However, this may change in the future with climate change.

Loss of profits

Even if a heat stress event triggering death occurred only once every ten years for an individual feedlot, it would decimate profits for that year. For example, a 20,000 head capacity feedlot might lose 2,000 head of cattle worth $2.2 m (with cattle valued say at $1,100 per head). The total throughput for the year may be say 40,000 head per year (2.5 times 80% of 20,000). If the margin on each head averaged $120, the total profit for the year would be about $4.8 m to cover fixed and overhead costs. The heat stress event would therefore reduce profit by about 40% for that year. A serious heat stress event such as this would result also in reduced productivity for the surviving cattle in the feedlot so profit losses could even be greater (Des Rinehart, pers.comm., June 2006).

It is assumed that the impact of the R&D investment has been to reduce the frequency of a heat load stress event occurring in the industry. Without the R&D investment it is assumed that an event will occur every five years. This is based on three severe events occurring in the Australian industry since 1991 (1991, 2000 and 2004). It is assumed that with the R&D program and the management changes it has developed and encouraged, this frequency will be reduced to one in every ten years.

Welfare benefits

Animal welfare benefits are estimated in terms of decreased heat stress levels. The value of a human life is assumed to be $2.5 million (Abelson, 2003). This is based on the willingness to pay studies of a middle aged person of 40 years with 40 years to live. On an annual basis this is equivalent to $150,000 per year at a 5% discount rate.

A major assumption in the current analysis is that for a small proportion of the community, the value of an animal's life is assumed to be similar to that of a human.

It should be noted that any intrinsic value of an animal's life has not been valued in the current evaluation. Society supports the killing of animals for food purposes. However, most people do not like animals suffering. In order to value the animal welfare loss due to suffering, some estimate of an animal's life has to be made in order to value suffering on some relative scale.

The proportion of the community that would value the life of the animal and hence the quality of life of the animal is assumed to be equivalent to the estimate of the proportion of the Australian population that are vegetarian. While there is little information available about the number of vegetarians in Australia, perusal of some statistics from Australia and the United Kingdom (Vegetarian Network Victoria, 2007) indicate that a rough estimate is about 10%.

Not all vegetarians would be strong supporters of animal rights as there are other reasons why vegetarianism is practiced. Likewise, there would be people in society who are not vegetarians but who would strongly support animal rights.

If the expected life of a feedlot bovine animal is assumed to be 2 years, then the value of life to the bovine is $300,000 (2 x $150,000). If 10% of the population view an animal life this way, then the value of a bovine life is $30,000. Dividing by 2 x 365, the value of life per day of a bovine is $41.10 per day.

It is assumed that the quality of life of a heat stressed animal is reduced by 50%, so each day of heat stress is valued at $20.55 per animal ($41.10 x 50%). The heat stress period is assumed to last for 4 days so the stress cost per animal is $82.19 per head (4 x $20.55).

The number of animals affected in a heat stress event is assumed to be 4 times those that die (inclusive), that is, 2,000 x 4 = 8,000 animals in each event. The welfare loss is therefore estimated at about $658,000 per heat stress event.

Summary of Assumptions

A summary of all assumptions made is given in Table 5.

Table 5: Assumptions for the Valuation of Benefits from the 16 Heat Stress Projects

Variable	Value	Source
Without R&D investment		
Productivity		
Frequency of heat stress events	Every five years	Agtrans Research based on discussions with Des Rinehart
Cattle lost	2,000 head	Agtrans Research
Value of cattle	$1,100 per head	Des Rinehart
Animal welfare		
Cattle affected by heat stress	Four times the number that die = 8,000	Agtrans Research based on discussions with Des Rinehart
Proportion of Australian population that values the life and suffering of an animal similar to a human life	10%	Agtrans Research, based on various estimates of vegetarianism in Vegetarian Network Victoria (2007)
Value of a bovine life	$41.10 per animal per day	Derived as in text
Quality of life reduction during heat stress period	50%	Agtrans Research
Length of heat stress period	4 days	Agtrans Research based on discussions with Des Rinehart
Value of loss of quality of life	$82.19 per animal affected in each event	$41.10 x 50% x 4
With R&D investment		
Frequency of heat stress events	Every ten years	Agtrans Research based on discussions with Des Rinehart
First year of benefits for both profits and improved animal welfare	2004/05	Agtrans Research
Cattle lost	2,000 head	Agtrans Research
Cattle suffering heat stress	8,000 head	2,000 x 4
Value of cattle	$1,100 per head	Des Rinehart
Animal welfare costs	Same as the without R&D investment, that is, $82.19 per animal affected in each event	Agtrans Research

Results

All past costs and benefits were expressed in 2006/07 dollar terms using the CPI. All benefits after 2006/07 were expressed in 2006/07 dollar terms. All costs and benefits were discounted or compounded to 2006/07 using a discount rate of 5%. The base run used the best estimates of each variable, notwithstanding a high level of uncertainty for many of the estimates. All analyses ran for the length of the investment period plus 25 years from the last year of investment (2005/06) to the final year of benefits assumed (2030/31).

Investment criteria were estimated for both total investment and for the MLA investment alone. Each set of investment criteria were estimated for different periods of benefits. The investment criteria are reported in Tables 5 and 6.

Table 5 shows the results for investment from all sources including the MLA funding for the sixteen projects. Table 6 shows the investment criteria for MLA funding. This MLA investment is limited to twelve of the sixteen projects that were in the population of projects from which the sample was drawn.

Table 5: Investment Criteria for Total Investment and Total Benefits for the Sixteen Projects

(discount rate 5%)

Criterion	**0 years**	**5 years**	**10 years**	**15 years**	**20 years**	**25 years**
Present value of benefits (m$)	0.62	1.91	2.93	3.73	4.35	4.84
Present value of costs (m$)	1.79	1.79	1.79	1.79	1.79	1.79
Net present value (m$)	-1.17	0.13	1.15	1.94	2.57	3.06
Benefit cost ratio	0.34	1.07	1.64	2.09	2.44	2.71
Internal rate of return (%)	negative	6.4	12.9	14.9	15.6	15.9

Table 6: Investment Criteria for MLA Investment in Twelve Projects in population[1]

(discount rate 5%)

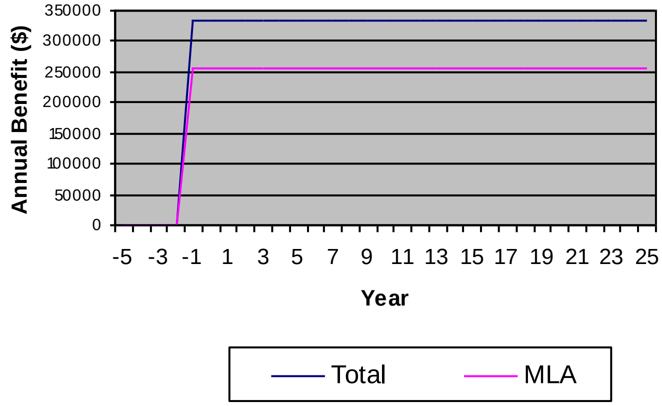
Criterion	**0 years**	**5 years**	**10 years**	**15 years**	**20 years**	**25 years**
Present value of benefits (m$)	0.52	1.62	2.48	3.15	3.68	4.09
Present value of costs (m$)	1.51	1.51	1.51	1.51	1.51	1.51
Net present value (m$)	-0.99	0.01	0.96	1.63	2.08	2.58
Benefit cost ratio	0.34	1.07	1.64	2.08	2.43	2.70
Internal rate of return (%)	negative	6.3	12.8	14.7	15.5	15.8

[1] Includes FLOT.307, FLOT.310, FLOT.312, FLOT.313, FLOT.316, FLOT.317, FLOT.319, FLOT.320, FLOT.321, FLOT.322, FLOT.327, FLOT.330

In terms of the quantified benefits, 77% could be attributed to the productivity component of the rural research priorities while the animal welfare benefits contributed 23% and could be placed in the categories of contributing to an environmentally sustainable Australia or promoting and maintaining good health.

The cash flow of benefits is shown in Figure 1 for both the total investment and for the MLA investment.

Figure 1: Benefit Cash Flow



Sensitivity Analyses

Sensitivity analyses were carried out on a range of variables and results are reported in Tables 7 and 8. All sensitivity analyses were performed using a 5% discount rate for the MLA investment only. Benefits were estimated over the life of the investment plus 25 years from the year of last investment. All other parameters were held at their base values.

Results of a sensitivity analysis varying the period between heat stress events with the R&D program are shown in Table 7.

Table 7: Sensitivity of Investment Criteria to Period Between Heat Stress Events
(Benefits and Costs for MLA investment in the twelve projects)

Criterion	**Discount rate 5%**		
	Low value 7 years	**Base value 10 years**	**High value 13 years**
Present value of benefits ($ m)	2.34	4.09	5.03
Present value of costs ($ m)	1.51	1.51	1.51
Net present value ($ m)	0.82	2.58	3.52
Benefit-cost ratio	1.54	2.70	3.32
Internal rate of return (%)	9.0	15.8	18.8

The break-even heat stress frequency change for the benefit-cost ratio to be 1 was a reduction from a five year frequency without the research to a six year frequency with the research investment.

Table 8 shows the changes in investment criteria with different assumptions regarding the number of deaths and affected animals in a heat stress event. The break even number of cattle deaths in a heat stress event to provide a benefit cost ratio of 1 is 694.

Table 8: Sensitivity to Animal Deaths in a Heat Stress Event (a)
(MLA investment, 5% discount rate; 25 years)

Criterion	1,000	2,000(Base)	4,000
Present value of benefits (m$)	2.04	4.09	8.18
Present value of costs (m$)	1.51	1.51	1.51
Net present value (m$)	0.53	2.58	6.67
Benefit cost ratio	1.35	2.70	5.40
Internal rate of return (%)	7.7	15.8	27.6

(a) The ratio assumed of 3 stressed animals in addition to each death remains the same and is included the results in the table

Table 9 shows the changes in investment criteria with different assumptions regarding the intrinsic value of a feedlot animal's life. The results show that the sensitivity is not high due to the predominant benefits being those associated with commercial values.

Table 9: Sensitivity to Value of Life of a Bovine
(MLA investment, 5% discount rate; 25 years)

Criterion	$20.55 per head	$41.10 per head (Base)	$82 per head
Present value of benefits (m$)	3.62	4.09	5.03
Present value of costs (m$)	1.51	1.51	1.51
Net present value (m$)	2.11	2.58	3.52
Benefit cost ratio	2.39	2.70	3.32
Internal rate of return (%)	14.2	15.8	15.8

No sensitivity to adoption (high, medium, low) has been presented as the assumptions made did not lend themselves to such an analysis.

Conclusions

The investment in the heat stress projects by MLA has increased the awareness of heat stress among feedlot managers. Also, a number of practices to manage heat stress in the summer period have been adopted by a high proportion of feedlot managers. Many of these practices have relied on information and products being produced from the investments. These changes will reduce the incidence of heat stress events in the future.

Given the assumptions made in the economic analysis, the investment has provided positive returns. For all investment in the 16 projects, the net present value is estimated at $3.06 m with a benefit cost ratio of 2.7 to 1.

Acknowledgements

Des Rinehart, Feedlot Project Manager, Meat and Livestock Australia, Brisbane

References

Abelson, P. (2003) “The value of life and health for public policy”. Economic Record 79, S2-S13.

ALFA (2005) “Submission to the Inquiry by the Senate Rural and Regional Affairs and Transport Committee into the National Animal Welfare Bill 2005”.

EA Systems (2003) “Measuring the Microclimate of Eastern Australian Feedlots“, Final Report to MLA on Project FLOT.317

EA Systems (2004) “Proposal to MLA for Project FLOT.327”, MLA

Vegetarian Network Victoria (2007) “Statistics on Vegetarianism”, www.vnv.org.au (updated as of October 2007).

Grainfed Investment in Beef CRC II

Introduction

The Australian Lot Feeders' Association (ALFA) represents Australian feedlots. Its mission is to lead the industry in a manner that fosters excellence and integrity; improve the feedlot business environment; and ensure its community standing. The Australian government collects a levy on the sale of all grainfed cattle on behalf of industry. The levy is provided to MLA to fund marketing and research and development.

MLA has worked closely with the Cattle and Beef Quality CRC since 1993. Projects completed have had a significant impact on the feedlot industry and this association with the CRC has continued through one MLA project (Project FLOT.215) in the form of funding over the period 2000/01 to 2005/06.

Members of the CRC in 2000/01 were the University of New England, NSW Department of Agriculture, Queensland Department of Primary Industries, and CSIRO.

Investment Description

The objective of the project was to provide outcomes for the feedlot industry, in line with the objectives of the CRC. The contribution of MLA grainfed R&D funds was to be distributed to individual projects by the CRC in consultation with ALFA/MLA and MLA had the right to veto the distribution of funds to individual projects. Also, ALFA maintained a representative on the CRC Board and the CRC Advisory Committee. MLA maintained a seat on the Research Committee of the CRC.

The CRC provides MLA with an annual financial report documenting the allocation and proposed future allocation of the MLA funds to individual projects as well as a report detailing progress of relevant projects, and their outcomes, impacts and benefits to the Australian cattle feedlot industry. Hence, while MLA had some indirect control over the allocation of the granted funds within the CRC, these resources were spread across CRC projects that had outputs relevant to the feedlot industry.

An example of the distribution of grainfed funds provided by MLA is given in Table 1. This was sourced from the CRC annual report to ALFA for 2004/05. The projects listed were those to which the MLA annual contribution of $108,000 flowed in 2004/05 and 2005/06.

Table 1: Example of Projects Funded by the MLA Grainfed Funds to the CRC for Two Years of the Six Years of Investment

CRC Project	Area of Research	2004/05 ($)	2005/06 ($)
Project 1.3	Regulation of intramuscular fat Development	38,000	10,000
Project 1.4	Functional Genomics of Marbling	10,000	10,000
Project 2.1	Discovery of genetic markers … for Marbling, Tenderness and Efficiency of Feed Utilisation	15,000	25,000
Project 2.2	Improving the Efficiency of Feed Utilisation	15,000	0
Project 4.2	Information Delivery Systems	0	30,000
Project 4.4	Integration and Delivery of CRC technologies and information	15,000	0
Project 4.4	Industry Training and Technology Transfer	0	33,000
New project	Rumen inoculum for the efficient use of high grain diets	15,000	0
Total		108,000	108,000

Investment Costs

The total investment costs in FLOT.215 are shown in Table 2.

Table 2: Resources Invested by Year for MLA, the Researchers and Funding Partners for Project FLOT.215 (nominal $)

Year	MLA funds	Total CRC expenditure (a)	MLA as % CRC funding
1999/00	0	12,700,000	
2000/01	90,000	12,700,000	
2001/02	108,000	12,700,000	
2002/03	108,000	12,700,000	
2003/04	108,000	12,700,000	
2004/05	108,000	12,700,000	
2005/06 (b)	108,000	12,700,000	
Total	630,000	88,900,000	0.71

(a) DEST (2004)
(b) Funds assigned to the new CRC for Beef Genetic Technologies

Principal Outputs, Outcomes and Benefits

A range of outputs has been produced over the five years from the MLA investment. Because of the distribution of the MLA funds to different CRC projects in six different years, defining the outputs and outcomes and then identifying the associated benefits from all MLA grainfed supported projects is beyond the scope of this current investment analysis.

MLA grainfed funds have been co-invested in areas of relevance to the feedlot sector and the CRC has simply acknowledged MLA's role in a very wide range of outputs and outcomes including (Heather Burrow, pers.comm., June 2006):

- DNA markers for feed efficiency and marbling;
- development of IGF-I tests to speed up genetic improvement of feed efficiency;
- development of EBVs for Net Feed Intake to assist in genetic improvement of feed efficiency;
- non-genetic knowledge relating to achievement of marbling;
- a new algorithm to measure marbling content and distribution in the carcase on-line using video image analysis techniques;
- post-graduate student education focusing on feedlot-related topics;
- educational activities specifically designed for feedlot end-users; and
- improved profitability and productivity resulting from greater achievement of market specifications.

The benefits for the CRC investment as a whole and the specific contribution from MLA grainfed funds ultimately fall in the economic area. The most prominent benefit will be an increase in the rate of genetic gain by Australian beef producers. Such gains may be expressed in the form of productivity gains (more product per input) or products more suited to market demand and consumer tastes. These gains will be translated into income gains for the industry as well as benefit consumers. Limited environmental and social benefits will be delivered.

A summary of the benefits emanating from the investment in FLOT.215 is given in Table 3.

Table 3: Economic, Environmental and Social Benefits from the Investment

Economic	Environmental	Social
Increased productivity of beef production systems through increased rate of genetic gain	Improved effectiveness of feed utilisation with a lowering of methane outputs	Delivery and training initiatives have enhanced the capacity of the industry
Product enhancement to better meet market demand and consumer requirements		

Public versus Private Benefits

The benefits identified from the investment in the MLA support of the CRC are predominantly private benefits. The majority of the private economic benefits will be captured by cattle producers. However, some of the benefits of the productivity gains and a majority of the demand-enhancing gains will be passed along the supply chain to Australian processors and domestic and overseas beef consumers.

Additionality

If MLA had not received funding (or had received less funding) from the Commonwealth, the investments most likely would not have been funded, or funded at a low level by MLA. This is because the investment was seen as long term and strategic by industry and there were more urgent investments regarding security of feed grain and heat stress in feedlots. These two issues dominated R&D associated with the longer term benefits and those with a high risk–high return investment profile (Des Rinehart, pers comm., 2007).

It is postulated that the level of commitment to this investment would have fallen more than proportionately to any small reduction in government funding to MLA. If the government contribution was removed altogether, there probably would have been very little investment in the CRC.

Match with National Priorities

The Australian Government's national and rural R&D priorities are reproduced in Table 4.

Table 4: National and Rural R&D Research Priorities 2007-08

Australian Government	
National Research Priorities	**Rural Research Priorities**
1. An environmentally sustainable Australia 2. Promoting and maintaining good health 3. Frontier technologies for building and transforming Australian industries 4. Safeguarding Australia	1. Productivity and adding value 2. Supply chain and markets 3. Natural resource management 4. Climate variability and climate change 5.Biosecurity Supporting the priorities: • Innovation skills • Technology

The program has made a major contribution to Rural Research Priority 1 through its impact on the rate of genetic gain. In addition, the investment would have contributed to maintaining or increasing demand by consumers through contributing to meat quality improvements such as marbling (Rural Research Priority 2).

The investment has made a significant contribution to the use of frontier technologies and innovation skills and technology for ensuring the sustainability of Australian industries (National Research Priority 3 and Supporting Rural Research priorities).

Quantification of Benefits

The six years of funding of FLOT.215 (2000/01 to 2005/06) mainly contributed to CRC II, except for the last year when the funding was allocated to CRC III (CRC for Beef Genetic Technologies). Because of the wide range of projects that were supported by FLOT.215, it was not possible to identify and quantify the benefits from each individual project supported. The approach originally intended was to use the overall benefits defined for CRC II and assign a proportion of those benefits to the FLOT.215. The proportion would be based on the financial contribution made by FLOT.215 to CRC II funding as a proportion of total CRC II funding. This proportion was small, less than 1% based on MLA grainfed funding of $108,000 per year for six years and total CRC II expenditure of about $12.7 m per year for seven years.

An economic analysis of the investment in CRC II had not been undertaken at the time of this evaluation report. However, a prospective economic analysis for CRC III had been undertaken. There was sufficient information in the analysis to satisfactorily reproduce the cash flows that led to the investment criteria presented for CRC III. These results were based on a 4% productivity gain due to CRC III over no CRC III. The assumption was made that CRC II would have produced similar productivity gains with similar benefits, R&D lags and adoption lags.

The Prospective Economic Analysis for CRC III

This analysis focused on the difference that funding CRC III would make to productivity growth in the beef industry. The increased productivity growth rate was translated into annual benefits from both demand enhancing and cost reducing outcomes. Appropriate R&D lags, adoption lags and adoption rates for both with and without CRC III were defined. Some of the key assumptions used in the economic analysis for CRC III are shown in Table 5.

Table 5: Key Assumptions Used in Economic Analysis for CRC III

	Potential rate of productivity improvement	**R&D lag**	**Adoption rate**	**Adoption lag**
	(%)	(years)	(%)	(years)
With-CRC	9	5	35	2
Without-CRC	5	7	25	5

(Source: Prospective Economic Analysis for CRC for Beef Genetic Technologies)

The results of the economic analysis for CRC III are shown in Table 6.

Table 6: Results of Economic Analysis for CRC III

Scenario	**Present value of total benefits (m$)**	**Present value of total costs (m$)**	**Net present value (m$)**	**Benefit to cost ratio**
With-CRC	1,930	98	1,832	19.69
Without-CRC	516	58	458	8.89
Difference	1,414	40	1,374	35.35

(Source: Prospective Economic Analysis for CRC for Beef Genetic Technologies)

The Simulated Analysis for CRC II

The same economic framework used for CRC III was assumed to apply for CRC II. This approach was supported by the CRC (Heather Burrow, pers. comm., July 2006). This approach was considered reasonable since:

- The method used for analysis of benefits from CRC III was a top down approach, rather than a bottom up approach that identified specific projects
- Much genetic research is of a "building block" nature, that is the scientific progress made in CRC II will be utilised in CRC III and some outcomes during the life of CRC III will be from R&D funded earlier; hence there is a continuum of outcomes that can be attributed back to a number of specific earlier investments.
- CRC I and II produced a range of products and packages, for example DNA markers; two vaccines for bovine respiratory disease, BREEDPLAN enhancements for feed efficiency and carcase and beef quality; enhancements to retail beef yield; marbling and feed efficiency as stand alone traits; pre-boosting and yard weaning to enhance subsequent feedlot performance (Heather Burrow, pers. comm., July 2006).

However, a significant change made for the analysis was a more conservative estimate of benefits than was made in the CRC III ex-ante evaluation. Firstly, the adoption lag for CRC III was assumed to fall from 5 years to 2 years with the advent of CRC III. This was due to the accelerated adoption component of CRC III. However, it was assumed that there would be no difference in the adoption lag with and without CRC II. Secondly the R&D lag for the 'with' CRC situation was assumed to be six years instead of five years as assumed for CRC III. Thirdly, the productivity gains for CRC II were scaled back to 50% of the original assumption made for CRC III. This resulted in a more conservative estimate of benefits than for the CRC as a whole and took into account the uncertain linkages between the CRC performance and its implications for the feedlot industry.

Summary of Assumptions

A summary of all assumptions made for the analysis is given in Table 7.

Table 7: Summary of Assumptions for the Valuation of Benefits from the Investment

Variable	Value	Source
Investment		
Total CRC II investment over seven years from 1999/00 to 2005/06 ($12.7 m per year)	$88.9 m	DEST (2004); also, estimate by Heather Burrow (pers.comm., July 2006) was $88.2 m
Total likely beef genetic investment over this period without CRC	59% of the "with CRC scenario" ($52.45 m)	Proportion from CRC III economic analysis
Benefits without CRC II		
Benefits at adoption rate below without CRC	$63 m per annum	CRC III economic analysis
R&D lag	7 years	CRC III economic analysis
Adoption lag	5 years	CRC III economic analysis
Adoption rate	25%	CRC III economic analysis
First year of benefits	2009/10	Agtrans Research
Benefits with CRC II		
Benefits at adoption level below with CRC	$89.5 m per annum	Based on 50% of that assumed in the CRC III economic analysis

R&D lag	6 years	CRC III economic analysis
Adoption lag	5 years	Agtrans Research
Adoption rate	35%	CRC III economic analysis
First year of benefits	2008/09	Agtrans Research

Results

All past costs and benefits were expressed in 2006/07 dollar terms using the CPI. All benefits after 2006/07 were expressed in 2006/07 dollar terms. All costs and benefits were discounted or compounded to 2006/07 using a discount rate of 5%. The base run used the best estimates of each variable, notwithstanding a high level of uncertainty for many of the estimates. All analyses ran for the length of the investment period plus 25 years from the last year of investment (2005/06) to the final year of benefits assumed (2030/31).

Investment criteria were estimated for both total investment and for the MLA investment alone. Each set of investment criteria were estimated for different periods of benefits. The investment criteria are reported in Tables 8 and 9.

Table 8 shows the results for the additional investment by the CRC including the MLA funding for FLOT 215. Table 9 shows the investment criteria for MLA funding for FLOT 215.

Table 8: Investment Criteria for Total Investment and Total Benefits for CRCII (discount rate 5%)

Criterion	0 years	5 years	10 years	15 years	20 years	25 years
Present value of benefits (m$)	0	44.69	139.08	213.04	270.99	316.39
Present value of costs (m$)	50.25	50.25	50.25	50.25	50.25	50.25
Net present value (m$)	-50.25	-5.58	88.83	162.79	220.74	266.14
Benefit cost ratio	0	0.89	2.77	4.24	5.39	6.30
Internal rate of return (%)	negative	3.4	16.1	18.7	19.5	19.8

Note: These results refer to the additional benefits and costs attributable to the CRC

Table 9: Investment Criteria for MLA Investment in FLOT 215 (discount rate 5%)

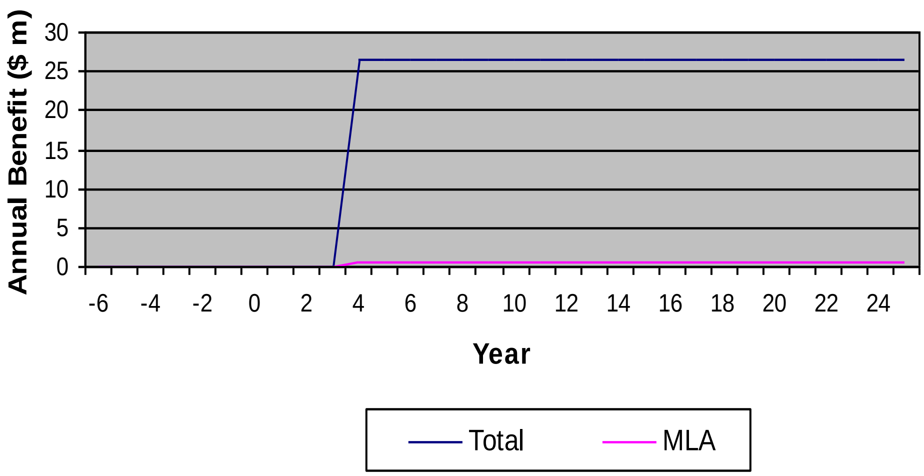
Criterion	0 years	5 years	10 years	15 years	20 years	25 years
Present value of benefits (m$)	0	0.76	2.35	3.61	4.59	5.36
Present value of costs (m$)	0.82	0.82	0.82	0.82	0.82	0.82
Net present value (m$)	-0.82	-0.07	1.53	2.78	3.76	4.53
Benefit cost ratio	0	0.92	2.86	4.38	5.57	6.50
Internal rate of return (%)	negative	3.7	17.4	20.1	20.9	21.1

Note: These results refer to the additional benefits attributable to the FLOT 215 estimated as the proportion that FLOT 215 funding made to the additional costs attributable to the CRC.

In terms of the quantified benefits, all of the benefits could be attributed to the productivity and enhancing demand components of the rural research priorities.

The cash flow of benefits is shown in Figure 1 for both the total investment and for the MLA investment.

Figure 1: Benefit Cash Flow



Sensitivity Analysis

Sensitivity analyses were carried out on a range of variables and results are reported in Tables 10 and 11. All sensitivity analyses were performed using a 5% discount rate for the MLA investment only. Benefits were estimated over the life of the investment plus 25 years from the year of last investment. All other parameters were held at their base values.

Results of a sensitivity analysis to the magnitude of the assumed likely benefits from CRC II are shown in Table 10. The results show that if the benefits were only 10% of those assumed, the investment would still more than break even.

Table 10: Sensitivity of Investment Criteria to Assumed Magnitude of Likely Benefits
(MLA Benefits and Costs for FLOT.215, 5% discount rate)

Criterion	**Likely benefits are 75% of current scenario**	**Current Scenario**	**Likely benefits are 125 % of current scenario**
Present value of benefits ($ m)	0.83	5.36	9.88
Present value of costs ($ m)	0.82	0.82	0.82
Net present value ($ m)	0.01	4.53	9.05
Benefit-cost ratio	1.01	6.50	11.98
Internal rate of return (%)	5.1	21.1	28.0

Table 11 shows the changes in investment criteria with different assumptions regarding the assumed adoption lag periods for research findings.

Table 11: Sensitivity to Adoption Lag Periods
(MLA investment, 5% discount rate; 25 years)

Criterion	**Adoption Lag period 7 years**	**Adoption Lag period 5 years (base)**	**Adoption Lag period 3 years**
Present value of benefits (m$)	2.80	5.36	8.17
Present value of costs (m$)	0.82	0.82	0.82
Net present value (m$)	1.98	4.53	7.35
Benefit cost ratio	3.40	6.50	9.92
Internal rate of return (%)	10.4	21.1	38.4

No sensitivity to adoption (high, medium, low) has been presented as the framework did not lend itself to such an analysis.

Conclusions

The MLA grainfed contribution to CRC II has been applied to a range of projects that will benefit feedlot operators as well as other sectors of the beef industry. The economic analysis has demonstrated high positive returns. The Net Present Value of the investment in FLOT.215 is estimated at $4.5 m with a benefit to cost ratio of 6 to 1 at a 5% discount rate.

Acknowledgements

Heather Burrow, Cooperative Research Centre for Beef Genetic Technologies
Des Rinehart, Feedlot Project Manager, Meat and Livestock Australia, Brisbane

References

ALFA (2002) “An Australian Lot Feeding Industry: Overview”, Sydney.

CRC for Cattle and Beef Quality (2005) “Milestone Report No 5: The ALFA contribution to the CRC for Cattle and Beef Quality “, Report to MLA.

Department of Education Science and Training (2004) “Cooperative Research Centres’ Program: CRC Directory”, Canberra.