mla
MEAT & LIVESTOCK AUSTRALIA

2 May 2005

Dr Anna Dacre
Standing Committee on Science and Innovation
Parliament House,
Canberra, ACT 2600
scin.reps@aph.gov.au

Dear Anna,

Re: Inquiry into pathways to technological innovation

The attached submission is in response to the terms of reference posted on the House of Representatives website regarding the inquiry into pathways to technological innovation.

Meat & Livestock Australia Limited (MLA) is a producer-owned company that provides services to the entire Australian red meat industry including producers, processors, exporters, live exporters and retailers. The company operates within the Rural R&D Corporation (RDC) framework under the Australian Government Department of Agriculture, Fisheries and Forestry.

Research and development (R&D) is a core activity for MLA and is critical to ensuring the Australian red meat industry maintains it current leadership position in the global market. MLA works with industry along the entire supply chain to ensure that R&D outcomes are adopted and commercialised as widely and effectively as possible.

As requested in the terms of reference, the attached submission consists of case studies detailing successful examples of innovations and the pathways to commercialisation. In addition, the submission describes MLA's broader commercialisation principles that provide the fundamental basis for decisions to commercialise R&D outcomes, and the subsequent pathways utilised to ensure successful adoption of these outcomes by the industry.

Should you wish to discuss the submission further, please contact Duncan Ferguson, Commercialisation and Business Services, in the first instance (ph: 02 9463 9381).

Yours sincerely

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Managing Director

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1. Meat & Livestock Australia commercialisation

Introduction

This document describes how Meat & Livestock Australia (MLA) addresses the key issues in the commercialisation process identified in the terms of reference for the inquiry into pathways to technological innovation to be conducted by the House of Representatives Standing Committee on Science and Innovation.

Also included are a series of short case studies of successful technological innovations and their pathways to commercialisation, followed by a further three detailed case studies, which also address the issues raised in the terms of reference. It should be noted that a significant part of our R&D is focussed on an outcome that is 'industry good' rather than strictly commercial.

The final attachment is MLA's commercialisation principles brochure. Our partners play a key role in delivering the benefits of R&D to industry and this brochure ensures they are aware of these principles, which form an integral part of all agreements MLA enters into.

Background to MLA R&D

At all points along the red meat supply chain, MLA is engaged in R&D projects and initiatives that share the common goal of achieving competitive advantage for the industry by improving productivity and profitability and ensuring sustainability. By constantly striving to help producers, processors, live exporters and retailers improve their productivity and profitability, MLA aims to ensure Australia's red meat and livestock industry not only survives, but prospers in today's competitive business environment.

Our key drivers and measures of success are the Australian red meat industry's awareness and adoption of R&D outcomes and the benefit derived from this adoption. This differs significantly from the values and measures of most other R&D providers, whose key metrics typically include: number of licences; and income generated, rather than the benefit gained by the end users.

MLA commercialisation framework

MLA has developed a framework, illustrated in Figure 1, to ensure the impact of the outcomes of R&D are maximised for the benefit of the Australian red meat industry. The framework involves a three-pronged strategy that progresses during the life of new technologies and addresses many of the issues identified in the terms of reference for the inquiry.

The key elements of the strategy are discussed below.

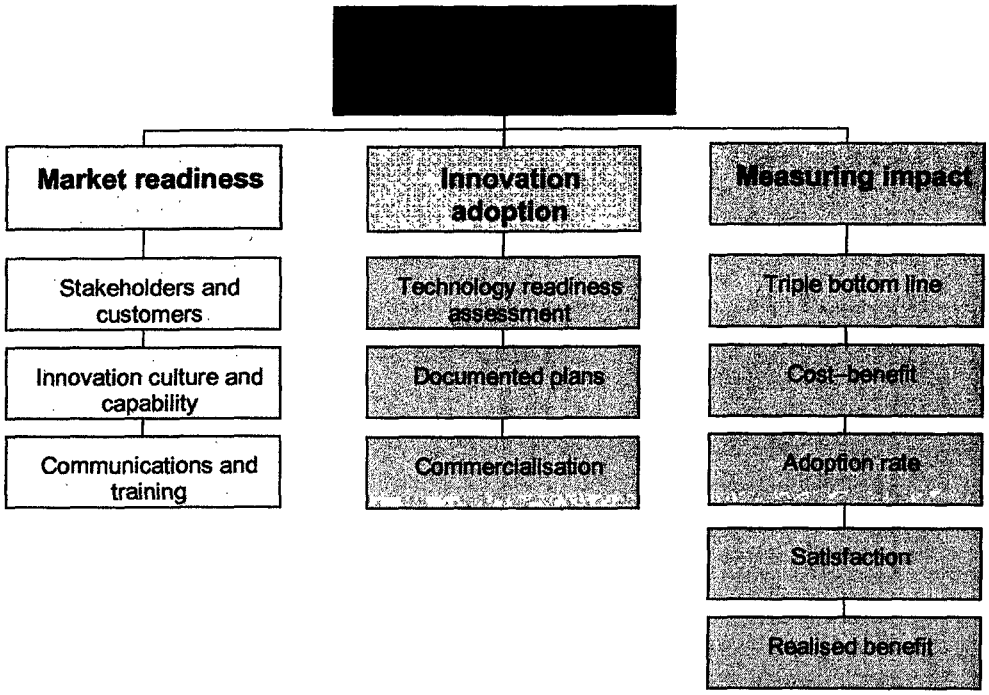

Figure 1: MLA's maximising impact framework to ensure the full benefit of MLA's programs is delivered to industry

Market readiness

When assessing a new technology in its earliest stages of development, the following areas must be addressed:

- The drivers and impact that **stakeholders and customers** will have on the success of the technology at its completion. This is not limited to direct customers of the technology and may include industry and regulatory stakeholders, commercialisers, competitors and supply chain partners.
- The **innovation culture and capability** of the identified stakeholders will be a critical component of the success of any innovations. This element must be assessed at an industry, enterprise and individual level to determine the full impact from the training programs implemented.
- The **communications and training** strategy developed at the early stages of MLA's programs is a critical component of future success. There are many tools at MLA's disposal to ensure innovations are adopted by directly addressing barriers identified in the stakeholder and capability assessments.

Innovation adoption

Three main activities are carried out at the completion of an R&D project to ensure the outcomes are taken to industry for rapid adoption:

- A **technology readiness assessment** is carried out to determine whether the outcomes are ready for adoption by industry or integration into further research.
- For those technologies ready for adoption, the most critical component is the preparation and implementation of **documented plans** that outline the strategy for adoption of the technology. This will usually expand on the communications and training strategy prepared in the market readiness phase.
- Where appropriate, the **commercialisation strategy** is developed as part of the documented plan. This will include intellectual property management, the appropriate pathway and any commercial agreements required. Specific issues addressed in this area are discussed later in this document.

Measuring impact

MLA's major focus is to ensure that the R&D outcomes are adopted and commercialised as widely and effectively as possible by the Australian red meat industry. Therefore, the company's success can only be assessed through the measurement of the impact of these R&D outcomes. Key areas of adoption impact measurements include:

- **Triple bottom line** assessment, looking at economic, social and environment benefits.
- Direct **cost-benefit** analysis at both an industry and enterprise level.
- Identifying the **adoption rate** of technologies by industry stakeholders.
- **Satisfaction** of stakeholders, providing a qualitative measure of the outcomes of technology adoption where appropriate.
- Where possible, measurement of direct **realised benefit** at an enterprise level.

Addressing specific MLA issues

The 'maximising impact framework' provides a basis for MLA to deliver outcomes to industry with the best opportunity of adoption and to subsequently gain benefits from the outcomes of MLA R&D.

This section looks at three particular areas that MLA has addressed to achieve this outcome and also directly address issues raised in the terms of reference for the inquiry.

Research and market linkages

MLA works with a range of other organisations, from industry bodies to government departments and commercial enterprises. By utilising their skills and expertise, MLA can harness the intellectual capital and skill set of a much broader community of interests to establish strategy and implement programs for the industry's benefit. This includes three specific programs that involve direct collaboration between MLA and industry stakeholders. These are:

- **Producer Initiated Research and Development** (PIRD) projects: A grant program available to groups of producers to undertake research to solve issues in their own production system that have benefits to the broader Australian industry.

- **Partners in Innovation** program: Collaborative R&D projects jointly funded by MLA and companies from right across the red meat supply chain to deliver outcomes that have both commercial returns for the company and broader industry benefits.
- **Plant Initiated Projects** program: A jointly funded R&D program available to meat processors to address site related issues that have a benefit to the whole industry, with the additional aims of developing capability and fostering innovation in the individual enterprises.

This collaboration with industry in establishing projects and strategy is essential for establishing market readiness and determining appropriate adoption plans, as discussed previously.

MLA's own experts work with scientists from many different universities, the CSIRO, private consultants and state departments of agriculture and primary industries on a range of programs designed to find solutions to the challenges facing the industry.

The uptake and adoption of the outcomes of MLA's R&D programs is essential to ensure that the industry benefits from MLA's investment. To achieve this, MLA works with industry along the entire supply chain to ensure that R&D outcomes are adopted and commercialised as widely and effectively as possible.

Commercialisation pathways

Each project outcome is reviewed individually to determine the most appropriate and efficient pathway to adoption. Commercialisation is one of the options available to MLA to manage this process. Commercialisation enables MLA to maintain a level of control such as agreeing to levels of market penetration with a commercialiser and using these performance criteria to ensure adoption by industry. If a commercialiser fails to perform to the agreed performance criteria, a well established commercialisation agreement can enable MLA to reclaim the rights to project outcomes and reassign these to another commercialiser.

By retaining an interest in project outcomes through intellectual property ownership and/or commercialisation agreements, MLA can also legitimately work closely with commercialisers to support adoption by the industry.

Another important value-add by MLA in the commercialisation of technologies is that the commercialised outcome usually arises from a larger program of work. As a result the commercialisation of an individual technology is often only one component of a suite of broader industry adoption activities for the entire program.

In the case studies presented for the inquiry, the commercialisation of gene marker tests by Genetic Solutions is supported by the broader education and dissemination activities that MLA is undertaking in genetics and meat quality. Similarly, the meat electronics technologies are supported by broader adoption activities in educating the processing industry on the benefits of stimulation and meat eating quality.

Intellectual property

MLA's commercialisation principles state that we will:

> *"In each case, establish and maintain ownership of intellectual property allowing MLA to exercise appropriate influence to achieve maximum industry benefit from the exploitation of intellectual property."*

As with the pathway to commercialisation, MLA assesses each project individually. In some cases it may not be appropriate for MLA to own intellectual property (IP) arising from an R&D project. For example, if MLA were entering into a collaborative project with a small start-up company that is bringing significant IP into the project, it may be appropriate for the company to retain full rights to the IP arising from the project. This will help the company source future capital investment, as it is widely accepted that companies seeking venture capital provide a much better opportunity for investors if they have full ownership of their intellectual property.

The most important consideration in deciding intellectual property ownership is that it is a separate issue to the rights and performance criteria that are agreed. A properly drafted commercialisation or IP rights agreement, such as a licence, can often provide greater freedom to operate and certainty of direction than merely taking ownership of a proportion of IP.

Summary

MLA has established a clearly defined framework to ensure adoption of R&D outcomes by the Australian red meat industry. Commercialisation is just one component that is utilised by MLA, when appropriate, to deliver benefit to our stakeholders.

There are no defined rules as to the appropriate pathway for commercialisation of MLA technologies. Instead, the framework and the commercialisation principles provide a basis around which projects can be assessed and the optimum pathway determined and negotiated by the appropriate personnel within MLA.

The following case studies provide examples of the varied pathways MLA has utilised to take R&D outcomes to industry.

2. Short case studies

The following case studies are summaries of commercialisation activities undertaken by MLA to deliver outcomes to the Australian red meat industry.

EDGE*network*

EDGE*network* is a national network of licenses and deliverers, managed by MLA and jointly owned with the Victorian Department of Primary Industries, which provides a range of workshops for livestock producers to improve their skills to increase profitability and sustainability.

Workshop topics include marketing, finance, human resources, natural resource management, pasture and livestock management, with each workshop undertaken building towards a whole farm business plan.

Approximately 9,000 sheep and/or beef producers have participated in EDGE*network* workshops since 2001, with up to 90% of attendees reporting that they have changed their on-farm management practices as a result; EDGE*network* participants have reported productivity increases of 4–5% in the short-term, and up to 12% in the long-term.

LAMBPLAN

LAMBPLAN is the national genetic evaluation program for the Australian prime lamb industry that has been developed and managed by MLA since 1994. LAMBPLAN provides a performance recording system that predicts an individual animal's ability to produce progeny that meet the requirements of the current and future markets for lamb products.

LAMBPLAN has been a major factor in the world-class improvement in Australia's prime lamb industry productivity. Genetic improvement in terminal sire sheep is averaging 5% per year since 1995, and dual-purpose meat breeds are averaging improvement of 2% per year for a combination of growth, carcase, wool and reproduction traits. This contributes an extra $15–20m in on-farm returns each year, due to continual improvement in lamb growth rate, carcase composition, and maternal traits such as number of lambs weaned.

LAMPLAN will continue to be a key component of Australian Sheep Genetics, a new collaborative venture between MLA and AWI that aims to increase the rate of genetic improvement of the Australian sheep industry through access to a large base of objective genetic data. The strategy is to develop capacity in sheep genetics so that R&D outcomes are transferred and benefits flow to industry as rapidly and cost effectively as possible.

SGS

The Sustainable Grazing Systems (SGS) program was established by MLA and partners in 1996 to address the issues of declining pasture productivity and sustainability in the grazing systems of the high rainfall zone (HRZ) of southern Australia.

The program consisted of a national experiment of multiple sites, database development, predictive model and analytical tools, regional producer committees, farmwalks, information dissemination and structured learning opportunities.

Survey results show that 42% of all HRZ producers were reached by the SGS program, with 8,000 making changes to their grazing practices – changes they anticipated would yield financial (78%) and sustainability (81%) benefits. Active participants in SGS were not only more likely to have made changes, but were also more confident than non-participants that the changes would be effective.

BREEDPLAN

BREEDPLAN is Australia's cattle genetic evaluation and performance recording scheme that offers stud and commercial cattle breeders the opportunity to achieve continuous improvement in the genetic worth and productivity of their cattle.

MLA funds the development of BREEDPLAN through the Animal Genetics and Breeding Unit at Armidale. BREEDPLAN is delivered by the Agricultural Business Research Institute (ABRI) under license from MLA, NSW Agriculture and UNE.

BREEDPLAN contributes an extra $15–20M in on-farm returns each year in increased growth rate, carcase merit, feed efficiency and maternal ability, and has been a major factor in positioning the Australian beef industry as a world leader in genetic progress.

Approximately 40% of cattle producers now actively use BREEDPLAN Estimated Breeding Values (EBVs) in deciding which bulls to purchase or breed from, to achieve their production objectives and monitor their genetic gain. Over 90% of bulls either have EBVs themselves, or are bred by sires with EBVs.

PRIME TIME

MLA's Prime Time program is a knowledge diffusion and awareness campaign for sheep producers across all states of Australia. Conducted during 2003–2005, the program has comprised a series of producer forums, publications, workshops and demonstration trials to provide lamb/sheep producers with information and tools to help increase their productivity and profitability through genetics, grazing management and the breeding cycle.

To date, 55 producer forums have been held, and information packages distributed to about 10,000 producers. Approximately 80% of forum participants are changing management practices as a direct result of the information provided, including plans to increase lamb/sheep production.

Prime Time has been a key factor in influencing an increase in lamb supply to meet both domestic and export demand, with a 13% increase in the estimated number of lambs on hand in 2004, and a further increase of 9% in forecasted lamb slaughterings for 2005.

3. Detailed case studies

Case study 1 – predictive microbiology

Context

Australia has exported red meat for over two centuries and currently services more than 150 markets around the world. Globally, the regulatory climate under which we trade meat has changed radically in the past decade following serious public health concerns such as BSE. Domestic regulation also changed radically following meat-associated illness in the mid-1990s. Worldwide, meat safety has become a non-negotiable basis for market access.

MLA's food safety program has maintained a lead position for the Australian industry, both for enterprises and regulators, by providing strong scientific underpinning for new, risk-based regulation acceptable to over 100 trading partners. As a result Australian companies have traded unimpaired, avoiding the major disruptions suffered by many competitors as a result of meat safety concerns.

Pivotal to enhancing the industry's trading position is MLA's investment in predictive microbiology, a tool now used routinely by every sector of the meat processing industry.

Technology summary

Predictive microbiology brings together information on how microorganisms grow or are inactivated, particularly those that affect the shelf-life and safety of foods. This information is transformed into a mathematical model that informs on how meat safety is affected by industrial processes. Such models are then used by industry to improve process control and by regulators to draft modern, outcomes-based regulations. A full validation of predictive microbiology applications in meat processing has been completed to provide AQIS with the scientific underpinning, should this be required by an importing country.

The identified benefit derived by industry from predictive microbiology is the culmination of nearly 8 years of research with a value of approximately $400,000.

In the Australian meat industry predictive microbiology is now used routinely in:

Export Control Orders

In the Export Control (Meat and Meat Products) Orders 2005, predictive microbiology forms the underpinning of regulations for chilling and cold storage via the refrigeration index. Each exporter will use the refrigeration index to satisfy its customers that it is using validated processes for controlling temperature of its products.

Hot boning

The refrigeration index replaces the hot boning index, which was developed to secure sound, scientifically-validated regulation for this sector, replacing the former approved arrangement.

Weekend chilling of beef

Predictive microbiology is used to validate weekend chilling regimes by providing a sound scientific basis for their use.

Rewarming of carcases

In a significant proportion of the industry, boning of carcases has occupational health and safety issues due to the difficulty of incising hardened fat. The process of rewarming carcase surfaces to prevent injury to operators without impairing meat safety is validated using predictive microbiology.

Refrigeration breakdowns on-plant

When refrigeration systems malfunction, plants are required to prove that any product affected by impaired chilling regimes is still fit for human consumption. The predictive microbiology tool is now used to assess fitness of these products.

Cooling of cooked meats

Meats that are cooked (eg hams, comminuted and roasted products) are subject to a three-stage process for cooling. This regulatory standard is unattainable for products of large dimensions even using the most efficient chilling systems. Predictive microbiology is used on-plant to validate chilling regimes and was instrumental in providing the scientific underpinning for amendment to the Australian Standard.

Uncooked comminuted fermented meats (UCFM)

Following the mettwurst-associated disease outbreak of 1995, interim regulations were introduced to improve the safety of UCFM. Recently, MLA was instrumental in having the regulations revised to produce a sound, scientifically-based regulation for the sector by providing a predictive microbiology tool for use by operators and regulators that would predict the safety of the production process.

Commercialisation and adoption

Commercialisation and adoption strategy

Commercialisation and adoption of predictive microbiology by the Australian abattoir and processing sectors has been completed. Strategies used for dissemination and uptake of predictive microbiology by the industry have followed a pathway of:

- international scientific validation of the concept;
- industry/regulator acceptance;
- development of predictive microbiology tools;
- market testing; and
- dissemination to industry.

Pivotal to acceptance of predictive microbiology is the scientific rigour of the research and development undertaken by university and government scientists under contract to MLA. Because much of the science of predictive microbiology is both novel and fundamental, it must be tested in a global, peer-reviewed context. This has been done via MLA publications and in the international literature.

Industry and regulatory acceptance was secured via expert panels in which MLA facilitated scientific and technological interplay between industry and regulators.

A series of tools developed for specific sectors and products across the industry were market tested and evaluated in a single jurisdiction or through test marketing, prior to refinement for dissemination across the industry as a whole.

Uptake of predictive microbiology was facilitated by: a series of workshops run by MLA for operators and regulators in each state; engagement of regulatory committees and standards writing groups; publications disseminated to industry; and provision of industry consultants and help lines.

The twin objectives of MLA's food safety program – meat safety and market access – have clear 'public good' bases both for the public health and wellbeing of consumers and for the economy of the agri–meat–retail continuum. Any loss of market access, such as those suffered by the Canadian and US meat industries, would have ramifications across Australian society.

For these reasons the MLA food safety program operates in a 'free-to-air' manner where every meat establishment and regulator is provided with all the tools needed to manufacture meat and meat products that meet the highest global standards for food safety.

Outcomes and current status

The outcomes and current status of commercialisation have an impact across the entire industry and have enhanced its status as a supplier of safe meat both globally and at home. With the technology continuing to be developed and applied in new areas, the full potential from the application of this technology is yet to be realised.

Economic

In purely economic terms, the value of predictive microbiology can be estimated from the value of the trade that it protects. Without the market confidence instilled by this approach to scientifically-based risk management in the industry, it is possible that additional, potentially-costly controls may have been required by domestic regulators or importing countries. It is also possible that trade disruptions may have occurred potentially resulting in loss of access to a particular market and flow-on effects in others. We have therefore estimated the direct economic benefit based on the value of the process/product being protected by the application of predictive microbiology. The identified benefit derived by industry from predictive microbiology is the culmination of nearly 8 years of research with a total value of approximately $400,000.

Note that no estimate is made of the flow-on effect on financial viability and stability of the entire supply chain that would have occurred either had there been any loss of major market (such as those currently affecting the Canadian and US industries) or any meat-associated disease outbreak.

Use of predictive microbiology tools by the meat industry	Value ($m) per annum
Providing predictive microbiology basis in new ECOs	Under evaluation
Securing regulatory status of hot boned meat	15.0*
Validating weekend chilling and carcase rewarming	30.0**
Measuring the effect of refrigeration breakdowns	7.5***
Validating regulation of the cooling of cooked meats	3.0****
Providing scientific regulation for uncooked fermented meats	***** 30.0
TOTAL	**$85.5M**

The basis for each estimate is the value of the sector. Without sound scientific regulation, market access of these sectors is made more fragile. Therefore, the value has been calculated as a percentage of the market that predictive microbiology is protecting, with, conservatively, 5% of the value of sales being used, except for fermented meats that has used 20% based on the effect of past disease outbreaks on sales in this sector.

*** The hot boned manufacturing meat comprises 10% of exports to the US, ie around $300 million per annum.**

**** Weekend chilling accounts for almost 20% of carcases in the export sector that has a value of around $3 billion per year and satisfactory control ensures that these products are suitable for export markets.**

***** The annual saving made by product that would otherwise be downgraded following refrigeration breakdown is estimated to be $7.5 million.**

****** The estimated value of large, cooked, cured meats is $56 million per year.**

******* Each year, the UCFM industry in Australia manufactures around 30,000t of product with a wholesale value ($5/kg) around $150 million.**

Social

The social benefits of this work are clearly shown in the financial impact, particularly on rural and regional Australia, of the maintenance of market access for a high value export industry.

In addition, the role of protecting the wellbeing of vulnerable groups in the population, such as children and the elderly, has significant health impacts on the Australian community at large.

Commercialisation issues addressed

Pathways to commercialisation

Commercial application of these technologies has followed a pathway of:

- international scientific validation;

- industry/regulator acceptance;
- development of predictive microbiology tools;
- market testing; and
- dissemination to industry.

Intellectual property and patents

International acceptance of the technology and the regulatory approaches built on the technology has relied upon the generated intellectual property being in the public domain. Furthermore, there is commercial advantage if the technologies are applied in other countries – their regulatory systems are harmonised with our own (as the leader in this technology) and there is less likelihood of loss of consumer confidence due to problems in the domestic market of importing countries.

Skills and business knowledge

Both industry and regulators need to understand the principles of the technology so that it can be applied correctly. An upgrading of skills is required, but this can be gained through short courses and seminars rather than extensive retraining. The technology needs to be incorporated into a quality management framework to gain the greatest benefit, and this can sometimes pose the greatest challenge to the skills of industry and regulators.

Capital and risk investment

These technologies result in the development of 'knowledge products' that require negligible capital investment.

Business and scientific regulatory issues

Businesses and regulators need to gain confidence in the technology and this is addressed through international peer review and cooperative development of structures and rules that allow the technology to be applied.

Research and market linkages

A critical mass of world-leading researchers in this area has been crucial to the development and international acceptance of the technology.

Factors determining success

Three critical success factors:

- World-class researchers with international linkages
- Strong cooperation between industry and regulators
- Outcomes-based regulations and industry quality systems

Contact details for further information:

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Case study 2 – meat electronics

Context

Advancing the consistent eating quality of Australian beef and lamb is clearly a strategic imperative for the Australian red meat industry and, therefore, an innovation priority for Meat & Livestock Australia (MLA).

To date there has been considerable investment and support in the Meat Standards Australia (MSA) program for beef and the Sheep Meat Eating Quality (SMEQ) program for sheep. These two programs have already achieved significant benefits for the Australian industry, with quantifiable improvements in eating quality and overall consumer satisfaction, which will translate into both domestic and overseas market growth. MLA is currently facilitating adoption of the outcomes of these innovations in the producer sector of the Australian red meat industry.

Research carried out via these programs has revealed that the single greatest contribution to variability in meat eating quality occurs during slaughter and the processing of carcases (Figure 1). While the MSA and SMEQ programs have provided the Australian red meat industry with systems to quantitatively measure meat quality, as well as management standards for the optimum production of high quality meat, there is a shortage of tools and systems available in the processing sector to enable the treatment of carcases to ensure consistent quality of product for the consumer.

In response to this identified deficiency, MLA has facilitated a major program of R&D into processing intervention meat electronics. The first technologies to arise from this program are currently being commercialised, and are delivering quantifiable benefits in eating quality and processing efficiency for the beef and lamb industries.

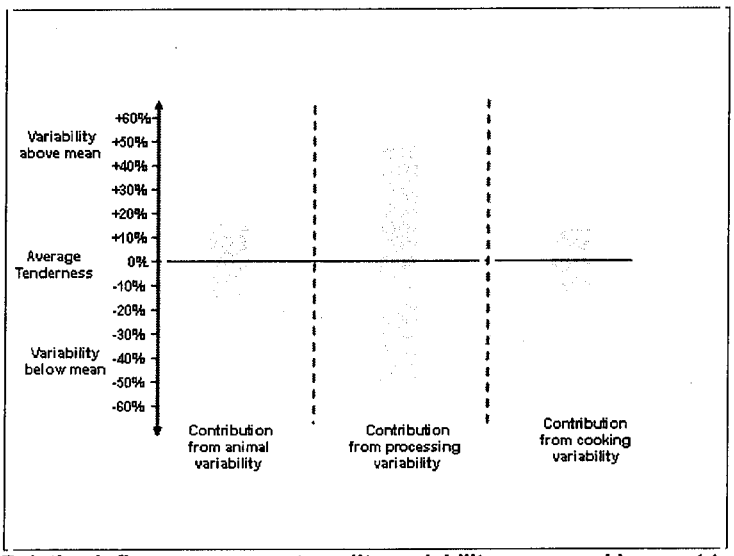

Figure 1: Relative influences on meat quality variability measured by meat tenderness

Technology summary

To address the quality variation that occurs during processing, MLA and its partners have developed a suite of computer controlled processing intervention technologies, funded through MLA's Partners in Innovation program. The technologies, based on new forms of electronics that maximise both eating quality and processing efficiency, have been through two stages of development to date:

Generation One

The Generation One meat electronics technologies arose from projects undertaken by MLA in collaboration with the technology development partner, Applied Sorting Technologies Limited (AST), through MLA's Partners in Innovation program.

The initial R&D into new processing technologies was completed for sheep in 2002 and for beef in 2003. The suite of technologies that comprise the Generation One meat electronics is summarised below:

- **Controlled dose low voltage carcase stimulation** (beef and sheep): to control meat tenderness
- **Electronic bleeding (beef):** to enhance blood yield, improve meat colour, improve plant hygiene and reduce costs
- **Low frequency carcase immobilisation** (beef and sheep): to reduce occupation health and safety risk; imparts a small stimulation effect
- **High frequency carcase immobilisation** (beef and sheep): to reduce occupational health and safety risk; no stimulation effect
- **Mid voltage electrical carcase stimulation** (beef and sheep): to control meat tenderness

The Generation One meat electronics technologies have three main components:

1. Intervention technologies that interact with the carcase;
2. A Computer Process Management System (CPMS) that regulates the intervention technologies; and
3. Measurement technologies that determine the quality attributes of the animal that feed into the CPMS.

The intervention technologies are controlled by the CPMS, which regulates the operation based on defined parameters for the animals being processed, such as age, sex, and husbandry, entered in by the operator.

The Generation One technologies are currently entering the adoption phase of commercialisation.

Generation Two

Generation Two technologies are the current focus of meat electronics R&D. These technologies aim to achieve more consistent product quality through tailoring inputs based on an analysis of individual carcase traits, as opposed to the batch treatment of animals employed by the Generation One technologies. The Generation Two technologies will leverage and build on the

research and experience of Generation One technologies, particularly the CPMS.

Commercialisation and adoption of Generation One meat electronics

As an industry organisation, MLA's measure of success in the commercialisation of technologies differs from normal commercial metrics. The main driver of success is the adoption of new technologies to ensure the red meat industry derives the benefit from MLA's R&D investment.

The meat electronics technologies represent a significant shift in meat processing knowledge and systems for the Australian red meat industry. To ensure take-up of the technologies by industry, a two-pronged strategy has been designed, linking a broad industry adoption strategy with the more focused commercialisation strategy for individual companies. This two-pronged approach seeks to ensure industry knowledge is aligned with the technologies that are commercially available to them. An intellectual property strategy has also been developed to ensure that adequate freedom to operate is guaranteed and the innovations are appropriately exploited to benefit Australia's red meat industry.

Adoption strategy

MLA supports the adoption of meat electronics technologies through activities such as:

- joint funding of early development systems;
- introducing key retailers to the benefits of the technology to deliver pull-through demand;
- the development and dissemination of generic industry outcome reports; and
- tools to communicate the benefits of the electronics technologies at an industry and enterprise level, such as industry workshops, site visits and information packs

In addition, the adoption plan has been designed to allow the meat electronics technologies to be integrated with the outcomes of the SMEQ and MSA programs, which have been adopted by the Australian red meat industry. This ensures that a through supply chain approach is adopted by both producers and processors to provide the end consumer with a higher quality product and raise demand for Australian red meat.

Commercialisation strategy

When considering the commercialisation strategy, the value of the Generation One meat electronics technologies to the Australian red meat industry was estimated, using a technology valuation tool developed specifically for the Australian red meat industry, to enable MLA to:

- determine the return to industry on MLA's investment in these technologies; and
- provide the basis on which to focus future technical and commercial efforts.

The two commercialisation pathways identified as appropriate routes to market for the meat electronics technologies were:

1. Non-exclusive licence to industry providers with MLA support provided through management of the licensees and provision of technical support to the various providers; or
2. Exclusive licensing to an external commercialising company supported by an industry adoption strategy.

During the evaluation of the commercialisation pathways the primary areas considered included:

- strategic alignment;
- product viability;
- customers;
- sales, marketing and support services;
- risk; and
- marketing strategy.

The outcome of the evaluation supported the decision to take the Generation One meat electronics technologies to market through an exclusive licence arrangement.

The Generation One meat electronics technologies are being commercialised by an external company – Millers Mechanical – under licence from the intellectual property owners – MLA and AST. Millers Mechanical was chosen after an extensive tender and selection process. Millers Mechanical is an engineering design and build company from New Zealand with an extensive background in beef, sheep and deer processing and handling equipment. The technologies are commercialised in Australia through a sister company – RealCold MilMech – which specialises in supplying meat processing systems and low temperature chilling and freezing equipment for the meat industry. Both companies are part of the RealCold Group of companies.

Intellectual property strategy

It was decided to patent the innovative areas of the meat electronics technologies to protect them from unwanted exploitation, both in Australia and overseas. Patenting provides a unique opportunity for MLA to manage the application and adoption of the technologies and business method.

The patent application, entitled 'Electrical treatment of carcases' (priority date of May 2002), is currently undergoing examination in Australia. The patent has also been lodged with the European, United States and New Zealand patent offices for examination, to provide protection in overseas jurisdictions and markets. Initial preliminary examination and international search reports have indicated that the criteria required for granting a patent should be met. The patent application captures the intellectual property (IP) around the electrical stimulation intervention technologies and the business method for the CPMS concept. If the patent application is granted as a full patent it is enforceable until 2022.

The IP in the Generation One technologies is shared equally between MLA and AST in recognition of the parties' background IP and funding contributions.

Outcomes and current status

Intellectual property and patents

Currently, the IP is owned 50:50 by MLA and AST in recognition of the parties' background IP and funding contributions. Shared IP ownership adds a degree of complexity to the commercialisation process and has important implications for the ongoing development and commercialisation of the next phases of the meat electronics technologies program, particularly in relation to the need for MLA to continue to consult with the original partner, AST.

Therefore, MLA and AST have reached an in-principle agreement for MLA to purchase the AST share of the IP. This will ensure MLA has the appropriate freedom to operate and to commercialise the Generation One meat electronics technologies and any future developments that transpire in the next phases of the program.

Benefits

Uptake by the Australian red meat industry

As at February 2005, there were 36 discrete meat electronics technologies installed or committed to be installed in Australian beef and sheep processing plants, representing 71% of Australian sheepmeat production and 42% of beef production. Current forecasts estimate that by the end of the 2005-06 financial year, the meat electronics technologies will be utilised across more than 85% of Australia's sheepmeat production and 75% of beef production.

Meat electronics technologies have been installed in six sheep processing plants with funding support through the MLA Plant Initiated Projects program as part of the original development project that began in 2000. The size, configuration, geographic spread and type of animals being processed at these plants provide important data for the commercial installation of further plants and the development of the parameters required for the operator inputs for CPMS control.

In addition, the installation of a system has been supported through the MLA Partners in Innovation program in Brisbane as part of the development of the beef system.

Economic

Preliminary estimates of the economic benefit to the Australian red meat industry have been modelled using an internal industry specific model. This has indicated that the benefit arising from the meat electronics technologies has a possible net present value of up to $383 million from 2005 to 2010. This benefit arises from an investment by the industry of approximately $3 million over the past five years.

Social

The social benefits arising from the implementation of the meat electronics technologies will be the support of the sustainability of the Australian red meat industry by delivering a consistent and high quality product to compete with other protein sources in the market.

Much of the economic benefit to the industry arises from improvements in meat processing efficiency. This will support the ongoing viability of meat processors, representing a national workforce of approximately 25,000.

Environmental

The electronic bleeding module results in the majority of post-slaughter blood collection occurring in a much more controlled and central area than is normally achieved. This means that less blood ends up in the processing waste water stream, which also helps manage the risk associated with the industry.

Skills and business knowledge

MLA has provided significant support to the licensee and commercialiser of the technology – Millers Mechanical – to facilitate the transfer of technical knowledge from the MLA program manager to the Millers Mechanical sales and installation staff. Given the scope of the benefit to industry compared with the smaller commercial benefit to Millers Mechanical, this support was deemed necessary to ensure the technologies were taken to market quickly. Support from MLA will continue until mid 2006 when the majority of the benefit from the meat electronics technologies will be realised by the industry.

The commercialisation strategy has been further supported by the broader adoption strategy. As the meat electronics technologies encompass a method of carcase treatment not yet widely accepted by the industry, MLA has undertaken an adoption strategy to educate the industry on the benefits at both an enterprise and industry level.

Research and market linkages

The installation of the new meat electronics technologies into processing plants has been carried out in close consultation with industry. The benefits of the installed Generation One technologies identified so are have been:

increased market from improved eating quality;

- electricity savings from hot boning;
- reduced carcase shrinkage;
- additional value per tonne gained by moving to hot boning;
- reduced labour;
- increased blood recovery;
- carcase immobilisation resulting in reduced occupational health and safety risk;
- improved meat colour;
- improved biological status;

- reduced waste; and
- increased production rate.

These benefits will aid increased consumer confidence and satisfaction in Australian red meat, which can translate into increased sales and market growth.

The meat quality benefits of the sheep electronics system have been demonstrated to major retailers in Australia, resulting in an inclusion in their product specification for the stimulation technologies. It is anticipated that the beef electronics system will follow this pattern of designated requirement by retailers. This pull-through effect will help in the adoption of the technologies by the red meat processing sectors who supply Australian retailers.

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Case study 3 – beef quality gene markers

Context

Beef gene markers are a technology that help identify, select and breed from beef cattle with meat quality traits that suit specific market needs. This allows the industry to more efficiently produce quality meat through selection at an early stage of feeding, thereby reducing costs, or by selective breeding. Gene markers enhance existing genetic evaluation programs by providing methods to identify discrete elements of genetic variation, in some cases, for characteristics that are not easily measured in living animals. The combination of gene markers and genetic evaluation provide tools to increase the rate of genetic improvement in industry herds and flocks. Gene markers may also be used to select which animals go into specialised production systems.

Technology summary

The characteristics of red meat that give rise to variations in eating quality are partly determined during the growth of the animal by the complement of genes. Variation in gene sequence and corresponding function are responsible for some of the variability in eating quality. Gene markers are indicators of gene differences between animals. Typically they are a single base variation which is, or is near to, the gene affecting the trait. The tests are conducted on DNA extracted from a sample taken from the animal of interest (in the case of beef cattle, usually hair, but it can also be blood, semen or tissue). Currently Meat & Livestock Australia (MLA) and their partners have licensed gene markers made available to the cattle industry for two important traits – marbling (fat content and distribution in meat) and tenderness. Both of these traits are important eating quality attributes. At present one commercial partner is offering three gene markers each for marbling and tenderness. Because a gene marker is an indicator of only part of the genetic variation affecting a trait, multiple markers are possible and required to continuously improve the target trait.

MLA partnered with the CSIRO to discover the first gene marker for marbling, and also with the Beef CRC and CSIRO to discover the first gene marker for tenderness. The research program commenced in 1989, with initial investment by the Meat Research Corporation, and was accelerated in 1993 with the advent of the Beef CRC.

The products (tests) are marketed under the GeneStar brand by a technology start up company, Genetic Solutions.

The marbling marker technology provides the user with the capacity to test cattle before entry into a feedlot. The information in the gene marker profile is used to determine which animals to continue on feed for demanding markets. This reduces the cost of feeding by culling animals that would otherwise have a low chance of achieving specifications. Apart from reducing feeding costs, it increases the ability to forward sell into demanding export markets.

The use of tenderness markers increases the chances of breeders selecting tropically adapted animals with more tender meat. This flows on to improved customer satisfaction with the product and ultimately increased sales.

In each case, gene markers are used by breeders to determine which cattle to join to increase the chance of their calves better meeting future specifications.

Commercialisation and adoption

Outcomes and current status

Australian and international (predominantly North American) sales of gene marker tests to date are in excess of 15,000 tests for GeneStar marbling and 20,000 tests for GeneStar tenderness. The information for tests conducted in Australia is made available to the national beef cattle genetic evaluation scheme (BREEDPLAN).

Further investment in the development of beef gene markers is through:

a) MLA funded research and development (R&D), predominantly through the Beef CRC;

b) independent investment by the Beef CRC;

c) collaborative research and commercialisation agreement with the Beef CRC, CSIRO and the commercial partner Genetic Solutions; and

d) MLA Donor Company when near to market evaluation is required.

This pipeline of R&D and commercial arrangements is generating from 2–3 new gene markers each year. Our approach is to protect each gene marker by appropriate patents and to license rights to commercialise to a commercial partner.

Commercialisation and adoption strategy

The adoption of gene markers by industry is facilitated by ready access to a commercial partner who provides all the sampling and testing services. The results of the tests, in Australia, are made available to BREEDPLAN (the national genetic evaluation program). Over the three years since the first GeneStar marbling marker was launched, prices have fallen by over a third, in line with savings through increased throughput and improvements in technology. This trend is expected to continue.

The package of gene marker technologies is licensed to Genetic Solutions by MLA, Beef CRC and CSIRO under a collaborative research and commercialisation agreement (CRCA). Under the terms of the CRCA, each new marker (covered under the license) is available to be licensed if it meets strict technical and industry value criteria.

Licenses are offered exclusively, but constrained by field of application, jurisdiction and by specific marketing plans with set sales targets in each jurisdiction. Failure to achieve targets set in the marketing plan may place the license in jeopardy. It is the responsibility of the commercial partner to conduct marketing activities, for each test, with the object of maximising sales.

This relationship between industry strategy and commercialisation strategy is summarised below.

Industry objective

- Increased beef eating quality and capacity to achieve marbling specifications

Research strategy

- Establish a functional connection between investment in improved genetic evaluation systems and development of new technologies arising from molecular biology.
- Build large scale databases from measured industry animals and DNA for use in molecular genetics R&D.
- Conduct "fundamental" R&D to discover gene markers that can be used to select more tender animals and identify those with higher propensity to marble.

Development strategy

- Patent gene marker discoveries.
- License a package of underpinning data and know how to Commercial Partner.
- Conduct "near to market" R&D with the commercial partner to evaluate tests in industry herds.
- Provide technology licenses to the commercial partner on a case by case basis for each gene marker.

Commercialisation arrangements

- Exclusive license for commercialisation of technology (each gene marker, constrained by field, jurisdiction and by marketing plan)
- Rights to sub-license (overall, but explicitly in jurisdictions where local presence is important)
- Terms to deliver more favourable to Australian users than to overseas users.

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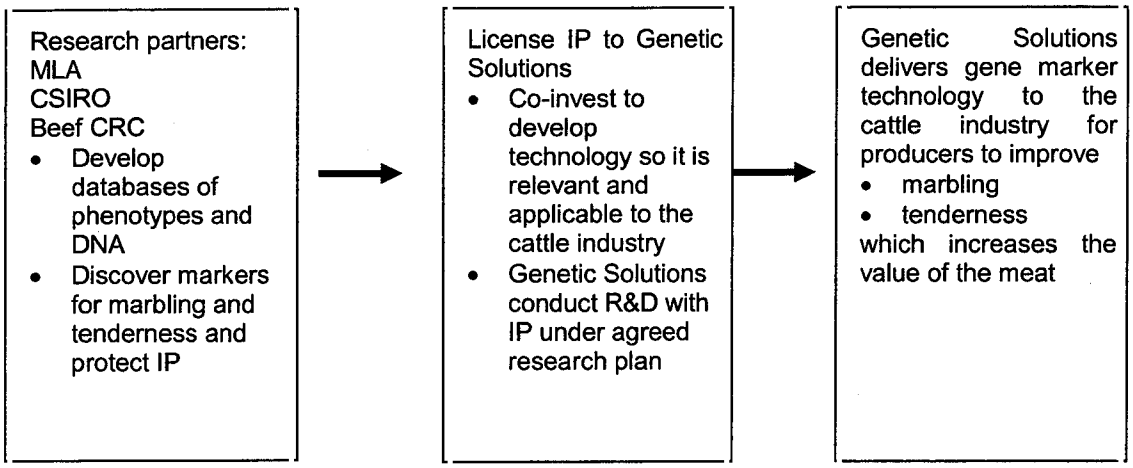

Figure 1: Summary of research to delivery pipeline

Summary of the commercialisation plan:

- Intellectual property – confidential information (umbrella agreement that leads to a collaborative research and commercialisation agreement) and patents to protect specific information
- Commercialiser – selected from expression of interest based on assessment of capacity to build the technology/user interface. MLA provides no explicit support, although we will partner donor company arrangements for near to market evaluation.
- Agreements – licences, specific requirements (such as market focus), royalties, exclusivity, performance requirements etc.
- Value proposition for commercialiser – based on exclusivity of license and their ability to extract value from the technology.
- Off shore commercialisation – encouraged through marketing plan, but sub-license arrangements offered when it is obvious that the most effective arrangements are to use local knowledge.
- Capital requirements (financing plan) – none done completely at commercialisers risk.
- MLA exit strategy – we are locked into the commercial arrangements for the life of the patents, except where performance against marketing plans triggers change in terms of license (non-exclusive at first, followed by loss of license). We want the commercialiser to succeed, and if they don't succeed, we reissue the license. However, it is at no cost (other than transactions in issuing new licenses) to MLA for the commercial partner to continue (indeed, as time goes, on our royalty stream increases).

Industry benefit

There is as yet no direct economic data on effect of the gene markers in industry herds.

However, uptake by industry is increasing. The tenderness gene markers are outselling the marbling markers. This is due to the perceived benefit on increased tenderness through MSA. It is anticipated that future benefits will arise as the users of the tenderness tests in Northern Australia see a return in *Bos indicus* cattle.

With respect to marbling, the use of animals with the positive alleles for the 1st of the gene markers results in a 0.2 increase in Ausmeat marble score overall and a 10% decrease in animals within the lower marbling grades. This translates into real economic benefit for the feedlot who purchase cattle with the positive marbling alleles. There is an expectation that this will flow through to calf producers over time.

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4. MLA's commercialisation principles brochure

MLA's commercialisation principles

Innovation to adoption

Research and development (R&D) for the benefit of the red meat industry is a fundamental element of the activities of Meat and Livestock Australia (MLA). MLA investigates and evaluates the research and development needs of the industry and facilitates the development and adoption of R&D results.

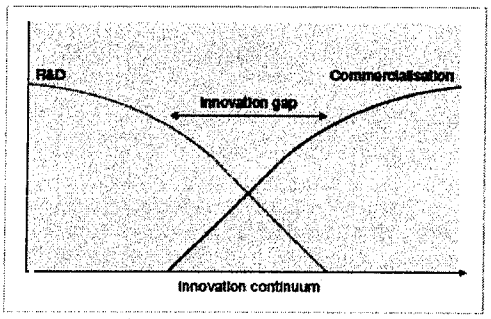
Commercialising innovations is at the heart of our industry's future and the success of the strategy helps bring sustained growth and competitive advantage. Our successes bring benefits to all sectors of the industry and community, such as improved industry profitability; environmentally sustainable industry practices; meaningful and productive employment; and regional development opportunities.

MLA's intellectual property ownership strategy and adoption methods vary from project to project. Each R&D project is reviewed individually to ensure the most efficient and appropriate path to adoption is selected that maximises benefit to the Australian red meat industry.

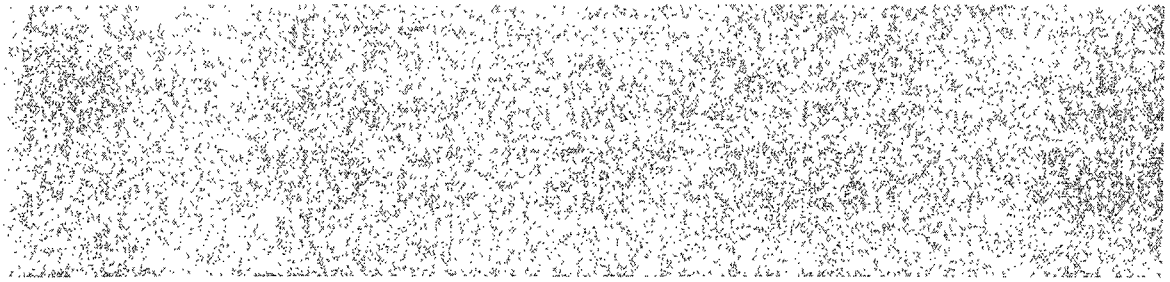
MLA recognises and values the key role our partners play in delivering innovation benefits to industry. This brochure outlines MLA's commercialisation policy and guiding principles, which set out MLA's objectives and commercial position with regard to investment in R&D. MLA partners need to be aware of these principles as they will form an integral part of any agreement that MLA enters into.

Commercialisation is one tool available for adoption that enables MLA to maintain a level of control and management of R&D outcomes to ensure that the benefit is retained for the Australian red meat industry.

One of the greatest challenges facing the innovation industry in general is successfully bridging the 'innovation gap'. This gap represents the cross over from R&D to commercialisation and adoption.



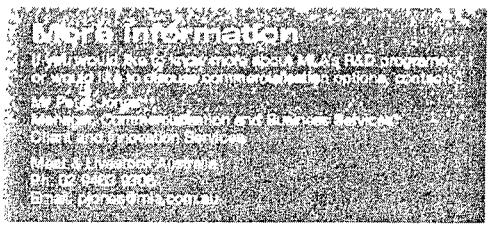
MLA's commercialisation strategy targets the innovation gap to maximise the return on R&D investment by facilitating the transition of new technologies and processes from the R&D phase to commercialisation and adoption. In order to manage, protect and deliver R&D outcomes MLA has formulated a set of guiding principles for the commercialisation of R&D innovation.



The commercialisation principles

The objective of these principles is to maximise opportunities and benefits to the Australian red meat industry. To achieve this, MLA will implement a structured commercialisation framework and allocate sufficient resources according to the following principles:

1. MLA will ensure that it has appropriate resources (qualified and experienced staff; external expertise; funding) and systems in place to protect and manage intellectual property rights on behalf of the red meat industry.
2. In each case, establish and maintain ownership of intellectual property allowing MLA to exercise appropriate influence to achieve maximum industry benefit from the exploitation of intellectual property.
3. MLA will endeavour to accelerate the adoption of R&D outcomes by selecting the most appropriate commercialisation pathway and by ensuring that an effective commercialisation supply chain is in place to service the needs of the red meat industry.
4. MLA will grant periods of exclusivity only where required to reflect private commercial investment and where there are unnecessary restrictions imposed which will limit adoption and industry benefit in the longer term.
5. MLA will encourage private commercial investment and involvement in the commercialisation processes wherever appropriate.
6. MLA will generate an appropriate commercial return on exploitation of intellectual property (via licensing, royalties, divestment, equity vehicles and other commercial arrangements) while ensuring industry benefits and advantages are maintained.
7. Appropriate exit strategies will be determined as soon as MLA's ongoing involvement is no longer desirable or required to maintain industry benefit.
8. Systems will be implemented to ensure due diligence and risk management principles are applied to all commercialisation activities undertaken by MLA.
9. Consideration will be given to commercialisation of industry-funded intellectual property outside of Australia when:
   - it can be clearly demonstrated that no disadvantage to the Australian red meat industry will arise; and
   - it will enhance the industry's competitive position; and/or
   - it will reinforce the reputation of the red meat industry's systems; and/or
   - it is necessary to underpin the capability and viability of the commercialiser.
10. Income generated from commercialisation will be expended on projects and activities that are:
    - consistent with the objects of MLA as defined by our Constitution;
    - in keeping with approved delegations in this respect; and
    - directed towards achieving specific benefit for the red meat industry.
11. Outcomes of commercialisation strategies will be measured and regularly reported to the MLA Board, government, and stakeholders.



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