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Sustainable packaging value chain opportunities in the Australian red meat industry

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Executive Summary

The purpose of this project was to develop a research, development and adoption (RD&A) strategy for sustainable packaging within the Australian red meat supplychain over the period 2016 to 2020. The strategy is aligned with the MISP 2020, which focuses on increasing profitability of the red meat industry in a sustainable manner and sets the direction for MLA's Supply Chain Sustainability (SCS) Programme over the period 2016 to 2020.

The aim of the strategy is to contribute to MLA's goals pertaining to adding value to waste generated by the red meat industry and to reducing energy and water consumption, greenhouse gas emissions and the volumes of liquid and solid wastes by 25% by 2020.

The strategy contains two RD&A programmes of activity which present an economic value proposition to industry, demonstrate environmental stewardship of environmental resources, and maintain product safety, integrity and consumer acceptability.

The RD&A programmes were developed through:

- background research to understand the types and quantities of packaging used in the sector
- an industry workshop to identify RD&A opportunities
- preparation of two preferred RD&A programmes which include indicative budget, activities, and an estimated benefit:cost ratio.

The objectives of the RD&A programmes are to address a number challenges relating to use of packaging across the Australian red meat supplychain. The first programme **"*Sustainable Packaging Innovation Platform*"** is focused on analysis of packaging needs and use in the wholesale segment of the red meat supply chain. To implement this programme, a sustainable packaging innovation platform will be established to promote best practice packaging within the wholesale segment. A core working group will be established to coordinate the activities of the innovation platform. Technical working groups will also be established to oversee the deliverables sort by the core working group. The key areas of focus for the innovation platform will include:

- identifying opportunities to reducing excess packaging in the wholesale segment
- investigating the feasibility of re-usable packaging
- investigating waste to energy as a disposal option for red meat packaging.

Preliminary research indicates that a modest 0.25% reduction in packaging use within the wholesale segment, can result in savings of $1 million. The cost to administer the program will be approximately $800,000 including staff and external costs resulting in a benefit cost ratio of 1.4:1. This ratio does not include the savings associated with implementing the re-usable packaging and waste to energy opportunities. However, the research will inform the best approach to implement these initiatives and result in further potential savings.

The second RD&A programme, entitled ***"Consumer messaging"***, is focused on consumer packaging. While consumers value sustainable packaging and are keen to recycle, they may be confused with the recyclability of red meat packaging. They may also not fully understand the role packaging plays in reducing the environmental impact of red meat. To overcome these issues, MLA will focus on providing information to consumers across the following three areas:

- The important role packaging plays in protecting red meat and reducing food waste
- What the industry is doing to reduce its impact
- Practical steps that consumers can take to reduce their own impact.

To deliver these messages, MLA will undertake a consumer facing program through in-store displays, media, online and on-pack labelling. MLA will research, develop, test and roll out this information in consultation with industry.

The practical steps which consumers can take to reduce their packaging will focus on providing suitable on-pack labelling, to provide consumers with clear instructions on the correct disposal path for each packaging type. The benefit to the red meat sector is through improved environmental reputation, leading to increased red meat sales. While difficult to quantify, the value to producers of this program, through increased red meat sales, resulting in an estimated benefit based on increased sales of $33 million over the period of the program based on implementation rate of 90%. The cost to administer the program will be approximately $200,000 per year for four years, and there will be costs of around $2 million for the brand owners. The benefit cost ratio for this programme is estimated at 12.5:1.

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1 Introduction

1.1 Background

Meat and Livestock Australia (MLA) wishes to develop a 2016-2020 strategy to guide the development of sustainable packaging in the red meat sector. EY was engaged to help provide the framework for the strategy which will guide MLA's research, development and advocacy activities to enhance existing packaging, as well as establish new environmentally sustainable packaging supply chains within the Australian red meat sector.

The strategy proposes two programmes of research, development, adoption and marketing initiatives for sustainable red meat packaging, to improve conventional non-renewable packaging products and to reduce the amount of packaging ending up in landfill.

1.2 Scope

This project is focused on improving the sustainability of packaging for the Australian red meat sector which includes beef, sheep and goat meat. The study investigates sustainable packaging opportunities for the entire value chain from meat processors, export, wholesalers, retail and domestic consumers. Environmental impacts of the meat sector, and packaging associated with live exports, are outside of the scope of the strategy.

The objective is to ensure that practical, viable sustainable packaging initiatives are developed for the red meat sector, by exploiting opportunities which offer the best return for investment.

1.3 Methodology

To create suitable programmes of RD&A and marketing activities for sustainable red meat packaging to improve on conventional non-renewable packaging products and reduce the amount of packaging going to landfill, EY's methodology detailed in figure 1 involved the:

- Development of a topical background paper containing background information on the red meat sector and packaging. (see appendix A)
- Identification of best practice packaging approaches and benchmarking with existing/current packaging
- Facilitation a workshop with a reference group of industry representatives to identify barriers, challenges and opportunities for sustainable red meat packaging
- Consultation with industry representatives and other stakeholders to better understand the factors impacting the viability of the opportunities
- Development a short list of sustainable packaging opportunities, based on workshop outcomes for further analysis
- Development of an environmental and economic analysis and assessment of opportunities using a Multi-Criteria Analysis (MCA) approach
- Ranking potential initiatives based on the above MCA
- Recommending the preferred approaches for MLA to support their sustainable packaging strategy.

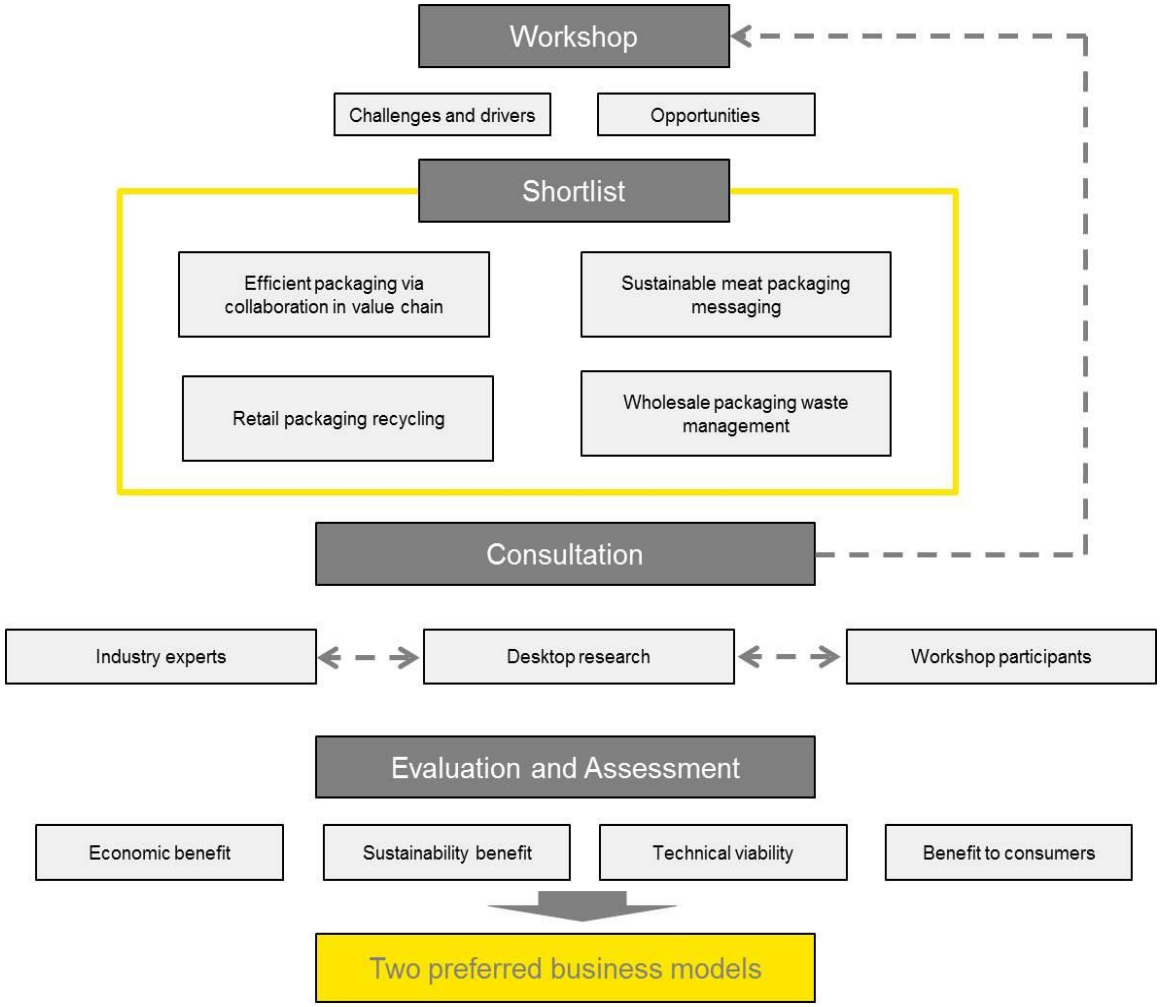

Figure 1: Programme development process

1.4 The Case for Change

EY developed an extensive topical background paper (see appendix A) which provides an overview of past studies and reports of the red meat sector in Australia to establish an understanding of the sustainable packaging value chain opportunities in the Australian red meat sector. The following provides a summary of the research paper and the case for change to establish new environmentally sustainable packaging supply chains within the Australian red meat sector.

The red meat sector in Australia is significant, producing over 2.8 million tonnes of meat per year (carcass weight)[1] (Spencer & Kneebone 2012). Australia is a major exporter of red meat, with over one million tonnes of red meat forecast to be exported in 2016 (shipped weight) (Spencer & Kneebone 2012).

Packaging is an important part of the red meat value chain. It plays a key role in the protection, promotion, convenience, utilisation and handling of red meat in both the wholesale (export and domestic) and retail markets (Verghese et al 2013; Chandra Lal, Yambrach & McProud 2015). Over 40,000 tonnes of packaging is used in the domestic market, and a similar amount in the export market (McKinna 2006).

A key driver of packaging technology innovation is to extend the shelf life of red meat and improve cost efficiency. Important attributes of meat packaging are that it supports traceability of meat products and ensures meat products meet food safety requirements.

There is an environmental trade-off between packaging and food waste, with more packaging (including individual packaging) generally leading to lower rates of food waste (Verghese et al 2013). Verghese et al (2013) found that *"On average packaging accounts for only 10% of total energy but it plays a critical role in ensuring that the other 90% is not wasted".* The environmental impact of producing one kilogram of red meat is greater than the environmental impact of creating the 80 grams of packaging to adequately protect it. Consequently ensuring adequate packaging for red meat is an effective way to reduce the overall environmental impact through the reduction of food waste.

Sustainable red meat packaging will benefit the red meat sector by:

- Saving money through efficient packaging and resource recovery
- Meeting ongoing and emerging regulatory drivers relevant to packaging
- Development of packaging technology which responds to sustainability drivers in line with or ahead of its competitors, and before it becomes a problem for the industry
- Ensuring access to existing and emerging markets
- Encouraging innovation through packaging including ensuring that packaging meets the needs of consumers.

A number of factors challenge the sustainability of red meat packaging in Australia. These include:

[1] This represents the total tonnes of beef and sheep meat (2, 814,000 t) with production and trade volumes based on the average of 5 years to 2010, sourced from ABARES and MLA. S & Kneebone, M (2012), FOOD map: An analysis of the Australian food supply chain. Goat meat 32,900 tonnes as reported by the ABS in 2015. MLA's Market information & Industry insights – Australian goat industry summary 2015.

1. **Low recycling rates, especially for plastic packaging**. A high proportion of plastic red meat packaging (wholesale and retail) is currently sent to landfill in Australia (McKinna 2006), which is similar to the UK market (Walsh 2013). Despite progress in packaging recycling at a retail level, there are still low recycling rates for plastic meat packaging in Australia.
2. **A trend toward increased packaging in the red meat sector**. McKinna (2006) found that there was a trend toward greater use of packaging across the meat value chain due to the following trends:
    - Smaller cartons (due to OHS weight constraints in Australia)
    - Smaller primal cuts, increasing vacuum bag use per kg
    - The use of 'case ready systems' which can lead to a larger quantity of smaller cuts.
    - Increased primary packaging demand due to consumer preference for more convenience and desire to extend retail shelf life.

While the Australian red meat sector faces challenges to address the sustainability of its packaging, consumers are becoming more aware of sustainable packaging and are willing to pay more for sustainable packaging (Leavy 2013; Chandra Lal, Yambrach & McProud 2015). Research has shown that while consumers value the function of packaging, they are sensitive to excessive packaging, and that over packaging can influence their purchasing behaviour (Ahmed, Parmar & Amin 2014; Chandra Lal, Yambrach & McProud 2015). The relationship between packaging and food waste is well established; however the value of packaging can be a difficult message to sell to consumers (Verghese et al 2013).

1.4.1 Packaging use in the Australian red meat sector

The most comprehensive data regarding the volume and cost of packaging in the Australian red meat sector was found in the 2006 MLA funded study "Fate of packaging" by McKinna. This study focused on all packaging through the value chain for the domestic red meat market in Australia (i.e: not including export packaging).

To complete the EY assessment, data on packaging types, volumes and costs was sought from selected industry participants but only very limited data was able to be obtained within the timeframes. To complete the analysis required, the data from the McKinna study (2006) was extrapolated to reflect changes to packaging types, volumes and costs. The breakdown of this packaging is shown below in table 1. Based on this study, together with industry stakeholder evaluations, it is estimated that 49,000 tonnes packaging will be used in 2016. A full breakdown of this table, by packaging type, can be found in the Topical Background in Appendix A.

The Australia red meat industry is heavily regulated to maintain quality and freshness of product and protect the consumer. Packaging has been specifically designed to protect the product from contamination and spoilage yet allow the utilisation and handling of the product for transport and retailing. Our research shows that there are three key drivers that will continue to shape the current and future packaging regulatory requirements for the Australian red meat industry.

Value Chain Segment	Packaging Components	Volumes (kg)	Cost ($)
Wholesale packaging	Cartons (based and lid), Liner bag, Vacuum bag, Boneguard, Weight label, carton label, Pallet Pallet wrap	41,623,000	$312,340,161
Retail packaging	Tray (MAP), Lid film (MAP), Gas, Absorbent pad, Product label Exp PS tray, Overwrap film	7,679,026	$119,975,798
Total packaging		49,907,333	$432,315,959

Table 1: Breakdown of domestic packaging

These include:

- The national and state regulatory context including food safety laws and standards and sustainable food packaging requirements
- The international drivers including global standards, international associations and programs, and country-specific programs
- A shift in consumer perception and understanding of waste impacts, climate change, finite resources and the trend towards buying more sustainable packed products.

These drivers result in conflicting pressures between meeting regulatory needs, international and domestic supply and demand of the product, and shift in consumer behaviour that will continue to drive changes in packaging regulation and create challenges for the red meat industry.

Feedback from stakeholder consultations and the reference group suggested that there is a strong need to tell a sustainability story for red meat. The MLA wants to ensure red meat is positioned as a premium protein option and to do this they require good sustainability credentials for all aspects of the product, from production through to consumption, including packaging. Consumer level of concern over environmental issues tend to come in waves, triggered by an environmental event such as drought, our research suggests that consumers are increasingly becoming more interested in packaging and the environmental impact of that packaging, in particular plastic packaging. Yet, there is an expectation by consumers that the industry will manage the environmental impact of packaging and make incremental improvements as part of their business.

It is important that the red meat sector shows it is managing its packaging in a sustainable way. Further to this, consumer goods that demonstrate commitment to sustainability tend to outperform those that do not (Adams 2014) and 55% of consumers are willing to pay a premium for sustainable goods (Leavy 2013).

2 Sustainable red meat packaging programmes

EY has developed two programmes of RD&A and marketing activities for sustainable packaging in the red meat sector. The first programme **"*Sustainable Packaging Innovation Platform*"** is focused on reducing the environmental impact of packaging in the wholesale sector. The platform will promote best practice packaging across the wholesale sector, focusing on the reducing excess packaging, the feasibility of re-usable packaging, waste to energy as a disposal option for red meat packaging.

The platform could result in lasting savings to the sector by reducing costs associated with packaging, costs associated with packaging waste, and potential savings through the adoption of re-usable packaging, and/or waste to energy. The platform could also result in environmental savings across production, use (transport) and disposal stages of sector packaging and enhancements to the sector's sustainability reputation.

The boundaries for the packaging material considered within this programme is shown in Figure 2.

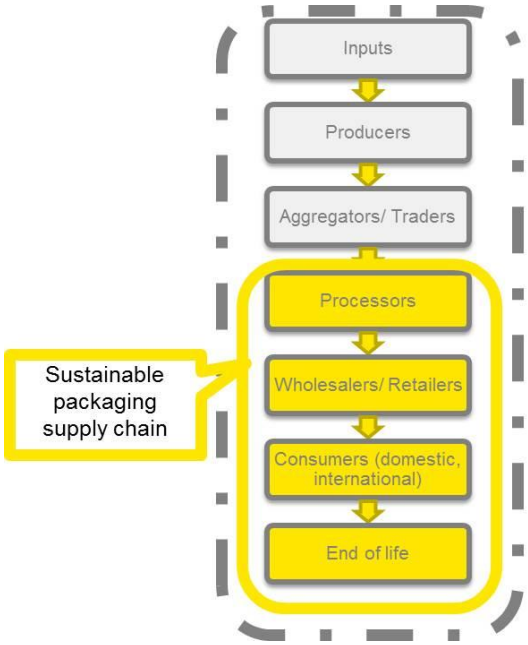

Figure 2: Packaging material boundaries within programme 1.

The second programme ***"Consumer messaging"*** aims to position the red meat sector as a leader in sustainable consumer packaging by providing information on:

- The important role packaging plays in protecting red meat and reducing food waste
- What the sector is doing to reduce its impact
- Practical steps that consumers can take to reduce their own impact.

Implementation of these messages will include a consumer facing program through in-store displays, media, online and on-pack labelling. It is proposed that the practical steps message will take the form of an on-pack recycling logo which will take the confusion out of consumers' decisions on whether they can recycle their packaging through normal kerbside collection.

The programme could provide lasting savings to the sector by helping to position it as a leader in sustainable packaging, and helping to address the issue of consumers being confused about which packaging is able to be recycled. It is envisaged that while other meat types may take up the labelling scheme for their packaging the red meat sector will have the advantage of being a leader in the market.

A high level cost benefit analysis was undertaken to determine the minimum benefit that could be achieved from the two programmes. This is to show the viability of each programme and provide a conservative basis for investment decisions. The costs and benefits applied do not include inflation. A 5% discount rate has been applied to the costing to reflect current interest rates and investment returns.

Consumers can be price sensitive whn making red meat purchase decisions. As such meat is price elastic to reflect consumer demand. The high level cost benefit analysis has not taken the elasticity of meat price into account as it was difficult to cost out the impact of this based on limited data available. Details of the assumptions and the high level cost benefit analysis are set out in Appendix D and Appendix E.

Programme 1:
Reduce or eliminate unnecessary packaging in the wholesale value chain

MLA will support a sector wide innovation program to encourage improved environmental outcomes in red meat packaging. The initial focus will be to identify and promote best practice aimed at reducing or eliminating unnecessary packaging in the wholesale sector.

There is over 40,000 tonnes of packaging produced through the wholesale value chain for the red meat sector, which cost the red meat sector over $300 million this year. Wholesale packaging refers to the business to business packaging of red meat that occurs from producers to wholesalers and the packaging that transports red meat for export or domestic markets. Consultation with stakeholders and the reference group workshop identified reducing packaging as a cost effective initiative. Packaging costs and disposal are born within the non-consumer section of the value chain. Reducing packaging use will help reduce the cost of product through to end markets which will benefit levy payers by contributing to red meat's competitive advantage.

An opportunity exists to improve the collaboration of producers, suppliers and wholesalers in the wholesale value chain. Driving collaboration within the wholesale value chain could drive efficiencies in wholesale packaging, reducing or eliminating unnecessary packaging in the wholesale value chain.

This program will run for four years and provides MLA with a roadmap to improve packaging efficiencies within the wholesale value chain. It identifies three strategic opportunities that deliver value for the red meat industry by supporting innovation activities across the value chain that result in increased benefit and sustainable competitiveness of the industry. The opportunities are:

- Reduce and improve packaging efficiencies in the value chain
- Re-use packaging
- Waste to energy

This program centers on a reduction in waste generation and associated environmental impacts (i.e. landfill, greenhouse gas emissions, resource consumption, etc.) by developing best practice guidance to encourage value chain collaboration and improve packaging efficiency across the wholesale value chain.

A core working group (CWG) comprised of key stakeholders from the red meat sector would be established by MLA to drive the initiative. Figure 3 outlines the program timeline and phase requirements.

The initial focus of the CWG (phase one) will be to undertake detailed evaluation and analysis of the value chain to quantify packaging volumes, identify packaging waste hotspots that require process improvements and waste management solutions, and to effectively map the relationships in the red meat value chain.

Phase two will identify and promote best approach to reduce or eliminate unnecessary packaging in the wholesale value chain.

Phase three will undertake a feasibility study to develop and apply a fit-for-purpose reuse packaging system in the identified hotspots from phase one which will work to reduce carbon

footprint of the industry, impose packaging efficiencies and further strengthen the culture of connected, collaborative players.

The final phase (phase four) will undertake a feasibility study to work towards the industry adoption of an effective waste to energy technology. This will allow emerging waste to energy technologies to manifest over the next four years creating a viable solution that will improve environmental outcomes in red meat packaging.

The proposed implementation of this strategy is set out in Figure 3.

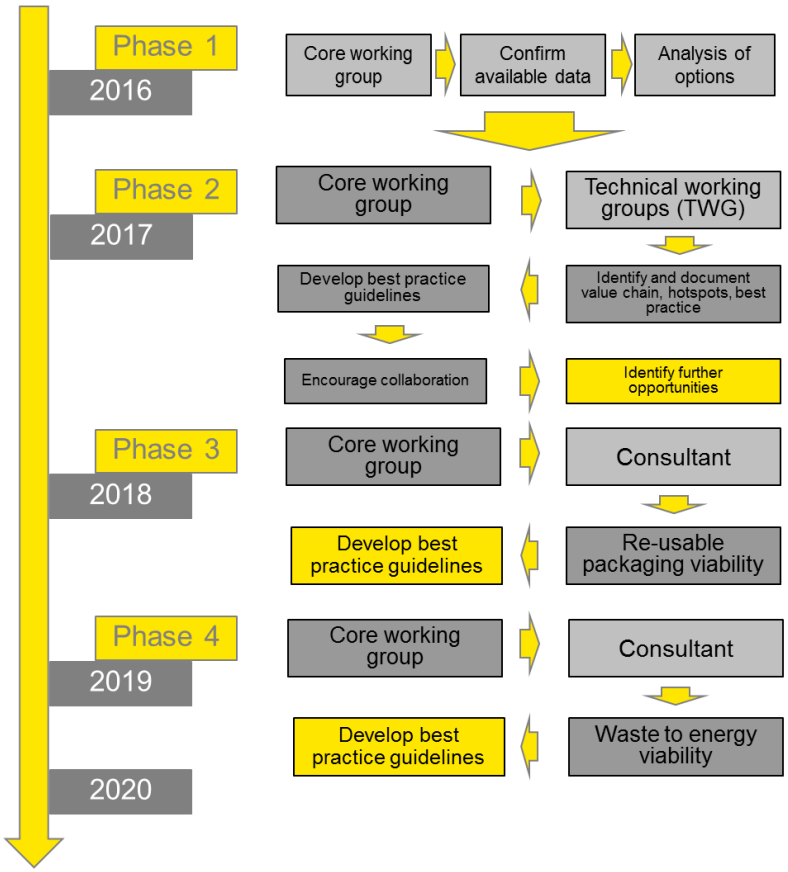

Figure 3: Innovation platform

Adoption of an industry wide program to reduce or eliminate unnecessary packaging in the wholesale value chain	
Value proposition	MLA will support a sector wide program to reduce packaging across the wholesale value chain, with an initial focus on reducing excess packaging. Packaging costs are incurred across the red meat sector. It is estimated that the red meat sector spends over $300 million per year on packaging across the wholesale value chain. In many cases the end customer does not see/interact with packaging used in the wholesale value chain and as such it adds no value to consumers. Yet, reducing packaging within the value chain will help reduce the cost of product through to end markets which will benefit MLA levy payers and contribute to red meat's competitive advantage. It is proposed that MLA establish an industry wide innovation platform for sustainable packaging in the red meat sector to reduce or eliminate unnecessary packaging use, and

Adoption of an industry wide program to reduce or eliminate unnecessary packaging in the wholesale value chain

explore options for re-use and waste to energy in the wholesale value chain.

Through an innovation platform model a reduction in wholesale packaging can be achieved without large investments in technology or R&D, resulting in fast pay back times for the sector, with only minor investment cost upfront. This is recognised as the most effective way of reducing the environmental impact of packaging (refer to the waste hierarchy figure 4). By reducing packaging the red meat sector will see a reduction in waste disposal costs, especially for packaging which is challenging to recycle.

Figure 4: Principles of waste management hierarchy (source: EPA Victoria)

Programs

1. Phase one (2016-2017):
   1.1. Engage a Coordinator to administer the program
   1.2. *Establish a MLA Core Working Group (CWG)*. This will be a working group comprised of key stakeholders from the red meat sector. The CWG would involve a core group to establish initial stages and coordinate the subsequent activities. The group would establish strategic industry goals that would form the basis for the terms of reference for the CWG to form the core responsibilities and role of the CWG. The Coordinator would be responsible for leading the CWG.
   1.3. *Mapping of relationships in the supply chain*. A detailed mapping progress would be undertaken to understand the relationships and their interactions in the supply chain. This program relies on strong understanding of the relationships within the value chain and how they can be leveraged to find opportunities to improve packaging efficiencies within the supply chain. This would help establish key areas of influence and therefore where the strength of opportunities to reduce packaging lies.
   1.4. *Audit of current packaging systems and processes*. Commissioning an audit to determine the actual quantities and types of different packaging used will be undertaken. It is suggested this be done through an accredited independent auditor to ensure quality assurance of data is maintained and accurate samples collected throughout the audit to provide a detailed picture of the packaging value chain.

   There is currently a lack of accurate data regarding the packaging systems, packaging types and packaging processes in the red meat sector. The most recent detailed analysis was undertaken in 2006. Due to this lack of accurate data it is difficult to understand the volumes of packaging within the supply chain, deduce how often a piece of meat is packaged and re-packaged along the supply chain to its end-of-life and the amount of packaging that is sent to landfill versus recycled or re-used. The relationship mapping exercise undertaken in 1.2 will support the sector wide audit process. EY suggests taking a representative sample of the industry to ascertain the types of packaging used

Adoption of an industry wide program to reduce or eliminate unnecessary packaging in the wholesale value chain

in the key areas of influence along the supply chain and therefore identify packaging hotspots for the greatest and most viable opportunities to reduce packaging.

1.5. *Initial analysis of packaging systems and processes*. The CWG will examine the relationship map and the audit results to determine where the hotspots are to reduce use of existing packaging. Understanding the relationships within the value chain, and the detailed packaging flows, will enable the key points of influence to be identified that will enable reductions in packaging use. These hotspot opportunities will be evaluated and prioritised.

2. Phase two (2017-2018) efficient packaging of red meat for distribution and wholesale:

2.1. *Establishing technical working groups*. Smaller groups, comprising 2-4 sector participants and a lead coordinator will examine a specific part of the value chain, relevant to their business area. Each technical working group (TWG) will identify opportunities to reduce packaging use in that specific part of the value chain. Guidance would be provided to the TWG to ensure consistency of approach. The TWG would be supported by the Coordinator to reduce the burden on industry participants (it is assumed they are volunteers).

The aim of each TWG would be to:

- Describe and document the 'before' situation
- Establish and document the sub value chain. For example: a sub value chain may be the point of distribution from producer A to wholesaler B of X cuts for retail and service clients.
- Describe the identified hotspots and opportunities to improve packaging efficiency for the sub value chain
- Show evidence that changes could reduce packaging without reducing packaging function or increasing costs elsewhere
- Identify cost savings
- Identify other benefits or considerations (which could become additional case studies)
- Document findings

2.2. *Developing best practice guidelines/ case studies*. Each finding would be documented by the TWG to develop best practice guidance suitable for dissemination via MLA networks.

2.3. *Encourage collaboration across sector*. The aim is to encourage other wholesale value chain participants to collaborate as per the best practice model. Collaboration could be encouraged through:

- Promoting economic benefits – the best practice guidelines could highlight sufficient economic benefits.
- Benchmarking – how do you stack up against your competitors?
- Awards – packaging reduction awards (or APC awards)
- Knowledge sharing amongst peers driven by the CWG
- Voluntary certification – development of a 'best practice' certification for use within the industry
- Ongoing promotion
- Collaboration with the APC

2.4. *Identification of further opportunities*. Work undertaken in phase one will drive innovation in packaging techniques such as light weighting or opportunities for reuse.

3. Phase three (2018-2019) feasibility study for reusable packaging:

3.1. Consultant undertakes feasibility study which include the following steps (with support from CWG):

3.2. *Identify suitable reusable packaging opportunities within supply chain*. Develop a list of products in the red meat sector that are frequently shipped in large volumes that are consistent in type, size, shape and weight. A flow of consistent products in large volumes is required to justify and maintain a reusable transport packaging system.

3.3. *Establish baseline costs of one-time and limited-use packaging costs*. The

Adoption of an industry wide program to reduce or eliminate unnecessary packaging in the wholesale value chain	
	consultant will determine baseline costs of one-time and limited-use packaging. This will include: • Cost to purchase • Cost to store • Cost to handle • Cost to dispose of the packaging • Added costs of any ergonomic or worker safety limitations 3.4. *Develop a geographical report*. Identify shipping and delivery points. The relationship mapping conducted in phase one will assist with this process. Evaluate the use of daily and weekly runs and consolidation centers (loading dock used to sort, clean and stage reusable packaging components). This should overlay the map of the supply chain and red meat sector value chain to facilitate a move to reusable packaging with suppliers. 3.5. *Review reusable transport packaging options and costs.* A review of the various types of reusable packaging systems available and costs to move them through the supply chain should be undertaken. Investigate the cost and life span (number of reuse cycles) of reusable transport packaging components. Some examples of suitable reusable options for the red meat sector have been given in Appendix A. 3.6. *Estimate the cost of reverse logistics*. Based on the geographical report estimate the cost of reverse logistics in a closed-loop or managed open-loop shipping system. 3.7. *Develop a preliminary cost comparison*. A cost comparison should be performed between the one-time or limited-use and reusable transport packaging and reusable transport packaging. This includes comparing the cost for the amount and type of reusable transport packaging in 3.5 and the estimated cost of reverse logistics in 3.6. 3.8. If proven viable, the system of re-usable packaging will be trialed and tested. 3.9. Develop best practice guidelines/ case studies (if found to be feasible). As for phase 1. CWG engages paid resource 3.10. Encourage collaboration across sector (if found to be feasible) CWG engages paid resource to undertake this work. *4.* Phase four (2019-2020) feasibility study for waste to energy: 4.1. As per 3.1 above 4.2. *Analysis of factors that determine viability.* The analysis performed needs to take into account the type and cost of energy replaced, capital costs incurred and any ongoing costs. For example fluctuations in the price of energy impact the viability of waste to energy initiatives, and different energy sources have different fluctuation profiles. On one hand, coal prices have been falling steadily over the past few years. On the other hand, gas prices have risen steadily in recent years. Waste to energy plants are capital intensive. Industry consultation found that typical costs were $5-10 million for a 1 MW plant. Emissions from waste to energy plants mean there is the need for ongoing licensing and monitoring costs. Industry consultation found that emissions monitoring costs for a waste to energy plant of the scale likely to process waste packaging could be as high as $300,000 per year. Ongoing licensing costs can vary depending on the type of technology used. 4.3. *Comparison of identified approaches.* It is important to perform a comparison of the identified approaches to compare factors which favor an approach versus factors which may hinder the approach. 4.4. Consultant identifies suitable waste to energy option based on analysis of the viability study. 4.5. Develop best practice guidelines/ case studies as for phase 1 (if found to be feasible). CWG engages paid resource to undertake this work. 4.6. Encourage collaboration across sector as for phase 1 (if found to be feasible) CWG engages paid resource to undertake this work.
Technology readiness	• Minimal technology elements are required to initiate this program. • To fully implement phase four some expansion on research for waste to energy models would need to be explored further. Phase four could develop regionally

Adoption of an industry wide program to reduce or eliminate unnecessary packaging in the wholesale value chain	
	specific information regarding emerging and current technology solutions and industry-wide analytics which could occur as a stage development linking technology and training for adoption. • Packaging innovation and packaging systems are constantly emerging these will be identified in 2.4 of the program.
Adoption	• Case studies have been provided in appendix A some of which demonstrate proof-of-concept to prove effectiveness of information-enabled supply chains to encourage improved environmental outcomes in packaging. • Training programs can be established through the MLA CWG and TWG. • Supply chain collaboration meetings and awards nights to share knowledge and improve packaging efficiencies. • Best practice guidance documents and funding support from the APC
Benefits	**Economic** The benefit to MLA levy payers from reducing packaging within the supply chain is that it will help reduce the cost of its product through to end markets, contributing to red meat's competitive advantage. Based on a conservative 0.25% reduction in packaging use it is estimated that packaging costs will be reduced by approx $1 million through the program. Details of our assumptions and the high level cost benefit analysis are set out in Appendix D. It is estimated that the direct costs to conduct the program would average to $183,000 per year over four years (2016-2020) amounting to approximately $735,000. These costs are based on estimated staffing requirements to deliver the program and external consultant costs. Based on the above figures, a benefit cost ratio of 1.4:1 is achieved. This ratio does not include the savings associated with implementing the re-usable packaging and waste to energy opportunities. However, the research will inform the best approach to implement these initiatives and result in further savings. As a comparison, Sustainability Victoria's Resource Assessment Grants scheme aimed at small to medium enterprises in Victoria has found that opportunities identified under the scheme achieve a payback time of 1.4 years. **Feasibility study of re-usable packaging** The focus of phase two is a study into the feasibility of re-usable packaging across the sector. A budget of $60,000 has been estimated for this study which will also draw on research conducted in phase 1. It is acknowledged that re-usable packaging is only viable in certain circumstances and that the Australian red meat sector may not find the approach viable. For this reason cost benefits associated with re-usable packaging have not been calculated. However, two industry studies were analysed to understand and demonstrate the potential cost benefits of re-usable packaging. Overall, the studies show that re-usable packaging can achieve a benefit cost ratio of between 4 and 6. Further detail regarding the two industry studies can be found in Appendix D. **Feasibility study of energy from waste** The focus of phase three is a study into the feasibility of waste to energy as a means to reduce waste to landfill in the sector. A budget of $60,000 has been estimated for this study which will also draw on research conducted in phase 1 and 2. Discussion with industry energy experts indicated that energy from waste can have a payback period ranging from less than one year, to over ten years (if considered viable). **Environmental** The main environmental benefit of this program is that is establishes a platform for an ongoing focus on packaging efficiency and waste reduction. While initial reductions in packaging use may be small, the promotion of best practice, will lead to larger savings

Adoption of an industry wide program to reduce or eliminate unnecessary packaging in the wholesale value chain	
	over time. Reducing packaging is also recognized as reducing impacts across all part of the life cycle including production impacts, use impacts (transport) and waste impacts (landfill).
Outcomes	• Industry governance and policy support in addressing current and emerging needs by relevant industry stakeholders, state and federal governments regarding red meat packaging. • A red meat sustainability story. Red meat is positioned as a premium protein option with good sustainability credentials for all aspects of the product, from production through to consumption, including packaging. • Established best practice for sustainable packaging for red meat. To promote best practice aimed at reducing or eliminating unnecessary packaging for red meat. • Positive sustainable messaging to consumers. This can be used to inform the consumer campaign detailed in programme 2 “Consumer Messaging”. • Reduction in levy payers costs. A reduction in the cost of product through to end markets contributing to red meat’s competitive advantage. • A culture of connected, collaborative players to drive transformational change in the red meat value chain, who continues to proactively seek and utilise collaborations for national and international success.
Risks	• The integration and collaboration required to make this program successful may be hindered by confidentiality and commercial interests within the supply chain. • Risk considered low due to precedents such as Red Meat PGP collaboration Programme for Greater Farmer Profitability (NZ) and five year strategic plan by the Red Meat Advisory Council (RMAC) (Locke 2015) which identifies collaboration and cooperation as key to delivering $13 billion in economic gains over 15 years. • A regulatory risk exists that agriculture could be excluded from gaining credits for reducing carbon emissions and that taxes may be imposed on agriculture for carbon emissions (CIE 2015). • Technical risk involved in phase four, will require further research into waste to energy methodologies to claim carbon reductions, ensuring that these methodologies are accurate, simple to use and relatively cheap
Customers	• A collaborative supply chain will be able to respond more rapidly to consumer preferences. As such, red meat can be positioned as a premium protein option through good sustainability credentials for all aspects of the product, from production through to consumption, including packaging. • Consumer support is likely to be enhanced by recognition of the sustainability story for red meat across the supply chain and the environmental benefits delivered.
Measures	• Reduction in packaging use relative to baseline data • Reduction in demand of packaging for the red meat sector, either in volume or in price, relative to baseline data • % adoption across industry/sector businesses. The proportion of the applicable sector/industry which is likely to adopt out to 2025 • Time between the investment in the program and implementation and adoption by industry • The investment level that would be required to achieve the maximum benefits identified above • Current investments across service companies • % of APC signatories within red meat wholesale value chain

Programme 2:
Driving consumer awareness of sustainable use of packaging in the red meat industry

MLA is committed to a sustainable packaging approach for the red meat sector.

Consumer's value sustainable packaging, and are keen to recycle but may be confused on the recyclability of red meat packaging. They may also not fully understand the role packaging plays in the reducing the environmental impact of red meat. It is important for the sector to not only get the balance right in terms of not over packaging red meat, but also educate consumers about the link between reducing food waste, and sustainability.

While recycling appears to be the main sustainability attribute recognized by consumers, sustainable packaging can take different approaches, particularly in the red meat sector. These include lightweight packaging, biodegradable packaging, recycled content and recyclability.

This programme is focused on delivering three main messages to consumers:

1. The important role packaging plays in protecting red meat and reducing food waste
2. What the industry is doing to reduce its impact
3. Practical steps that consumers can take to reduce their own impact.

To deliver these messages, MLA will undertake a consumer facing program through in store displays, media, online and through on pack labelling. Over four phases, MLA will research, develop, test and roll out this information consultation with industry, and based on sound science.

To promote practical actions that red meat consumers can take to manage packaging waste at home, MLA will support the adoption of standardised messaging for how consumers can recycle packaging. An example of this messaging is the Australian Recycling Label, which empowers consumers to make correct decisions regarding recycling of packaging. The label is shown in Figure 5.

The initial focus of this messaging program will be consumer retail packaging in Australia (supermarkets). While the campaign will be initiated in the domestic consumer market, it will provide a model which can be easily translated to export markets, other parts of the value chain (food service, quick service retail), and other retail outlets (such as online or specialty butchers) in subsequent years.

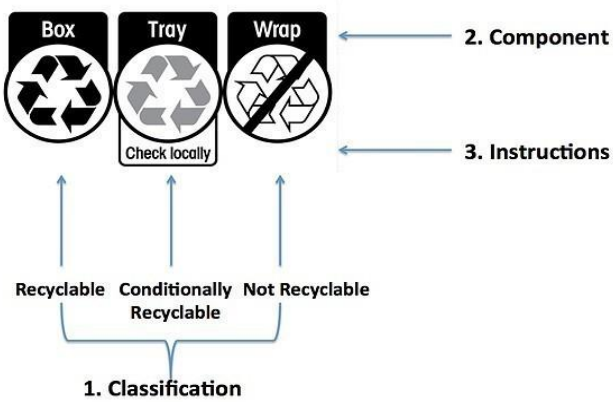

Figure 5: Australian Recycling Label (source: Planet Ark 2016)

Consumer campaign to inform on the sustainable use of packaging in the red meat industry

Consumer campaign to inform on the sustainable use of packaging in the red meat industry	
Value proposition	Packaging is the first contact point between the products of MLA levy payers and consumers, making it a powerful point of influence on reputation and value. Sustainable packaging will add value to the red meat brand. Consumers are increasingly assigning value to the environmental performance of the products and services they buy, and are assessing packaging sustainability as part of purchasing decisions. Sustainable packaging is shown to lead to higher sales (Enso 2015). Sustainable packaging will reduce risks to the red meat brand. As the value of sustainability attributes of products rises in the minds of consumers, the red meat sector is effectively competing with other meat products on the sustainability of its packaging. It is therefore important that consumers see that the red meat sector is reducing the environmental impact of its packaging over time. Red meat packaging is complex and must meet high standards to ensure it delivers product quality and convenience. Education about the role that packaging plays in protecting meat products, and how the sector is reducing impacts while maintaining consumer expectations will help ensure the red meat sector is seen as environmentally responsible. Importantly, providing clear instructions on how consumers can reduce the impact of the packaging they buy, for example through recycling, will further reinforce that the sector is taking practical steps to reduce its environmental impact. By providing accurate and easily understood information for consumers, this program will help the red meat sector increase the value of products, ensure it presents as environmentally responsible, and ensure that packaging impacts are minimized.
Programs	MLA will support the development of a consumer campaign to address the sustainability of red meat packaging. It consist of a four phases, and will be coordinated from with the MLA. Phase one (2016-2017) 1.1. *Sustainable packaging coordinator.* MLA will assign a coordinator to administer implementation of the program. 1.2. *Objective setting and scoping*. A scoping exercise will focus on understanding at the high level types and attributes of existing packaging, the range of possible messaging options, the costs involved and ensure that potential risks to the sector are identified and managed. 1.3. *Stakeholder consultation*. Identification of and engagement with stakeholders including retailers, brand owners, and packaging suppliers. Adequate consultation will ensure that the sector as a whole supports the program. Stakeholders will also be involved in the sourcing of data, developing the delivery strategy for messaging, and in testing the messaging. 1.4. *Confirm sources and accuracy of data*. A targeted study will generate a detailed inventory of packaging types, their environmental attributes, packaging trends, and industry initiatives which will support the messaging program. 2. Phase two (2017-2018). 2.1. Develop messaging *First messaging topic:* The first area of messaging will focus on emphasising that appropriate packaging contributes to less food waste, that packaging impacts are a small part compared to the impact of the total product, and that each packaging type has unique properties which help protect the product and deliver it to the user. The aim will be to provide information well founded in fact (based on phase 1 work). *Second messaging topic:* The second area of messaging will focus on the initiatives that the industry is undertaking to reducing the amount of packaging it uses. Where possible this will draw on initiatives specific to the red meat sector and include case studies to ensure that the story is 'real'. Again, each message will be evidence based.

2.2. Roll out messaging.

Strategy development: A messaging delivery strategy will be developed in consultation with stakeholders to ensure it reaches the target market.

Message testing: Messages will be tested with consumers to ensure they meet required goals, and to reduce the risk to the sector.

Delivery: The two messaging topics will be delivered through a range of channels including digital (online), point of sale and print media. We do not envisage this program including large scale (for example television) advertising.

2.3. *Develop third messaging topic approach:* During this phase, the messaging format which will be used to portray practical steps consumers can take to reduce packaging impacts (for example recycling) will be scoped and an implementation plan developed. This will include a detailed assessment of the suitability of the Australian Recycling Label being used as on-pack labelling.

3. Phase three (2018-2019)

3.1. *Implementing on pack labelling*: The focus of this phase will be implementation of on pack labelling to inform consumers of the practical steps they can take to reduce environmental impacts associated with their red meat packaging. The specific message will be informed by the work undertaken in phase 2.3 but is likely to include a label which clarifies recycling options for packaging.

The Australian Packaging Covenant and Planet Ark have researched and developed an Australian Recycling Label for packaging which is backed up by evaluation using the Packaging Recyclability Evaluation Portal (PREP). This assessment is usually done by the brand owner, using information provided by the packaging supplier. Once the packaging is assessed, a suitable label is assigned. A licence fee applies to the use of the label (see figure 6).

Figure 6: Australia Recycling label packaging process (source: Planet Ark 2016)

For those brands where recycling is not an option for their packaging (for example flexibles), alternative messages will be considered where the environmental advantages are clear. However, the value consumers place on recycling makes it a priority for on pack messaging.

3.2. *Set implementation target for on pack labelling*: It is not expected that full implementation of will be achieved in this phase (for example due to changes required to labeling). It is therefore recommended that a modest target (for example 10% of packaging to carry the label) be set for this phase, increasing in later phases.

3.3. *Develop outcomes measurement method:* Establish a suitable means to collect data to track the impact of the messaging program on the reputation of the sector, and if possible sales of red meat. Measures may include participation rates for consumers (engagement with messaging, recognition of label, engagement with promotional activities (in store) or measurement of reputation of the sector.

3.4. *Develop suitable metrics for more detailed messaging:* Focus on developing suitable metrics to allow more detailed reporting on how the red meat industry is reducing the environmental impacts of its packaging. A target of three metrics is proposed, drawing

Consumer campaign to inform on the sustainable use of packaging in the red meat industry

on analysis of data collected in phase 1 and further consultation with the sector if required. An example of a metric is quantification of the amount of packaging used per kilogram of meat packaged.

4. Phase four (2019-2020)
   4.1. *Increase take up rates for on-pack messaging:* The target for adoption of on pack messaging (for example the Australian Recycling Label) is 50-80% of red meat packaging. Participation will be encouraged through ongoing promotion of the scheme in sector communications, demonstrating the business case, and promoting a list of participating brands.
   4.2. *Trial implementation of more detailed messaging for message topic one and two:* If suitable data is available to develop metrics (phase 3), a trial of more detailed messaging could be communicated through point of sale, digital communication (website) or incorporated on-pack for certain products.

5. Subsequent phases.

This program could be rolled out across other sectors and markets.

The proposed implementation for this programme is set out in Figure 7.

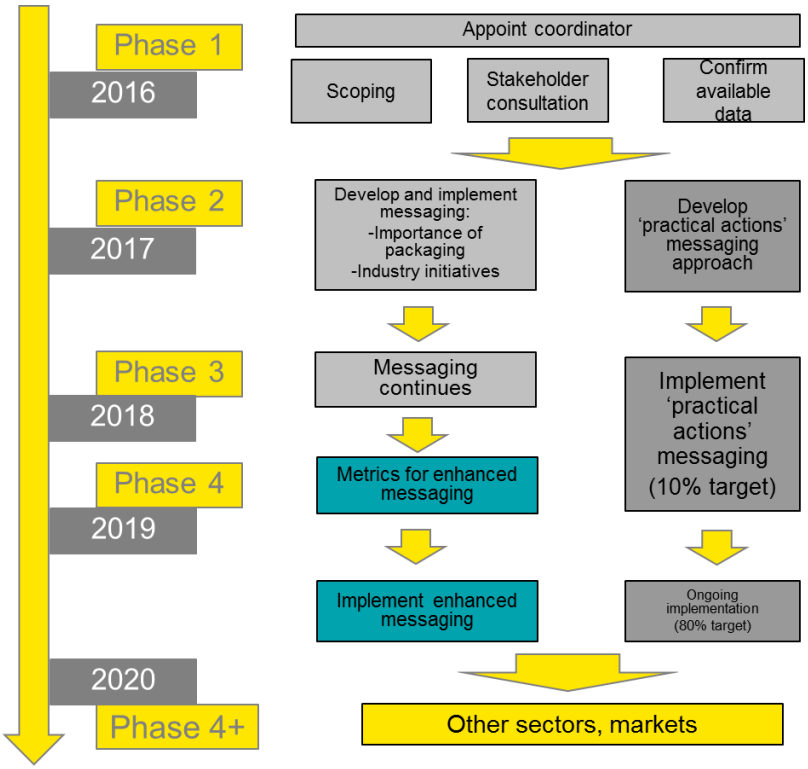

Figure 7: Proposed implementation of programme 2

Technology readiness

The approach described utilises well established technology. No technological barriers are foreseen in the implementation of this approach. However the following factors need to be taken into account to ensure success:

- On pack labelling needs to be compatible with existing recycling systems (in particular for plastics). For example labelling on meat trays acts as a contaminant so should either be avoided or the use of a compatible label be adopted.
- Any changes to labelling will incur costs to brand owners, which may reduce participation.

Adoption

The following aspects of the strategy have been developed to improve the success of the initiative

- A feasibility study/ scoping exercise in phase 1 to confirm current situation (recycling

Consumer campaign to inform on the sustainable use of packaging in the red meat industry	
	rates, barriers to recycling) and determine overall feasibility • Setting achievable goals for uptake e.g.: 10% of brands assessed and labelling in phase three • Negotiation of an 'industry rate' to reduce the cost of assessment and licensing • A marketing and communications program within the industry and to more broadly to promote the benefits and encourage greater uptake by brand owners. • Listing participating brands on the MLA website (similar to the MSA list of brands) to promote uptake of on-pack branding • Information for sector participants to demonstrate business case/ benefits.
Benefits	<u>Economic benefits</u> This is a relatively low cost program with potential to achieve considerable return on investment. The benefit to MLA levy payers is based on increased sales associated with increased brand value from sustainable packaging. Research has shown that sustainable packaging can help retailers and brand owners achieve an increase in net sales of 1-4% and an increase in their margins. The staged rollout of the program, including a 10% target for on pack labelling in phase 3 and 50% in phase 4 was factored into calculations, resulting in an estimated benefit based on increased sales of $ 33 million over the period of the program. Based on these figures there is a benefit cost ratio for this project of approximately 12.5:1. The cost benefit of this initiative is extremely sensitive to several factors including: • The extent to which messaging and labelling increases sales revenue • The extent to which increase sales revenues are passed on to producers • The costs to brand owners associated with implementing on-pack labelling. Details of our assumptions and the high level cost benefit analysis are set out in Appendix E. <u>Environmental benefits</u> • This program is intended to ensure proper recycling of red meat packaging, to increase recycling rates and reduce contamination in the recycling stream. • Increasing recycling rates for packaging has environmental benefits through reduce production impacts of virgin materials and reduce reduction of fossil fuel reserves. Due to the number of different materials that are used in meat packaging, it is difficult to quantify environmental benefits. However, if recycling rates can be increased by 10% through domestic kerbside collection, this will help divert around 2500 tonnes per year of packaging from landfill. • Reducing contamination rates increases recycling efficiency and improves the quality of recycled materials resulting in higher value. Improving the quality of recovered material makes it suitable for a wider range of applications, and improves the demand for recycled materials generally (source: discussion with industry).
Outcomes	• A red meat sustainability story. The red meat sector is seen as taking sustainable packaging seriously (for example through promoting practical actions such as recycling) • The red meat sector is seen as a leader in promoting practical action on recycling and removing confusion in the minds of consumers. • Significantly clearer information for consumers on how they should recycle red meat packaging – resulting in higher recycling rates and reduced contamination for red meat packaging • A strong understanding of the progress that the red meat sector is making to reduce packaging impacts, including the capacity to quantity progress (for example reductions in packaging per unit of meat sold) • Competition within the sector to develop packaging which meets labeling requirements (for example encouraging a move toward recyclable packaging)

Consumer campaign to inform on the sustainable use of packaging in the red meat industry	
Risks	The following risks have been identified as applicable to this initiative: • Messaging does not increase sales as planned This risk can be managed by ensuring that adequate testing of messaging is undertaken prior to release to ensure it achieves the objective of the program. • Messaging reduces sales by creating a negative campaign This risk needs to be carefully managed by ensuring that messaging is carefully tested to ensure that it doesn't portray any negative image on red meat, or have the potential for consumers to question the safety, or quality of the product. In addition, if a high proportion of plastics used for meat packaging are not recyclable, this creates negative publicity for the red meat sector. While there is red meat packaging that is recyclable, it will be important for the sector to establish the overall proportion prior to committing to a full roll out. • That increased sales do not lead to value for producers Given the small percentage gains expected, this will be difficult to measure. However monitoring of retail sales will ensure this is tracked and managed. • Brand owners and retailers do not wish to be part of the program. This risk is most likely to arise where the costs involved (direct and indirect) are too high or their product does not rate well under the scheme. Adequate stakeholder consultation, together with careful framing of messaging will help to reduce this risk. If the risk is high, an alternative message may need to be include which takes into account that not all packaging is recyclable through kerbside systems at the current time. An example might be that a label is developed to explain the environmental advantages of non-recyclable packaging (where this is appropriate).
Customers	The core group of customers for this initiative is: • Brand owners in the red meat retail sector • Packaging suppliers • Retail consumers.
Measures	• Proportion of brand owners signed up to the scheme (by number and market share) • Recycling rates (annual survey of recyclers) including changes over time • Levels of contamination in • Proportion of products which are recyclable (measuring change) • Media coverage/ hits to website, social media metrics • Consumer feedback • Consumer participation in program (use of website, take up of point of sale materials)

3 Conclusion

The strategy proposes two programmes of RD&A and marketing activities for sustainable packaging in the Australian red meat sector. The programmes provide a way for MLA to support the red meat sector make progress toward reducing the environmental impact of its packaging.

While both programmes may deliver modest economic benefits initially, they have the potential to provide long lasting benefits across the value chain. For example programme one, **"S*ustainable Packaging Innovation Platform*"**, creates a valuable legacy for the industry of identifying best practice, a culture of collaboration, and a better understanding of where the key impacts lie. The viability of initiatives such as re-usable packaging and waste to energy will be investigated and developed under this programme.

The second programme, **"Consumer Messaging"**, has the potential for longer term benefits by helping the industry to better understand where its impact lie and be able to articulate its progress. Providing clear messaging on the practical actions that consumers can take (for example recycling) will have lasting benefits to the sector, and if adopted more widely, other sectors. By being a first adopter of this approach, the red meat sector will be recognized as being a leader in providing this information compared to others in the sector.

It is recommended that MLA further investigate these programmes with view to implementation in the short term. The benefits of sustainability initiatives can be difficult to measure, especially where outcomes rely on measuring factors such as social licence to operate. In addition, due to restrictions on the available data, a number of assumptions have been made tounderpin the value propositions for each programme. Changes to these assumptions and underlying data can severely impact the benefit cost ratios. It is essential that further analysis be undertaken prior to MLA proceeding with implementation.

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5 Appendix A: Topical Background

5.1 Australian Red Meat industry overview

The Australian red meat industry encompasses the production, processing facilities and live export sectors of Australian beef, sheep and goat meat supply chains (RMAC 2015). Currently, the industry produces over 2.8 million tonnes of meat per year[2].

The Australian red meat industry has a strong export focus with more meat exported than consumed domestically. In 2014, 74% of Australian beef production was exported and this trend toward increasing exports relative to domestic sales is expected to continue in the foreseeable future (Crossin, Verghese & Lockrey 2015). The key markets for Australian red meat are North America, Japan, Korea, China, EU, Russia, and the Middle East. Estimated total exports of beef, sheep and goat meat in 2016 are set out in table 2.

	Beef	Sheep	Goat
Exports (tonnes)	1,055,000	382,309	29,474

Table 2: Estimated exports of Australian red meat in 2016

The viability of the Australian red meat sector is affected by climatic conditions, currency fluctuations, economic conditions in export markets, and competition between protein sources based on value, health, and convenience attributes (Spencer & Kneebone 2012).

The red meat sector in Australia is also getting more complex, as it consolidates processing, and improves integration of supply chains. Processing is dominated by major facilities developed to service exports, while retail is increasingly dominated by supermarkets (with traditional butchers losing market share). Increasingly, major retail chains are integrating their supply chains, providing opportunities for improved efficiency, but making it harder for smaller players (Spencer & Kneebone 2012).

Changing demographics (an ageing population, smaller households) and consumer preferences are creating changes in red meat markets. Smaller portion sizes, and a greater focus on convenience are creating opportunities and challenges in the sector (Spencer & Kneebone 2012).

[2] This represents the total tonnes of beef and sheep meat (2, 814,000 t) with production and trade volumes based on the average of 5 years to 2010, sourced from ABARES and MLA. S & Kneebone, M (2012), FOOD map: An analysis of the Australian food supply chain. Goat meat 32,900 tonnes as reported by the ABS in 2015. MLA's Market information & Industry insights – Australian goat industry summary 2015.

5.1.1 The value chain for Australian red meat

The value chain for Australian red meat incorporates the meat processing facilities, the co-production facilities, wholesalers, export and the overseas supply chain, through to the retail, and consumer stages. Figure 8 represents the process, and cuts produced at each of stage.

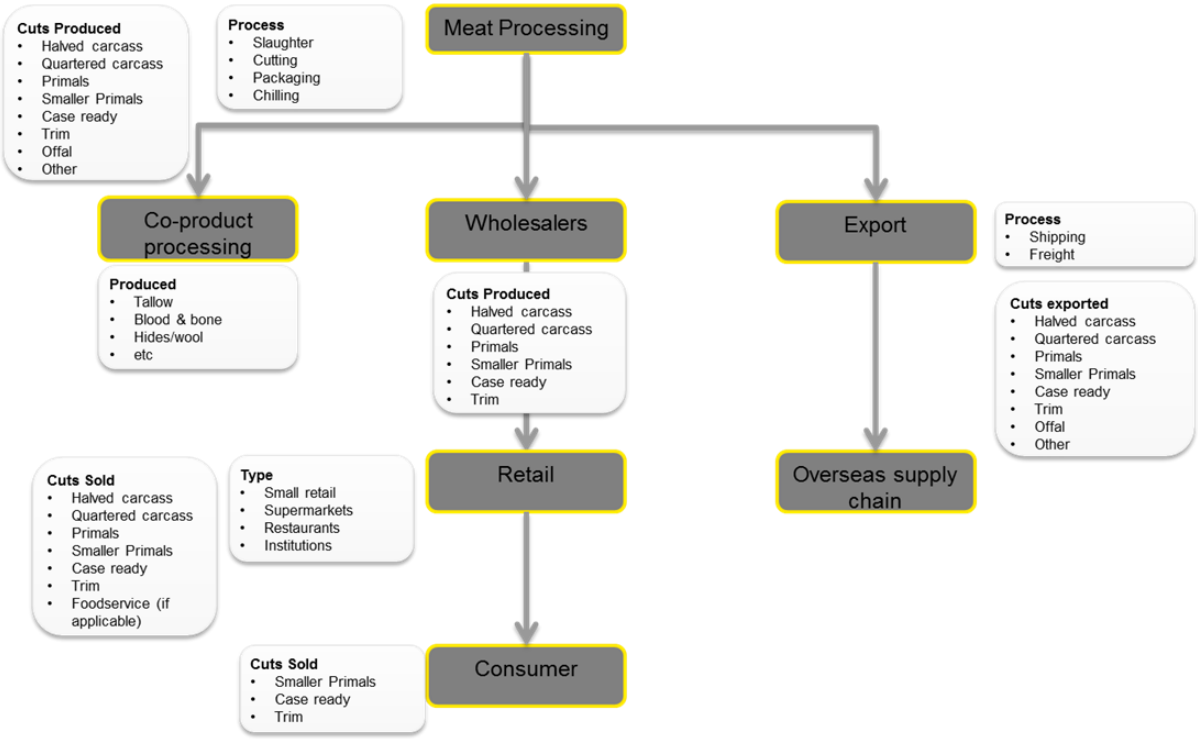

Figure 8: Australian Red Meat Value Chain – Process and cuts.

The domestic market includes supermarkets, butchers/specialty, and foodservice. Supermarkets have the largest market share of the retail market, estimated at around 57% in 2010 and gradually rising. Table 3 shows that food service has around 27% while butchers and specialty shops have around 16% of market share (Spencer & Kneebone 2012). This study did not include goat meat due to the small domestic quantities consumed.

Table 3: The red meat sector in Australia

Australian red meat sector (2010)	Beef		Sheep	
Slaughter (head)	8,700,000		31,200,000	
Total production (tonnes)	2,166,000		648,000	
Processed (tonnes)	1,470,000		556,000	
Export (tonnes)	985,000		370,000	
Domestic consumption	Tonnes	%	Tonnes	%
Supermarket	251,000	57	92,000	56
Butcher/specialty	71,000	16	21,160	23

Australian red meat sector (2010)	Beef		Sheep	
Foodservice	117,000	27	52,000	31
Retail total (tonnes)	439,000	100%	165,160	100%

5.1.2 Role of packaging in the red meat sector

Packaging plays a key role in the containment, protection and distribution of red meat, including:

- Protection, including preventing breakage, spoilage and contamination
- Promotion, including describing product features, ingredients and branding
- Information, including product identification, product preparation and end-of life management
- Convenience, including preparation and portioning
- Utilisation and handling, including providing for transport and retailing
- Waste reduction, including increasing shelf-life. (Crossin, Verghese & Lockrey 2015)

Packaging which is unable to perform adequately in either of these areas will result in economic loss along the supply chain through higher rates of food waste.

Red meat packaging in Australia is designed to maintain the integrity and shelf life of the product, and respond to consumer needs. It must do this whilst meeting the regulatory requirements of the Australian food safety and packaging laws.

There is a trade-off between more packaging and lower rates of food waste, with more packaging (including individual packaging) generally leading to lower rates of food waste (Verghese et al 2013). The environmental impact of producing one kilogram of red meat is greater than the environmental impact of creating the 80 grams of packaging to adequately protect it. Verghese et al (2013) found that *"On average packaging accounts for only 10% of total energy but it plays a critical role in ensuring that the other 90% is not wasted".* Consequently ensuring adequate packaging for red meat is an effective way to reduce the environmental impact overall through the reduction of food waste.

The relationship between the impact of the packaging relative to the impact of the product was raised a number of times throughout the project. In particular workshop participants raised the importance of adequately explaining this concept to consumers.

5.1.3 An overview of sustainability challenges facing red meat packaging in Australia

A number of factors challenge the sustainability of red meat packaging in Australia. These include:

1. **Low recycling rates, especially for plastic packaging.** A high proportion of plastic red meat packaging (wholesale and retail) is currently sent to landfill in Australia (McKinna 2006), which is similar to the UK market (Walsh 2013). Despite progress in packaging recycling at a retail level, there are still low recycling rates for plastic meat packaging in Australia. Factors affecting the recyclability of packaging are discussed in section 2.3.

2. **A trend toward increased packaging in the red meat sector.** McKinna (2006) found that there was a trend toward greater use of packaging across the meat value chain due to the following trends:
    - Smaller cartons (due to OHS weight constraints in Australia)
    - Smaller primal cuts, increasing vacuum bag use per kg
    - The use of 'case ready systems' which can lead to a larger quantity of smaller cuts.
    - Increased primary packaging demand due to consumer preference for more convenience and desire to extend retail shelf life.

While the Australian red meat sector faces challenges to address the sustainability of its packaging, consumers are becoming more of aware of sustainable packaging and are willing to pay more for sustainable packaging (Leavy 2013). Research has shown that while consumers value the function of packaging, they are sensitive to excessive packaging, and that over packaging can influence their purchasing behaviour (Ahmed, Parmar & Amin 2014). While the relationship between packaging and food waste is well established, the value of packaging can be a difficult message to sell to consumers (Verghese et al 2013) Consumer attitudes toward packaging are covered in more detail in section 2.5.

5.1.4 Value proposition for sustainable red meat packaging

As outlined above, packaging plays an important role in the red meat sector, but is facing increase sustainability challenges. The size of the Australian red meat sector (and therefore the amount of packaging used), together with emerging consumer preferences for sustainable packaging, and a trend toward more packaging, emphasises the need to address packaging sustainability. Sustainable red meat packaging will benefit the red meat sector by:

- Saving money through efficient packaging and resource recovery
- Meeting ongoing and emerging regulatory drivers relevant to packaging
- Development of packaging technology which responds to sustainability drivers in line with or ahead of its competitors, and before it becomes a problem for the industry
- Ensuring access to existing and emerging markets
- Encouraging innovation through packaging including ensuring that packaging meets the needs of consumers.

5.2 Analysis of Australian red meat packaging

5.2.1 Profile of existing red meat packaging types

Meat packaging in Australia can be divided into two distinct categories:

- Wholesale packaging. For the purposes of this project we have defined wholesale packaging to be any packaging that is used in the value chain other than consumer packaging.
- Retail packaging – this is packaging that meat used to sell meat to consumers.

This distinction is made due the different attributes of packaging required for non-consumer applications compared to consumer applications.

Wholesale packaging is primarily used for shipment of meat within the supply chain whether it be the domestic or export market. The primary role of wholesale packaging is the protection and preservation of the product during transit, and meeting labelling (including traceability) and food safety requirements. However, wholesale packaging may also be branded with producer imagery to differentiate and promote the contents. The main types of wholesale packaging used are plastic vacuum bags, and fibreboard cartons (McKinna 2006). Packaging examples are shown in Table 3.

Red meat sold in Australian is likely to have been packaged more than once before it reaches the retail stage (McKinna 2006). For example, meat may leave the processor as primal cuts, in a fibreboard carton, palletised. From here it is destined for a wholesaler or value adding processor where it is unpacked, divided into smaller cuts (portions) and re packaged into retail packaging. Product destined for retail may be further packaged to protect it during transport to the supermarket, depending on supply chain logistics involved. Retail packaging is used to present the meat to the consumer in a way that meets their needs. As a result, retail packaging introduces additional requirements compared to distribution packaging and factors such as appearance and ease of use are the focus of packaging designer's efforts.

Packaging technology is constantly advancing, meaning that the market share of different packaging type's changes constantly, and new packaging types replace existing packaging types over time.

Competition between packaging suppliers drives innovation in the packaging industry as they strive to meet the needs of brand owners and consumers. This includes the following areas (Verghese et al 2013):

- Extending shelf life
- Enhancing ease of use
- Increasing convenience
- Reducing costs

Current retail packaging types (identified through discussion with the MLA) include Modified Atmosphere packaging (MAP), Overwrapped Expanded Polystyrene (EPS) Trays, skin systems, vacuum packed meat, and ready meals.

Table 4 lists the dominant packaging types in used in the Australian Red meat industry. (Images are sample only).

Table 4: Dominant packaging types in Australian red meat industry

Wholesale packaging (export, domestic)	
Meat is generally vacuum packaged prior to export or local distribution in plastic packaging and then placed in a fibreboard carton.	
Vacuum packaging Vacuum bags consisting of polyethylene/ Ethyl Vinyl Alcohol (EVOH) or Polyamide type barrier layers.	
Fibreboard cartons Australian meat cartons are made in accordance with Australian Standard 3724 -1994. Typical capacity is 13-26kg.	
Retail packaging (case ready)	
MAP - modified atmosphere packaging Primal cuts are placed on retail-ready trays (known as case ready), flushed with a mixture of gases to remove the oxygen and covered with plastic film (type). The packs are impermeable and retain the modified gas atmosphere around the meat to preserve meat quality and shelf life by restricting bacteria growth.	
Vacuum packaging Air and oxygen are both removed from the packaging. This creates a vacuum and assists in the preservation of meat and improvement in meat quality and shelf life by minimising bacteria growth due to the lack of oxygen.	
Skin packaging These are secure packs that follow the natural shape of the product. They are designed to provide improved appearance compared to standard vacuum packs. Skin packs are a recent technology which combines the shelf life of vacuum packs with superior presentation.	
EPS (Expanded Polystyrene) trays Meat is packed into an open EPS container or tray, and covered with stretch plastic film. This is mainly used in smaller primal cuts or portioned meat. EPS packaging may be black or white	

Ready trays Convenience product designed to be heated in a microwave oven. It incorporates film technology to limit steam build up when re-heating. The predominate material is CPET (Crystalline PET) which is black in colour.		

5.2.2 Packaging volumes used in Australia

Domestic Packaging – Distribution and Retail

The most comprehensive data regarding the volume and cost of packaging in the Australian red meat sector was found in the 2006 MLA funded study “Fate of packaging” by McKinna. This study focused on all packaging through the value chain for the domestic red meat market in Australia.

To complete the EY assessment, data on packaging types, volumes and costs was sought from selected industry participants but only very limited data was able to be obtained within the timeframes. To complete the analysis required, the data from the McKinna study (2006) was extrapolated to reflect changes to packaging types, volumes and costs. The approach used was to:

- Inflate 2006 dollars to 2015 dollars using the Reserve Bank of Australia’s Inflation Calculator (Reserve Bank of Australia 2016)
- Consult closely with an industry packaging supplier to estimate changes
- Compare the results against other observations made during the project including conversations with other industry stakeholders.

Key findings of this consultation were that:

- There has been an overall increase in packaging of 10-20%. While packaging use has increased (due to smaller pack sizes) packaging has become lighter in weight which partly compensates
- The number of vacuum bags used has doubled per carcass, which represents an increase in volumes of 60%
- MAP trays represent 70% of the retail packaging market in 2016 whereas in the 2006 study they represented 30%. In contrast, EPS trays have decreased in use, and only represent 30% of the market today
- The use of absorbent pads have decreased in use by 30%
- The cost of packaging per unit volume has remained steady (but volumes have increased 10-20%). Therefore spend on packaging has increased 10-20% (not including the adjustment for inflation).

Analysis of meat consumption volumes led to an assessment that volume remained constant at 976,000 tonnes per year.

The 2006 data was adjusted accordingly to reflect the above findings and is shown in table 5 below.

Table 5: Estimated breakdown of domestic packaging

Packaging Component*	2006 Volumes** (kg)	2016 Volumes*** (kg)	Cost ($) in 2006	Cost ($) in 2016****
Carton base	24,989,788	29,987,746	$62,746,089.00	$94,119,133.50
Carton lid			$42,264,129.00	$63,396,193.50
Liner bag	1,951,940	2,342,328	$2,156,813.00	$3,235,219.50
Vacuum bag	5,391,412	8,626,259	$84,847,716.00	$127,271,574.00
Boneguard	554,973	665,968	$2,107,680.00	$3,161,520.00
Weight label			$11,771,553.00	$17,657,329.50
Carton label			$2,225,643.00	$3,338,464.50
Pallet			$53,575.00	$80,362.50
Pallet wrap	571	571	$53,576.00	$80,364.00
Tray (MAP)	1,614,328	4,099,901	$12,264,269.00	$18,396,403.50
Lid film (MAP)	44,730	113,601	$3,449,326.00	$5,173,989.00
Gas			$1,379,730.00	$2,069,595.00
Absorbent pad	1,897,549	1,328,284	$8,172,530.00	$12,258,795.00
Product label			$9,614,741.00	$14,422,111.50
Exp PS tray	3,266,507	1,757,101	$32,326,829.00	$48,490,243.50
Overwrap film	543,056	380,139	$6,061,280.00	$9,091,920.00
Plastic bag			$6,488,800.00	$9,733,200.00
Separator sheet			$226,360.00	$339,540.00
Motherbag	605,436	605,436		
Total				
Retail packaging	7,366,170	7,679,026	$79,983,865.00	$119,975,797.50
Wholesale packaging	32,889,000	41,623,000	$208,226,774.00	$312,340,161.00
Total packaging	40,860,000	49,907,333	$288,210,639.00	$432,315,958.50

Data from the study showed that the weight of wholesale packaging used per unit of meat can be equal to or greater than the weight of consumer packaging, as shown in table 6. While the weight of packaging is not directly comparable to the environmental impact it is important to recognise the significance of packaging used before the product reaches the consumer.

All packaging types have different environmental impacts and are not easily compared. For example, fibreboard cartons are heavier than plastic packaging which increases transport costs. However they are commonly recycled which reduces their impact overall. Flexible plastic packaging is very light weight (uses less material) but being multilayer is difficult to recycle. Both types of packaging are made using industrial processes. Packaging is chosen based on a number of criteria, not just environmental impact. This emphisises the importance of reducing the environmental impact of each specific packaging type.

Wholesale packaging is more likely to be recycled overall compared to retail packaging due to a higher proportion of fibreboard packaging being used. The recycling rate for fibreboard carton packaging used in the domestic value chain was found to be greater than 90% in 2006 (McKinna 2006) and we believe it is unlikely to be lower in 2016.

Table 6: Distribution of packaging used per unit of meat

Packaging stage	Example	Kg packaging/kg product	Disposal fate
Wholesale packaging			
Vacuum packaging	Primal vacuum pack	0.01	landfill
Fibreboard carton	20 kg capacity carton	0.035	recycling
pallet wrap	stretch film	8E-8	landfill
Wholesale packaging weight		0.045kg	
Retail packaging			
Retail packaging	MAP tray (Rigid PS)	0.036	landfill
Retail packaging weight		0.036 kg	

The study found that most domestic plastic packaging is generally sent to landfill (McKinna 2006). A study conducted in the UK found a similar fate for plastic packaging, with all wholesale packaging (primal vacuum bags) going to landfill (Walsh 2013).

Export Packaging - Wholesale packaging

Fibreboard

Fibreboard cartons are used extensively in the meat value chain. They are either combined with vacuum packaging or use other methods (for example plastic sheets between layers, coated boards, liner bags) to provide a barrier between the meat and the fibreboard.

MLA data shows that Australia exports of beef are around 1 million tonnes. Based on an average capacity of a fibreboard carton of 20kg (McKinna 2006), and an estimated that 80% of beef (based on discussion with MLA) is exported using this packaging method, 42 million fibreboard cartons are required. Figures for sheep and goat are proportional to the amount exported. Please refer to table 7.

Table 7: Tonnes of red meat exported by type and number of cartons required

	Beef	Sheep	Goat
Tonnes exported (MLA 2016 est.)	1,055,000	382,309	29,474
Number of cartons @ 20 kg per carton	52,750,000	19,115,450	1,473,700
Proportion of meat exported in cartons (80%)	0.8	0.8	0.8
Number of cartons required	42,200,000	15,292,360	1,178,960
Cartons required (millions)	42.2	15.3	1.2

Export packaging - plastic

It is estimated that four vacuum bags are used for every carton of meat (McKinna 2006).

Based on this ratio of vacuum bags to fibreboard cartons, 168 million vacuum bags are used to export approximately 1 million tonnes of beef. Please refer to table 8.

Table 8: Number of vacuum bags required for export

	Beef	Sheep	Goat
Cartons required (millions)	42.2	15.3	1.2
Vacuum bags @ 4 per carton (millions)	168.8	61.2	4.7

5.2.3 Map of meat packaging material flows

Figure 9 maps the use of meat packaging throughout the value chain.

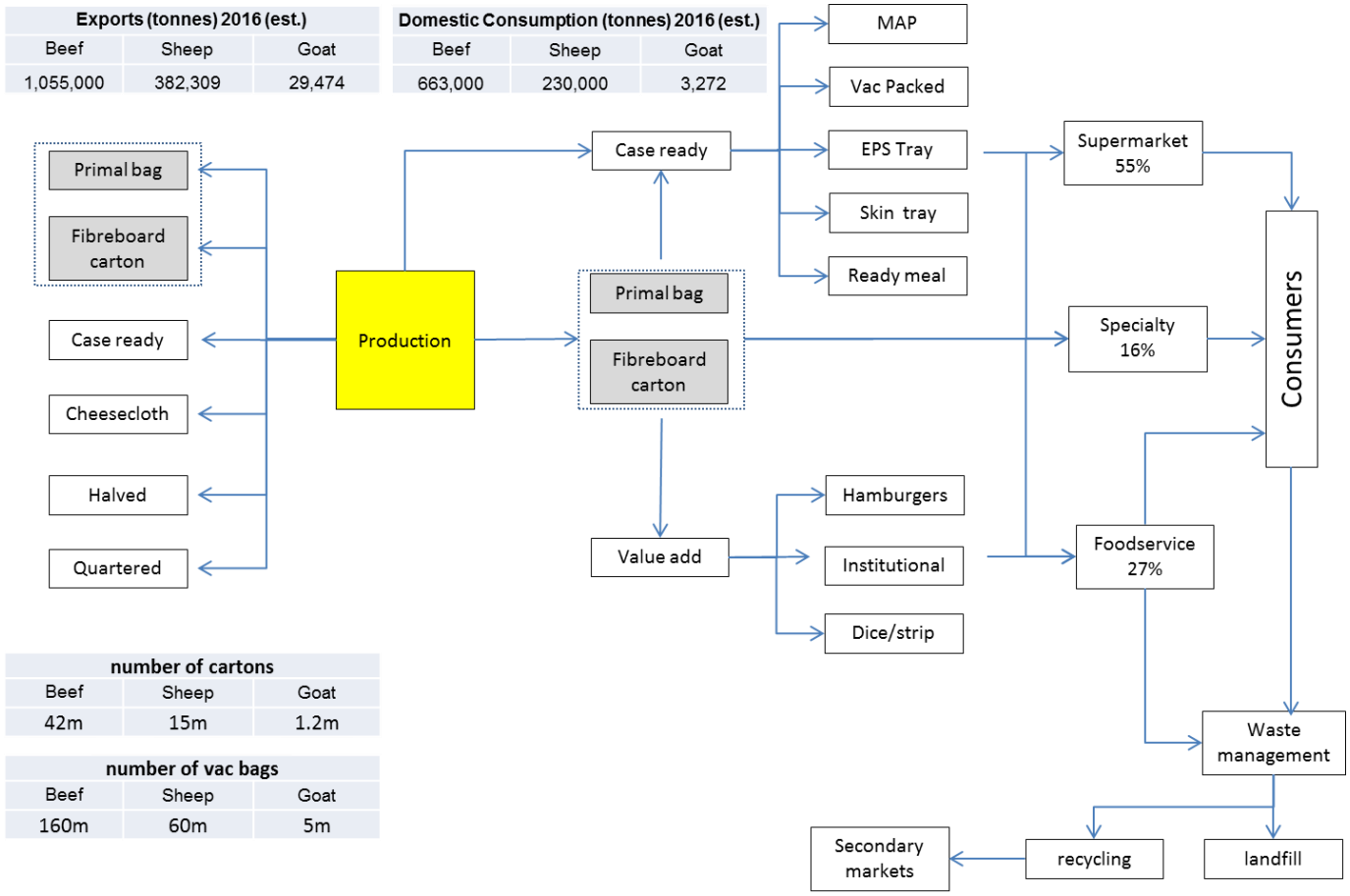

Figure 9: Map of meat packaging material flow

5.2.4 What is sustainable packaging?

Sustainable packaging aims to optimise economic outcomes by optimising function, and efficiency while minimising resource use and environmental impact. A sustainable packaging approach considers the impact of packaging design, and recognises the role that packaging plays in protection, promotion, and transporting of goods. It also recognises the importance of product information and ease of use of packaging.

Framework for sustainable packaging

The Sustainable Packaging Guidelines, developed by the APC (APC 2016) define sustainable packaging as:

- Fit-for-purpose
- Resource efficient
- Made from low-impact materials
- Reusable or recyclable at the end of its useful life.

The Sustainable Packaging Guidelines were developed to assist APC signatories and others to review and optimise consumer packaging to make efficient use of resources and reduce environmental impact without compromising product quality and safety. Table 9 provides more detail on the four principles of sustainable packaging (APC 2016).

Table 9: Four principles of sustainable packaging (APC 2016)

Principles	Potential strategies
1. **Fit-for-purpose:** Packaging should be designed to meet market and consumer needs, while minimising net impact in a cost-effective way.	• Meet technical performance requirements • Minimise supply chain costs • Meet consumer needs and expectations, including for accessibility.
2. **Resource efficiency:** Packaging should be designed to minimise the use of materials and other resources without compromising product quality and safety.	• Minimise materials • Use recycled materials • Minimise transport impacts • Maximise water and energy efficiency
3**. Low-impact materials**: Packaging should be designed to minimise the environmental and social impact of materials and components. Materials should be selected on science and incorporate a whole-of-lifecycle approach.	• Minimise risks associated with potentially toxic and hazardous materials • Use renewable or recyclable materials • Use materials from responsible suppliers.
4. **Resource recovery:** Packaging should be designed to maximise its potential for recovery and recycling and to minimise the environmental and social impacts of its disposal.	• Design for reuse where appropriate • Design for recovery • Design for litter reduction • Inform consumers about appropriate

Principles	Potential strategies
	disposal.

The Sustainable Packaging Guidelines are broad enough that they can be interpreted to suit the requirements of different sectors, including red meat packaging. Although primarily designed to assess consumer packaging, the principles of sustainable packaging outlined above can be tailored to suit both non consumer packaging.

The waste management hierarchy

The principle of the waste hierarchy, shown in figure 10, is an order of preference for managing waste responsibly. A sustainable approach to packaging should follow the principles of the waste management hierarchy to minimise waste and environmental impact. In accordance with the hierarchy, with avoidance (through design) is the being the most preferred option and disposal being the least. This is an important principle which underlines most waste management strategy in Australia.

Figure 10: Principles of waste management hierarchy (source: EPA Victoria)

5.2.6 Factors impacting sustainable packaging

Despite principles of sustainable packaging such as those developed by the APC being readily available, it can be difficult to achieve sustainable packaging in practice. Some of the common challenges facing sustainable packaging include:

- Allocating a low priority to sustainability in the packaging design stage, compromising the sustainability (materials, recyclability) of packaging outcomes
- Financial factors where a sustainable packaging material may cost more than the market is prepared to pay at the current time, or would require new equipment/tooling
- Poor quality recyclate. Where technical requirements of packaging dictate specific materials choices this may impede recycling or reduce quality (for example mixed plastics, contamination) (Walsh 2013)
- Logistics of collection of waste packaging where low volumes of waste are dispersed over large geographic areas, impacting recycling viability
- Behaviour of end users. A lack of consumer awareness may lead to packaging being sent to landfill when it is recyclable.
- Cost of recycling packaging waste may be more than the cost of landfill for business. Businesses will generally choose the cheapest disposal service.

5.2.7 Approaches to sustainable packaging

This section examines examples of packaging which respond to one or more principles of sustainable packaging including:

- Incorporation of recycled material, renewable or low impact material while meeting current packaging needs
- Facilitation of packaging recycling.

Incorporating recycled content

Incorporating recycled content is an effective way to reduce the life cycle impact of packaging.

A carbon footprint analysis in plastics manufacturing (Dormer et al 2012) was undertaken to compare recycled content packaging with virgin packaging. A Life Cycle Analysis (LCA) was used to compare the carbon footprint of food packaging trays made using 85% recycled content with the same packaging made using virgin PET. It studied the impacts over the life cycle from raw material sourcing, manufacturing, secondary packaging, and transport to end-of-life.

Over the life cycle of the packaging, the highest impact was from the extraction and production of raw materials, followed by processing. Transport and end of life impacts (assuming a 30% recycling rate) both contributed 3% and 9% respectively. The study found that use of 85% recycled content led to a 24% decrease in the carbon footprint of the packaging compared to existing packaging. The carbon footprint savings of using 100% recycled content packaging compared to virgin packaging provided a further decrease as shown in figure 11.

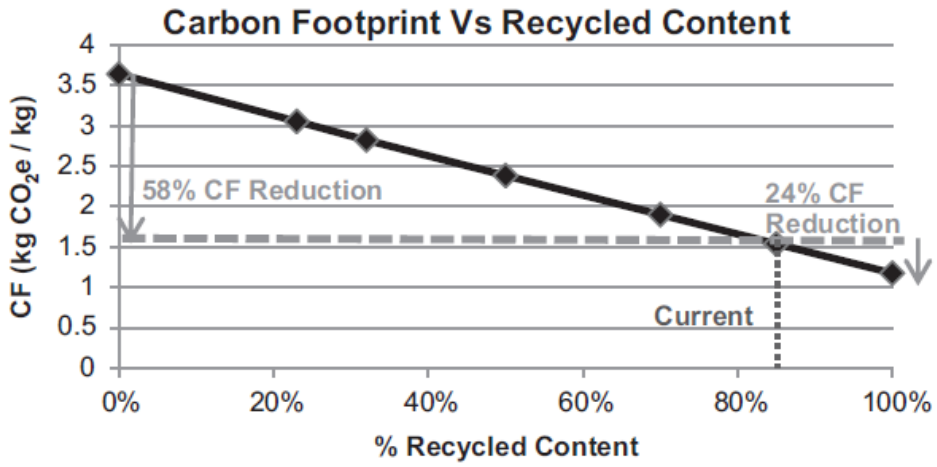

Figure 11: Carbon footprint vs recycled content

Increasing recycled content is an area of focus for packaging suppliers, including meat packaging suppliers. An example is Linpac's RPET packaging which is made using up to 95% recycled content PET. Note: fibreboard commonly contains recycled content fibre.

Light weighting

As meat packaging currently has low recycling rates, reducing the amount of material used to achieve functional packaging is an effective sustainable packaging strategy.

Dormer (2012) identified the importance of reducing the weight of packaging as a strategy to reduce carbon footprint. The study found that the impact of 'light weighting' the tray was equal to the impact of increasing recycled content, and more effective than increasing end of life recycling rates.

Please refer to figure 12.

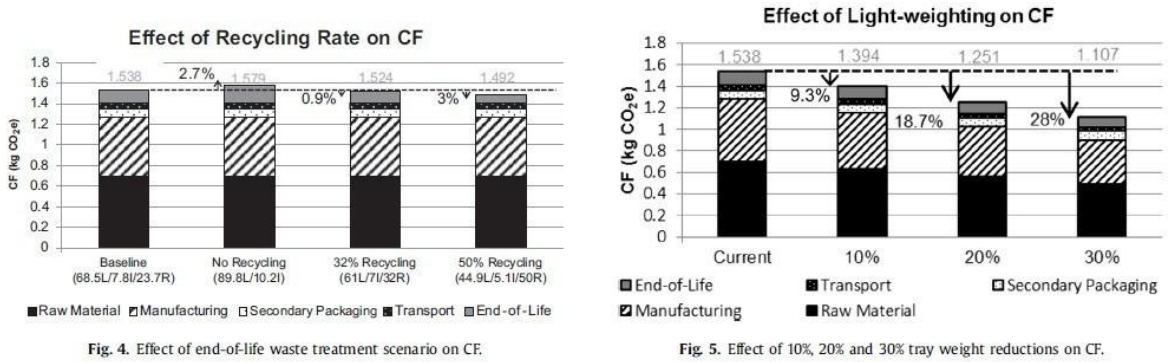

Fig. 4. Effect of end-of-life waste treatment scenario on CF.

Fig. 5. Effect of 10%, 20% and 30% tray weight reductions on CF.

Figure 12: Effect of light weighting vs recycling

Light weighting can have additional environmental benefits, for example those associated with transport, and can further reduce costs through the use of fewer raw materials.

Renewable materials

Plastics based on renewable materials are an emerging focus for sustainable packaging and are starting to be used in red meat packaging. For example Coles is using a plant based

plastic in its meat trays (Plantic 2012). Polylactic Acid (PLA) is biodegradable polyester derived from corn starch. Being derived from renewable sources and biodegradable it offers considerable promise as sustainable packaging material. PLA films have been developed which offer barrier properties equivalent to traditional fossil based plastics.

Studies have shown that the lifecycle carbon emissions and non-renewable energy (among other impacts) of PLA packaging are lower than petrochemical derived plastics, including recycled plastics. This is due to the fact that the corn used to produce PLA sequesters carbon from the atmosphere during its growth phase. However, other impacts, for example those associated with agricultural activity (Eutrophication) can be higher. Figure 13 shows the relative performance of PLA compared to recycled PET (Binder & Woods 2009).

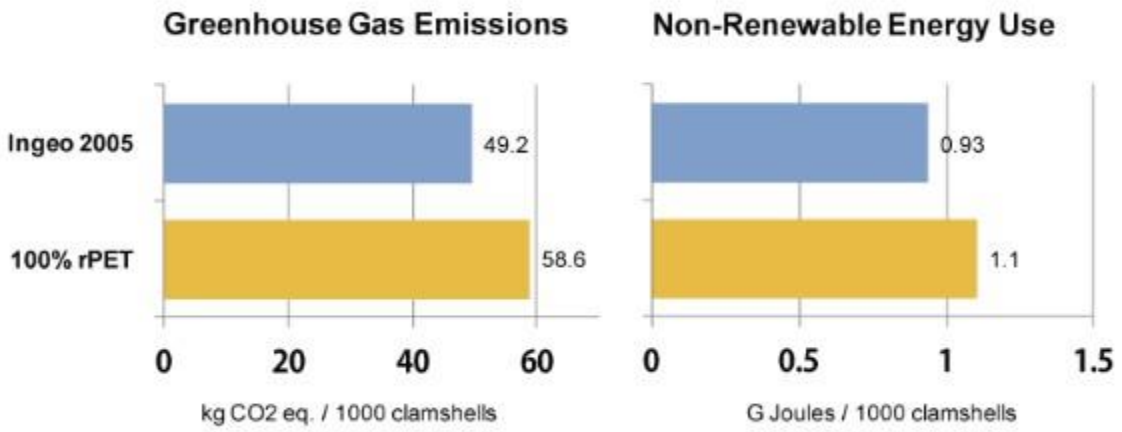

Figure 13: Comparison of PLA (Indeo) and recycled PET plastic (source: Binder & Woods 2009)

PLA is considered inert in landfill, which means it won't break down. While this puts it on par with petrochemical plastics in landfill, it means that there is no environmental benefit.

While PLA is biodegradable, certain conditions must be met for this to occur. Life cycle studies for PLA make the assumption that biodegradation of PLA are through industrial composting. This means that the biodegradability benefits of PLA plastic are not realised if a product is either landfilled or sent for material recovery through recycling.

However, the use of PLA in meat packaging opens up possibilities to send meat packaging waste to an industrial composting facility. This option may be attractive where contamination issues mean material recovery through recycling is not possible.

Low impact materials

Polypropylene (PP) is a traditional plastic which is used for meat trays by a number of suppliers. Compared to other packaging types (PET, PS) it has benefits including that it has lower density, which can reduce the overall weight of the packaging, with corresponding reductions in transport impacts. PP also has high recyclability in Australia, although not at the same rate at other plastics (around 20%).

A study was undertaken for a plastic meat packaging manufacturer in Australia to compare the life cycle impacts of Polypropylene (PP) packaging, PET packaging and HIPS packaging. The manufacturer commissioned the study conducted in accordance with ISO 14024 (third party peer review) to better understand the relationship between material choice and recycling rates when assessing the life cycle impacts of packaging. The manufacture was considering changing the material it uses to produce meat trays from HIPS to PET or PP. PET enjoys a higher recycling rate in Australia than either PP or HIPS and this influences decision making.

The comparison focused on the global warming potential, solid waste and water use for both zero recycling (100% waste to landfill) and for recycling rates of each material, for identically size meat trays.

The study concluded that PP had the lowest global warming potential, and water use of the three materials. For solid waste PP was higher than for PET due to lower recycling rates. Please refer to figure 14.

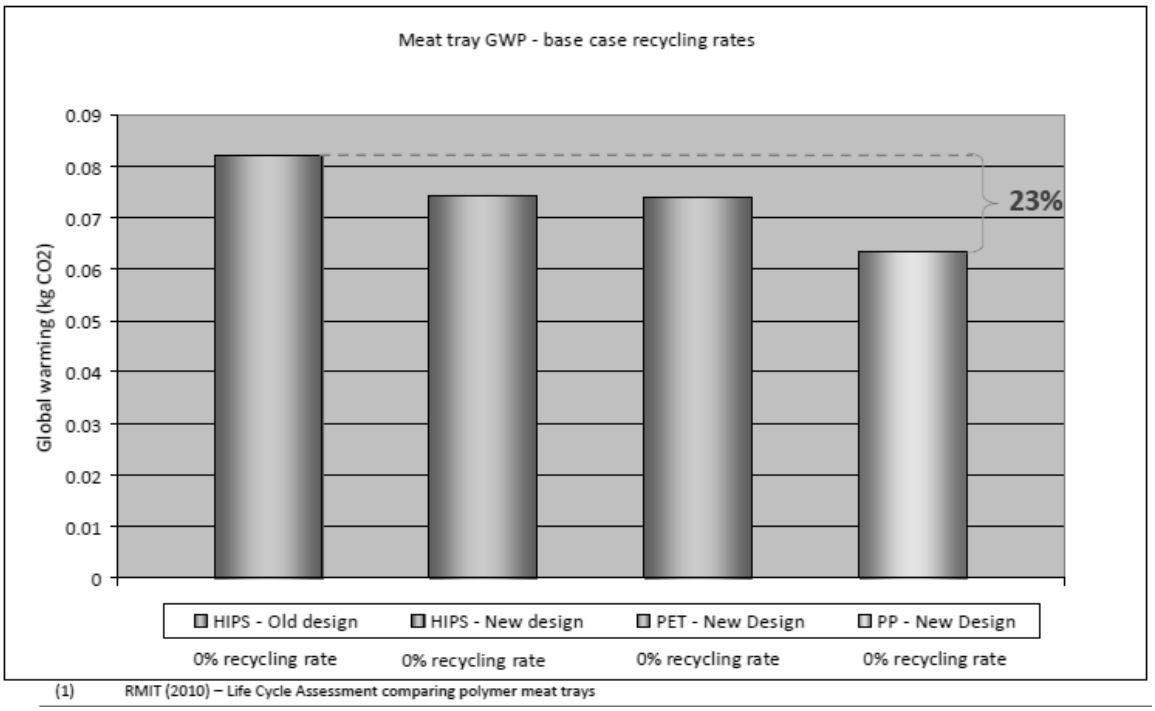

Figure 14: Base recycling rates (source: Binder & Woods 2009)

Facilitating recycling and/or end of life recovery

Increasing the rate of recycling is a major sustainability challenge for meat packaging, especially for plastic. McKinna (2006) found that all plastic packaging was going to landfill. A similar study (Walsh 2013) found a similar situation in the UK for wholesale meat packaging.

Walsh (2013) found that the factors reducing recyclability of plastic meat packaging in the UK included:

- The composition of the plastics used for red meat packaging were not types that were readily recycled (due to low volumes and lack of end markets)
- Contamination by moisture and other contaminants
- The use of multilayer packaging to meet performance requirements.

One of the barriers to recycling retail packaging is that consumers do not always know whether packaging is recyclable or not through normal kerbside collection. However, there is steady increase in the number of packaging types (in particular plastics) which can be recycled. Initiatives have been created to develop more comprehensive information for consumers regarding recycling of the packaging. This includes providing information about specific parts of the packaging. The logo in figure 15 has been developed for the Australian market by Planet Ark, based on a similar scheme in the UK.

Figure 15: Australian packaging recycle label (source: Planet Ark 2016)

The UK study (Walsh 2013) reviewed a number of waste recovery options including incineration (including in cement kilns) for multilayer plastics. However, it concluded that the UK does not have an extensive network of facilities for recycling contaminated plastic waste or recovering energy from waste, e.g. using incinerators to generate electricity and heat, and the technologies used generally lag behind those being used on the continent.

Barriers to recovery of waste (for example through incineration) were identified as:

- Contamination. Companies in waste recycling and cement companies approached to take plastic waste would not process waste unless it was washed and dry.
- Community concern. The report quotes that a number of ‘pressure groups’ have been established opposing waste to energy plants in the UK (due to concern over local air quality), and opposition to waste to energy in favour of recovery and recycling.

However, the high calorific value of meat industry plastic waste makes it a good candidate for waste to energy once barriers are overcome, given the difficulty of material recovery through recycling mentioned above.

The UK study is relevant to Australia due to existing low recycling rates of meat packaging.

Reusable packaging

Due to the significant volumes of wholesale packaging use, there is a significant opportunity to adopt reusable packaging, as is done in other industries. Re-usable packaging , in the form of plastic totes (usually collapsible) is widely used in other sectors, for example the automotive sector. In the food sector, re-usable packaging is used in fruit and vegetable, and fish sector.

Research found that there is very little use of re-usable packaging in the meat sector, either in Australia or overseas. One of the reasons for this appears to be the difficulty of maintaining hygiene standards where packaging becomes contaminated with meat waste.

The viability of re-usable packaging is improved where there are multiple trips utilising standardised packaging. An example is where one part of a wholesale chain provides product for another part. In the red meat sector an example is where value adding companies supply a small number of food service or quick service retailers on a regular basis. In some cases, meat is supplied straight from the boning room to the food service operator.

A study for WRAP identified a number of primary factors which help determine the environmental benefits or otherwise of re-usable packaging. These include:

- Raw material use and energy use in manufacture
- Transport distances
- Number of trips
- The size of the pool required for re-usable packaging
- Vehicle utilisation.

It was also noted that longer transport distances tend to favour single use packaging.

These factors would need to be further examined to determine the viability of re-usable meat packaging in Australia.

Woolcool technology

Woolcool carton technology is an example of reuseable packaging which has been trialed, tested and implemented successfully in the EU, UK for seven years. It is now being introduced into Australia. Woolcool insulation has been proven to keep contents packed at 1 degree Celsius, chilled below 5 degrees Celsius for at least 24 hours, and has superior performance to other similar insulation packaging currently used. The product is made from 100% biodegradable, sustainable and compostable felted sheep's wool, sealed within recyclable food grade polyethylene wrap. Further to this, Woolcool can be reused many times over (dependent on rips or tears in the wrap).

Reducing Packaging use

Reducing packaging is an effective strategy for reducing impacts across the life cycle (production, use and disposal) of packaging. It can have economic benefits across the value

chain including a reduction in packaging costs, transport costs (reduced weight), and disposal costs (landfill).

Reductions in packaging must consider the functions of packaging including protection, presentation and identification of the product. In the case of meat, the high value of the product (per kilogram), and its requirements for protection, means there is value in adequate packaging.

Factors which impact the cost benefits of reducing packaging include:

- Cost of packaging
- Savings from reduced packaging
- Cost of initiatives to reduce packaging (new equipment etc.)
- Savings in waste disposal costs (where relevant)

A number of case studies were reviewed to better understand the benefits and challenges to reduce packaging use in the red meat sector. These were drawn from:

- Australian Packaging Covenant (APC) Packaging Assessment case studies
- Sustainability Victoria
- Queensland Government

Key findings were that many organizations are able to find ways in which they can reduce the impact of their packaging, once they go through a formal assessment process. Packaging assessments are a part of process which signatories to the Australian Packaging Covenant are encouraged to take. Several studies reviewed found that a packaging assessment could find simple changes that could be made that resulted in reduce packaging. Examples include:

Fuji Xerox found that they could redesign some of their packaging for the multi-function devices which reduced the amount of cardboard required by 50% and resulted in multiple savings including warehousing reductions and savings of over $57,000 per year. Other innovations which Fuji Xerox employed to reduce their packaging use included:

- Using a thinner gauge cardboard where possible
- Ensuring cartons are the correct size (reduces carton size and shipping costs)

Robert Bosch undertook an in house workshop to undertake a trial packaging assessment as part of its commitment to the APC. Some of the findings they made, relevant to reducing packaging were:

- replacing the outer box with a sleeve that includes the branding and product information;
- using folded cardboard inserts to replace the current bags, boxes and dividers, and in a way that shows that all components of the kit have been packed;
- Using standard packaging for a range of products.

A materials assessment undertake for Morgan Ceramics in Melbourne identified measures to save materials, improve energy efficiency, reduce packaging, minimize waste, and upgrade machinery that have the combined potential to save Morgan Technical Ceramics more than $60,000 per year. In terms of packaging, Morgan Ceramics redesigned its

packaging by using more compact fitting cardboard boxes replacing the need for protective sponge wrapping which not only reduced packaging costs by 20%, but reduced packaging waste and disposal costs.

These initiatives and others like it show that focusing on reducing packaging will lead to positive results. However some of the challenges and considerations tending to work against efforts to reduce packaging include:

- That significant change to packaging will require re-tooling, new equipment and/or upgrades to existing equipment. This will offset some of the cost savings
- In some cases, packaging design is beyond the control of the organization concerned. This may be due to packaging being specified and designed overseas, or the use of generic packaging (this may be relevant to smaller red meat value chain participants using off the shelf boxes and vacuum bags).

Overall, focusing on packaging as a way of reducing resource use across a company will pay for itself in the short to medium term. Sustainability Victoria's Resource Assessment Grants scheme aimed at small to medium enterprises in Victoria has found that opportunities identified under the scheme achieve a payback time of 1.4 years (Sustainability Victoria 2016).

5.3 Regulatory drivers for Australian red meat and sustainable packaging

The Australia red meat industry is heavily regulated to maintain quality and freshness of product and protect the consumer. Packaging has been specifically designed to protect the product from contamination and spoilage yet allow the utilisation and handling of the product for transport and retailing. There are three key drivers that will continue to shape the current and future packaging regulatory requirements for the Australian red meat industry. These include:

- The national and state regulatory context including food safety laws and standards and sustainable food packaging requirements
- The international drivers including global standards, international associations and programs, and country-specific programs; and
- A shift in consumer perception and understanding of waste impacts, climate change, finite resources and the trend towards buying more sustainable packed products.

These drivers result in conflicting pressures between meeting regulatory needs, international and domestic supply and demand of the product, and shift in consumer behaviour that will continue to drive changes in packaging regulation and create challenges for the red meat industry.

5.3.1 National and state regulatory context

There are two key parts of regulation in Australia that affect red meat packaging. These are the Australian Food Safety Regulations and *National Environmental Protection Measure (Used Packaging Materials) 2011* (NEPM).

Australia's food safety regulation ensures that red meat packaging protects the quality and integrity of the product, and also serves to extend the shelf life of the product whilst maintaining freshness.

Australia's packaging regulation is designed to help minimise the environmental impacts of packaging (NEPM 2011).

Australian food safety regulation

Food safety is a significant factor in consumer food purchasing decisions and as such the industry is heavily regulated.

The Australian food safety regulation is multi-layered and includes the following federal acts and subsequent regulations, state acts and regulations, standards, systems and programs:

- The Food Standards Australia New Zealand Act 1991
  - Each state in Australia has a Food Act, a list can be found on the food standards website (http://www.foodstandards.gov.au/about/background/foodlaw/Pages/default.aspx.)
- The Food Standards Australia New Zealand Regulations 1994
- Meat and Meat Products Standard 2.2.1
- AS 4696:2007 Australian Standard for the Hygienic Production and Transportation of Meat and Meat Products for Human Consumption

- Imported Food Control Act 1992
- The SAFEMEAT program. This is a food safety partnership between the red meat industry and government.
- AUS-MEAT is a national organisation that ensures the quality at the consumer level
- Meat Standards Australia
- Livestock Production Assurance
- National Feedlot Assurance Scheme (NFAS) and National Livestock Identification System (NLIS)
- Australian Quarantine and Inspection Service (AQIS).

Currently, multi-layered plastic dominates primary packaging in the industry as it serves to protect the contents along the value chain, maximise shelf life whilst meeting regulatory requirements. Fibre board cartons serve as secondary packaging enabling the effective transport and distribution of the product. The use of these packaging types has served to increase the quantity and cost of packaging used by the food industry (McKinna 2006).

Australian packaging regulation

Governments require that brand owners with a turnover larger than $5 million either sign the Australia Packaging Covenant (APC) or comply with the National Environmental Protection Measure (Used Packaging Materials) 2011 (NEPM) to help minimise the environmental impacts of packaging. A brand owner refers to either a person who is the owner or licensee in Australia of a trade mark under which a product is sold or otherwise distributed in Australia or regarding in-store packaging, the supplier of the packaging to the retailer (NEPM).

The NEPM states that consumer packaging means:

a) *"All packaging products made of any material, or combination of materials, for the containment, protection, marketing and handling of retail consumer products. This also includes distribution packaging that contains multiples of products intended for direct consumer purchase; and*
b) *From registration, all packaging products made of any material, or combination of materials, for the containment, protection, marketing or handling of consumer products. This also includes distribution packaging."*

The NEPM goal is to reduce environmental impact from the disposal of used packaging and conserve resources by encouraging waste avoidance and the re-use and recycling of used packaging materials. This is achieved by supporting and complementing the voluntary strategies in the Covenant and by assisting in the Covenant's assessment.

The APC is a sustainable packaging initiative which has three main aims:

- to change the culture of business to design more sustainable packaging
- increase recycling rates and;
- reduce packaging litter.

Signatories of the Covenant signal their commitment to:

- Design packaging that is more resource efficient and more recyclable

- Increase the recovery and recycling of used packaging from households and away-from home sources
- Take action to reduce the incidence and impacts of litter.

The APC provide guidance and funding to assist signatories to improve the environmental sustainability of their packaging. Signatories who do not meet their APC obligations will be deemed non-compliant and they will be referred to the relevant government jurisdiction for failing to meet these obligations to the NEPM.

This may be a risk for the Australian meat industry as it would appear that only 0.025% of wholesalers, processors and exporters are APC signatories. This is based on a sample of 40 organisations (AMIC 2016).

5.3.2 International drivers

International organisations, standards and associations are increasingly placing pressure on Australian domestic laws and policies to drive change to reduce food waste and improve the sustainability of packaging. This study will explore how international drivers will continue to affect meat packaging production.

These drivers are designed to reduce food waste, better manage the environmental impacts associated with the industry, and may improve sustainability of packaging materials.

These include:

- International Organization for Standardisation (ISO) and International Electrotechnical Commission) voluntary agreements for example, ISO 14001 provide practical tools for companies and organizations of all kinds looking to manage their environmental responsibilities
- The Sustainable Packaging Alliance is an international association that provides knowledge, tools and expertise that facilitate continuous improvement in the environmental performance and sustainability packaging systems
- The Sustainable Packaging Coalition, a US based industry working group transformed the packaging system into a circular economy that inspire economic gain and a sustainable fate or flow of materials
- The Waste and Resources Action Programme (WRAP), a UK based charity that promotes the encouragement of sustainable resource use
- United Nations Environment Programme (UNEP)
- UN's Food And Agriculture Organisation (FAO).

5.4 Benchmarking environmental and economic performance of existing Australian red meat packaging

To support the benchmarking of the environmental performance for red meat packaging, an evaluation of existing meat packaging and existing research was undertaken.

5.4.1 Methodology for assessing environmental and economic performance of existing packaging

A baseline evaluation was undertaken on existing red meat packaging to aid decision making when developing sustainable packaging business models. The assessment also informed the development of a suitable methodology for comparing meat packaging and relevant evaluation criteria for determining sustainable packaging business models.

The methodology for the evaluation included the following steps:

- Developing a descriptive assessment criteria and scoring system based on the principals of the APC's Sustainable Packaging Guidelines
- Scoring of key distribution packaging and consumer packaging types against the criteria. Each packaging type was assigned a score of 1-3 (with 3 meeting best practice)
- Providing an overall assessment (recommendation) based on the scoring
- Providing an analysis of strengths and weakness against the scoring criteria for each packaging type assessed.

The assessment drew on information gathered through desktop review, key stakeholders, personal experience, and direct observation (retail packaging). The results may change as information is updated over the course of the project.

5.4.2 Criteria for assessment

The assessment for existing packaging was based on the following criteria. The criteria addresses the four principles of sustainable packaging, and are interpreted to be relevant to meat packaging. Please refer to table 10.

Table 10: Defined criteria for assessing packaging

Criteria	Assessment parameter
Fitness for purpose:	
Traceability	Ability to comply with labelling requirements
Food safety	Material is safe for food contact Material does not transmit toxicity into food product (evidence)
Rated shelf life	Shelf life rated in days
Physical protection	Ability to meet transport and storage requirements.
Cost	Lowest cost available
Market needs/appearance (retail)	Presents acceptable appearance to market Facilitates adequate labelling to promote product.
Ease of use (retail)	Packaging can be easily opened/resealed by

Criteria	Assessment parameter
	consumers (if applicable)
Resource efficiency:	
Efficiency/ product fit/ light weighting	Minimum packaging is used to protect the product (close fit, lightweight)
Recycled content	Amount of post-consumer recycled content typically used in packaging type
Water and energy efficiency in packaging process	The water and energy used in the packaging process. (This was not rated for existing products)
Low-impact materials:	
Embodied energy and emissions	High level assessment based on material types with metals being highest, fibreboard rating next, light weight plastic being the lowest. Where information was available, differences in plastic weight were recognised.
Use of low toxicity materials	Evidence of high toxicity in the material itself (no differentiation in existing products)
Use of renewable materials	The extent to which renewable materials are used.
Resource recovery:	
Recyclability of materials (each material)	Materials received a high score if they were commonly recycled.
Ease of material separation for recycling	Packaging which was easily divided into different materials for recycling purposes was scored highest. Multilayer materials scored lower due lack of recycling opportunities.
Information to facilitate recycling (recycling symbols etc.)	Presence of recycling information on packaging.

5.4.3 Assessment against criteria

Each chosen packaging type was rated against the criteria. Where no differences could be determined between the relative performances of the packaging against a criteria element, they were scored equally. The assessment allowed for weightings to be applied as

appropriate, e.g. extension of shelf life was weighted more highly due to industry priorities. Please refer to table 11.

Table 11: Packaging assessment

	Fit-for-purpose	Score	Resource efficiency	Score	Low-impact materials	Score	Resource recovery	Score	Total Score	%
Distribution Packaging										
Vacuum packaging	Meets current requirements	3.0	Efficient fit to product. No recycled content	1.3	No use of renewable materials	1.3	Use of multilayer plastic limits recyclability	0.0	5.6	47%
Fibreboard cartons	Meets current requirements	3.0	Up to 50% recycled content Standard sizes may limit efficiency	2.3	Made using renewable materials higher embodied energy than plastics	2.5	Easily, practically recycled. High recycling rate. Limited by contamination. Not reusable	2.3	10.1	84%
Retail Packaging										
MAP Packaging (RPET)	Meets current requirements. Medium shelf life Physical appearance meets market requirements	2.6	Not always efficient fit to product may have recycled content Heavier than EPS	1.3	No use of renewable materials	1.3	PET has a high recycling rate. May not apply to meat packaging. Designed for recycling.	2.2	7.3	61%
Vacuum packaging	Meets current requirements. High shelf life Physical appearance may require supplementary packaging.	2.7	Efficient fit to product. No recycled content	1.5	No use of renewable materials	1.3	use of multilayer plastic limits recyclability	0.0	5.6	46%
Skin packaging	Meets current requirements. High shelf life Physical appearance meets market requirements	2.9	Not efficient fit to product No recycled content Multiple layers of packaging	0.8	No use of renewable materials	1.3	multiple materials hamper recycling	1.3	6.3	53%
EPS packaging	Meets current requirements. Lower shelf life Physical appearance adequate.	2.1	Lightweight Reasonable fit to product No recycled content	1.5	No use of renewable materials	1.3	Low density hampers recycling	1.3	6.3	52%
Ready Trays	Meets current requirements. High shelf life Physical appearance meets market requirements	2.6	High packaging to product ratio due to requirement for higher durability	0.3	No use of renewable materials Potential use of metals (aluminium) = higher embodied energy	1.0	Black material impacts recylate value	2.3	6.1	51%

5.4.4 Discussion of key themes and opportunities from analysis

While it is acknowledged that direct comparisons of different packaging types is difficult due to their specific characteristics, and it is acknowledged that information gaps exist, it is possible to make high level observations of performance and identify opportunities for improvement of existing packaging. Please refer to table 12.

Table 12: Discussion themes and opportunities

Highlights	Improvement Strategies
Retail packaging incorporating recycled content Retail packaging incorporating renewable content High recycling rates for fibreboard cartons Evidence of light weighting in packaging design across packaging types	**Easy wins** Provide information to consumers on recycling options (where applicable) Light weighting existing packaging where applicable Increase recycled content packaging Medium term initiatives Investigate viable recycling for multi-layer plastic films Overcoming barriers to recycling associated with meat related contamination Investigate on site waste to energy to manage packaging waste (for example to create hot water or electricity). Longer term goals Develop/adopt single film vacuum bags which meet technical requirements. Develop/adopt bio-plastic vacuum packaging which meets technical performance requirements (barrier properties, strength) and implement associated waste management (composting). Develop/adopt alternative films, for example those which do not need to be removed (edible, nano material etc).
Could improve	
Lack of recycling information for consumers Lack of recycled content across both distribution and retail packaging Use of multilayer films hampers recycling Low recycling rates for plastic packaging	

5.4.5 Potential areas of focus

The objective of this report and workshop is to inform the development of two value propositions for RD&A and marketing activities pertaining to sustainable red meat packaging.

Analysis of the performance of existing packaging, combined with an understanding of sustainable packaging principles, results in two clear emerging focus areas. These areas are:

- **Design focused:** Addressing the sustainability of packaging in the design stage
- **End of life focused:** Addressing the sustainably of packaging in the end of life phase.

Under each area of focus the following strategies should be further investigated and assessed for the potential to provide sustainable packaging business models.

Packaging – Design focused

- Light weighting existing packaging where applicable
- Increase recycled content of existing packaging
- Develop/adopt single film vacuum bags which meet technical requirements.
- Develop/adopt bio-plastic vacuum packaging which meets technical performance requirements (barrier properties, strength) and implement associated waste management (composting).
- Develop/adopt alternative films, for example those which do not need to be removed (edible, nano material etc).

Packaging – End of life focused

- Provide information to consumers on recycling options (where applicable)
- Investigate viable recycling for multi-layer plastic films
- Overcoming barriers to recycling associated with meat related contamination
- Investigate on site waste to energy to manage packaging waste (for example to create hot water or electricity).

5.4.6 Information gaps

The key information gaps identified in the creation of this report include:

- Current data regarding meat sector quantities
- Current data on existing packaging quantities and types for different product types.

5.4.7 Definition of sustainable red meat packaging

Sustainable Red Meat Packaging

- Meets all existing technical requirements of meat packaging to ensure protection, traceability, health and safety/ hygiene requirements and expectations.
- Minimises the use of materials
- Meets consumer expectations in terms of appearance and function (including ease of use)
- Is cost competitive with existing packaging (across the supply chain)
- Is made from materials that can demonstrate low impact
- Is technically recyclable by existing waste re-processors (which may include composters)
- Is practically recyclable through existing kerbside collections across a large proportion (for example 80%) of local government areas
- Provides information for users on recycling/waste management
- Is made from materials that have a value in secondary markets
- Reduces impacts across the packaging supply chain.

5.5 Consumer attitudes towards sustainable packaging

The global market for sustainable packaging is forecast to reach $244 billion by 2018 (Smithers Pira 2013). The biggest growth market will be Asia-Pacific, due to emerging middle-class in developing nations which are creating demand for prepared and packaged foods. Government and consumer concerns for the environment are driving the sustainable packaging agenda and pushing the introduction of legislation to minimize the impact of packaging (Smithers Pira 2013).

Packaging continues to be a key concern for consumers. Generally, consumers are increasingly seeking out foods that are locally and seasonally sourced, free from chemicals and additives and sustainably packaged.

Consumers appreciate packaging will deliver them a safe product, but want to be able to dispose of packaging responsibly after it has fulfilled its requirement. Whilst packaging serves to reduce food waste, consumers want to be able to dispose of packaging responsibly after it has fulfilled its requirement (Figure 16).

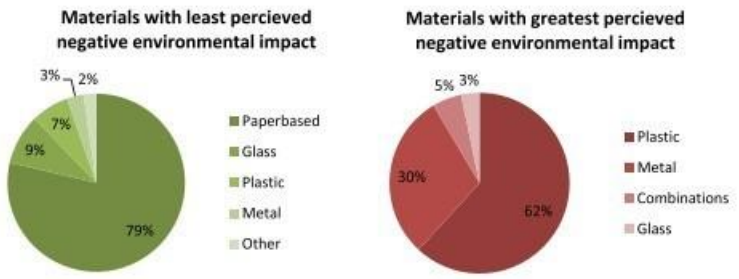

Figure 16: Consumers perception of the impact of packaging materials on the environment

An Ipsos study (Leavy 2013) found that 36 percent of consumers thought food products in general are "a little over-packaged" and 43 percent thought they are "very over-packaged." Consumers are now considering social and environmental benefits as part of their purchasing decisions and calculations of product value. On a global basis, consumers were most likely to say they would pay more for “Packaging that keeps food fresh longer” (55%) and “Packaging that is environmentally-friendly” (55%) (Leavy 2013).

5.5.1 Perception of the red meat industry

Consumers analyse the food they eat today more than in the past. There are more concerns regarding product composition, labelling concerns, product ‘naturalness’, safety concerns and issues relating to the environment and sustainability (Mintel 2014).

Consumer perception of meat and meat products is a major challenge for the meat industry because it directly impacts on its profitability. Red meat, like other products, is suffering as a result of the negative image due it’s perceived high fat content and links to specific health issues (Demeyer, Honikel, & De Smet 2008). At the same time, some of the most important micronutrients such as iron, selenium, vitamins A, B12 and folic acid, are only available from meat and are not readily available in plant-derived food (Biesalski & Nohr 2009). Many studies have concluded that consumer perception is complex, dynamic and difficult to define. The red meat industry should continue to respond to consumer and market-led quality cues

in order to remain competitive and sustainable (Troy & Kerry 2010). This includes maintaining packaging that does not compromise these cues.

Troy and Kerry (2010) determined that the consumer cues at point of sale include:

- Packaged meat colour - consumers require beef to be a bright cherry-red colour. The two important visual clues that determine perceived quality are colour and packaging
- Visible drip – negative impact on consumer attitude to fresh meat product purchase and quality perception
- Visible fat – fat content preference is often market specific. Meat with a fat content between 3 and 7.3% is generally considered acceptable

5.5.2 Sustainability and packaging: What does this mean for red meat packaging

Consumer perception of the red meat industry and its packaging could influence future demand of red meat. Consumers appreciate that packaging will deliver them a safe product, however, they want to be able to dispose of the packaging responsibly (Leavy 2013), after it has fulfilled its function. The relationship between consumer perception of quality, sustainable packaging and the food industry's drive to satisfy consumer needs is complex and includes many different components (Troy & Kerry 2010).

Among the growing population of consumers, environmental awareness is increasing the demand for sustainability and reducing the impact of packaging on the environment. Over the last decade, consumer attitudes toward sustainability have shifted dramatically and this is set to continue. Ethical purchasing behaviour has surfaced as a result of this greater environmental consciousness and concern for the general good of society, as well as understanding on the impacts for future generations.

To meet consumer expectations, the red meat industry needs to prioritise sustainability in the delivery of its product through the adoption of sustainable packaging solutions which include recyclability, cost, light weighting and supply chain efficiency while maintaining product quality. The workshops will provide an avenue to explore and unpack what this means for the red meat industry.

5.6 Emerging packaging technology

This section identifies and reviews emerging packaging technologies, either under development or in use, which address consumer and market-led quality cues and sustainability requirements.

5.6.1 Emerging technologies and trends in meat packaging

The main emerging trends and technologies that will influence the *sustainability* of red meat packaging are:

- An increase in the use of vacuum packaging
- An increase in the development and use of biodegradable packaging and materials
- Increased uptake of recycled content in food contact packaging
- Intelligent Packaging Technology

An increase in vacuum pack technologies for red meat using current technology, will have a negative impact on packaging sustainability, due to lack of recycling opportunities for vacuum packaging. Recycling is hampered by the use of multiple layers films to achieve the barrier properties required.

Developments in biodegradable plastic packaging, coupled with creation of suitable collection and processing systems (composting) could be a way of addressing waste associated with vacuum packaging.

Vacuum bag technology is predominately used in wholesale distribution rather than retail packaging applications. This will result in waste streams are likely to be closer and better able to be managed compared to retail packaging. This increases the viability of collection and processing systems for biodegradable plastics. The strength of this approach is that contamination of packaging with organic matter (meat products) is less likely to be an issue when packaging is composted compared to when it is recycled.

Bioplastics have the potential for strong synergies with agriculture, including meat production. For example the composting of food packaging waste is a natural synergy with improving soil quality on farms. Bioplastics are also created from crops, or potentially from food industry waste. At least one research project is currently underway to create bio plastics from beef and sheep industry processing waste (Target 100 2016). Other developments, for example using fibreboard combined with a biodegradable plastic barrier coating also offer synergies with on composting as a waste management strategy.

Edible films and coatings applied directly to the meat surface can improve permeability and quality properties such as tenderness. They can include preservatives, seasonings, anti-oxidants, anti-microbial and gelatin (Crossin, Verghese & Lockrey 2015).

An increase in the uptake of recycled content material in food packaging is another promising trend in food packaging with the potential to influence the sustainability of red meat packaging. Until recently food packaging was restricted to virgin material due to health

and quality concerns. The APC has developed guidance which helps those packaging suppliers that are considering using recycled content plastic in food applications (APC 2014).

Where food contact is proposed, stringent health, safety and performance requirements need to be met. Recent packaging developments, where (recycled PET) a major meat packaging supplier in Australia is using RPET (recycled PET) is evidence that those requirements are achievable.

Intelligent packaging technology can monitor the food properties and the environment to communicate to processors, retailers or consumers. These technology solutions add other sustainable benefits to the packaging to ensure the quality of the meat is maintained. Some examples include:

- Food traceability – “This fish” (This Fish Website 2016) allows customers to scan a quick response code with their smartphones to identify key salient information on where and how the product was caught.
- Freshness indicators provide direct product quality information resulting from microbial growth or chemical changes in food products. A bio reactive food expiry label has been developed (James Dyson Foundation 2016) which uses gelatine to model the decay process of food, the label is able to tell the consumer the condition of the food packaged by running their finger over the label. A smooth label indicates food is fresh as a bumpy label signifies that the food is decaying.
- Time temperature indicators could be a device used to show measurable, time temperature change that reflects the temperature history of a food product.

5.6.2 Analysis of emerging technology and trends

Emerging technologies and trends present opportunities for improvement and reduction in resource use for the red meat industry. However, each of the emerging technologies can come with limitations to the packaging that the industry will need to consider.

Further research will be required to determine whether biodegradable packaging can meet performance requirements of meat packaging, at an acceptable cost point. The limitations of biodegradable plastic include the need for industrial composting or accounting for additional methane production due to breakdown in landfill. In addition, the life cycle impacts of producing crop-derived packaging also need to be considered.

Biodegradable packaging may cost more per unit than traditional fossil based plastics. However, if business models can be developed to exploit the advantages of biodegradable packaging (for example creating waste with value) the total life cycle costs could be more financially attractive.

The traditional barriers to using recycled content in food packaging applications relate to risks around the potential for contamination from unverified post-consumer mixed waste streams, and the technical performance characteristics of the plastic. These factors are likely to be overcome as sorting technologies improve (Recycling International, 2013). However, concerns raised by some in the industry regarding the breakdown of recycled plastics leading to polymer migration into food will also need to be addressed (Food Australia, 2014).

As with all technological predictions, it is difficult to determine which intelligent packaging technology will succeed. Analysis of consumer attitudes concludes that consumer wariness for ‘over packaging’ may extend to the use of additional technology in food packaging, and hamper acceptance of some or all of these technologies.

5.7 Stakeholder identification

The following provides the identified key stakeholders within the Australian red meat value chain.

5.7.1 Commercial value chain participants

Large processors

The Australian meat processing sector is characterised by the increase concentration of processing in a small number of processors. The four largest players in slaughter and initial processing are:

- JBS Australia
- Kilcoy Pastoral Company
- Teys Australia
- NH Foods Australia.

Market share is less consolidated further along the supply chain, indicated by over 2,000 members of the post farm red meat sector.

Packaging suppliers operating in the Australian market

Major packaging suppliers to the red meat industry include, Linpac, Sealed air, Visy, Amcor, Pact group.

Due to the global nature of packaging supply chains, many of the major packaging players in Australia are overseas based and therefore have access to international packaging best practice technology.

It is important to identify the link between packaging suppliers and the suppliers of packaging equipment.

An important stakeholder, given their development of plant based packaging includes Plantic.

Retailers

Full service supermarkets comprise 70% of retail meat sales (Spencer & Kneebone 2012), making them an important stakeholder for red meat packaging.

Specialty meat retailers are an important avenue to market and are also considered an important stakeholder. However they appear to be represented by the Australian Meat Industry Council.

5.7.2 Key councils for red meat industry, retailers and packaging

The Australian Meat Industry Council

The Australian Meat Industry Council (AMIC) is the Peak Industry body representing some 2,000 post-farm red meat industry enterprises. AMIC members include firms processing for domestic and export consumption, small goods manufacturers, boning rooms, wholesalers and distributors through to independent retail butchers. AMIC operates through a number of industry councils representing sub sectors of the industry. The key industry councils of AMIC are:

- Retail and General Industry Council
- Meat Processors Council
- Export Meatworks (Beef) Processor Council
- Export Lamb, Sheep and Goat Council

The views of AMIC, in particular its Retail and General Industry Council, are an important stakeholder in relation to sustainable packaging initiatives in the sector.

Packaging Council of Australia (PCA)

The members of the PCA cover the entire packaging supply chain from raw material suppliers, packaging manufacturers and users, to retailers, designers and consultants and other companies servicing the packaging industry.

Key packaging suppliers that are members of the Council are important stakeholders in the context of sustainable red meat packaging. The Council may be an avenue for seeking their input (PCA 2016).

Australian Food and Grocery Council (AFGC)

The AFGC is the peak body representing the Australian food and grocery processing sector, including local and export markets. Membership comprises manufacturing industries, and is therefore an important stakeholder for this project. In particular, they focus on logistics and food labelling which may impact on packaging (AFGC 2016).

Australian Retail Association

The ARA is the Australian Retail industry's peak representative body providing support, advocacy and education for retailers (ARA 2016).

Australian Council of Recyclers

ACOR is a not-for-profit peak national industry Council representing businesses in the resource recovery and recycling industry of Australia. ACOR works with government to support the resource recovery, and represents the interests of business operating in the sector. ACOR is an important stakeholder in terms of representing the recycling sector as a whole, and due to their links into federal and state governments (ACOR 2016).

Traceability

GSI barcodes manages several types of barcodes designed for use in different situations. For meat packaging they deal with barcodes that relate to traceability (GSI 2016).

5.7.3 Research and development corporations

Meat and Livestock Australia (MLA)

MLA provides marketing, research and development services to Australia's red meat industry.

Australian Meat Processor Corporation (AMPC)

The AMPC provide research, development and extension services that support the red meat processing industry in Australia to improve the sustainability and efficiency of the sector.

LiveCorp

LiveCorp works to improve the performance in animal health and welfare, supply chain efficiency and market access.

5.7.4 Government bodies

Australian Packaging Covenant (APC)

The APC is a sustainable packaging government initiative that seeks to change the behaviour of business to design more sustainable packaging, increase recycling rates and reduce packaging litter.

Local government

As the primary waste management administrator for domestic waste (kerbside collection), local government are a significant stakeholder for the collection and recycling or red meat packaging. Key state bodies in the local government sector include:

- Municipal Association of Victoria
- Local Government and Shires Association (NSW)
- Local Government Association of Queensland
- WA Local Government Association
- ACT Government
- Local Government Association SA

6 Appendix B: Approaches to value chain innovation

6.1 Sustainable packaging value chain innovation

6.1.1 Background

Innovation in packaging arises from the combination and application of existing ideas or inventions in the market. To improve the competitiveness of a value chain, some form of innovative upgrading must take place (Neven 2014). Each leading technology or packaging design in society today stands on the foundations of others.

For example, Linpac's complete recyclable rPET meat tray could not exist without the efforts of others, particularly the Australian manufacturing industry (Packaging News 2014). The case studies in this section show that business is relationship driven and value chain innovation can arise from improving business relationships.

An innovation system, at its most basic level, is about networks of people. It is about how people use organisations, rules, culture and create personal interactions to generate and exploit knowledge and ideas (Hendrickson et al 2014). To increase the innovation capability in a country, the national innovation systems need to reflect the coordination between different players, actions and context settings. There are often three fundamental elements described in definitions of innovation systems:

- Innovation-related activities (technology)
- Networks of people
- An influential environment or culture within which these activities happen.

Few sustainability attributes in a supply chain come together across the value chain than packaging. Sustainable practices in packaging are important to drive supply chain efficiency (Meyer 2011). Packaging and repackaging is embedded along every step of the chain, from product design, prototyping, procurement production, distribution, consumer end use and post-consumer end-of-life management (McKinna 2006). A study by Accenture found that retailers can realize a 3 to 5 percent supply chain cost savings via sustainable packaging initiatives (Lacy & Hayward 2013).

6.1.2 Value Chain innovation for sustainable packaging

The FAO (Neven 2014) has defined a sustainable food value chain as:

"The full range of farms and firms and their successive coordinated value-adding activities that produce particular raw agricultural materials and transform them into particular food products that are sold to final consumers and disposed of after use, in a manner that is profitable throughout, has broad-based benefits for society, and does not permanently deplete natural resources."

Packaging is one component of the sustainable food value chain for the red meat industry.

The industry's approach to packaging prioritises its role to protect the integrity, quality and freshness of the product while maintaining sustainability and not permanently depleting natural resources. To drive innovation, the red meat industry need to recognise and ensure that all stakeholders of the value chain are in identified, the parts of the value chain are aligned and the value chain is mobilised to achieve the industry objectives.

There are different types of innovation approaches for sustainable packaging, all of which may complement each other in different ways at different times. For the purposes of this report and the objectives set by MLA, EY will focus on two approaches. These are:

- Value chain analysis
- Re-engineering of packaging.

Value chain analysis

The purpose of value chain analysis is to understand what values are being created for consumers and other stakeholders in the value chain, and at what cost (APC 2014). The analysis enables industry or an organisation to understand how the creation of value for consumers helps differentiate their product from other products. The art of sustainable supply chain management is to find changes in the supply chain that create new value to consumers and other stakeholders while also managing cost appropriately (Mauser & Reinier de Man 2003). Please refer to figure 17 which shows the steps required to undertake a value chain analysis for sustainable sourcing.

The value chain incorporates the inputs and outputs of all the activities along the supply chain to satisfy market demands for red meat packaging (APC 2014). By defining the primary value activities throughout the whole chain, and subsequently analyse the costs of each step, ways to create a surplus value for consumers can be realised and may result in a price premium for the unique product (Mauser & Reinier de Man 2003). Shifting from a supply chain comprised of individual components to a value chain can combine the collective strength of each supply chain link to strive towards shared industry goals. Understanding the places in the red meat supply chain where the most significant inputs and outputs occur is likely to result in opportunities for increased efficiencies, and can lead to, cost saving by reducing labour, energy, water and resource use. By interpreting "value" in new ways, i.e. not only in economic terms but also in terms of social and nature values for various stakeholders, new insights can be gained.

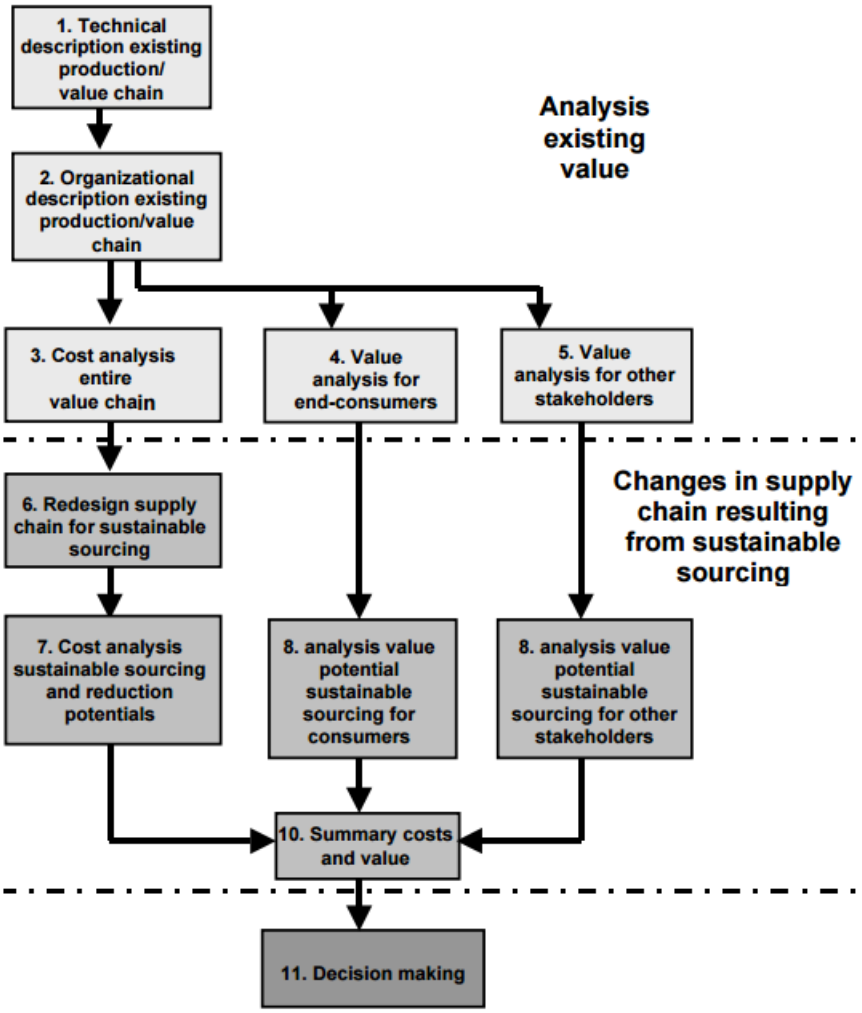

Figure 17: Value chain analysis for sustainable sourcing (source: Mauser & Reinier de Man, 2003)

Re-engineering packaging

The second approach is re-engineering packaging to minimize the environmental impact of a product through its lifecycle. According to Accenture, sustainable packaging solutions deliver reduced costs and a reduction in environmental impacts (Lacy & Hayward 2013).

Sustainable packaging relies on best engineering, energy management, materials science and life cycle rational to minimize the environmental impact of a product through its lifecycle (Meyer 2011). The following list provides innovative solutions for re-engineering packaging to improve its sustainability:

1. Reduce packaging and maximise the use of renewable or reusable materials
2. Use light weight, less toxic or other materials which reduce negative end-of-life impacts
3. Optimize material usage including product-packaging ratios
4. Use materials that are sourced from certified, responsible managed forests
5. Meet criteria for performance and cost (e.g. minimize product damage during transit)

6. Reduce or divert flow of waste to landfill

7. Reduce the cost associated with packaging (i.e. logistics, storage, disposal etc)

8. Reduce CO2 emissions through reduced shipping loads.

There are opportunities to improve packaging efficiency in the red meat sector by assessing the value of each component of distribution and retail packaging in the value chain. Figure 18 from the APC (APC 2014) illustrates how the multi players of the packaging value chain apply to the meat packaging sector. This indicates that the constraints and barriers that the meat packaging sector is facing are not unique to the industry. The key difference for the Australian red meat sector is they are an Australian primary producer focused on export and domestic consumption. Unlike other sectors (for example consumer products), very little red meat is imported for domestic consumption.

Conceptually we can see that building collaboration across the supply chain can lead to more sustainable packaging outcomes. This was raised in the workshop for this project which identified collaboration between value chain participants as a powerful tool for innovation. To maximise the benefit of this approach, MLA needs to perform a detailed analysis of the value chain to understand what the purpose of the packaging is at each point, assess why the packaging is required and the focus areas for improvement.

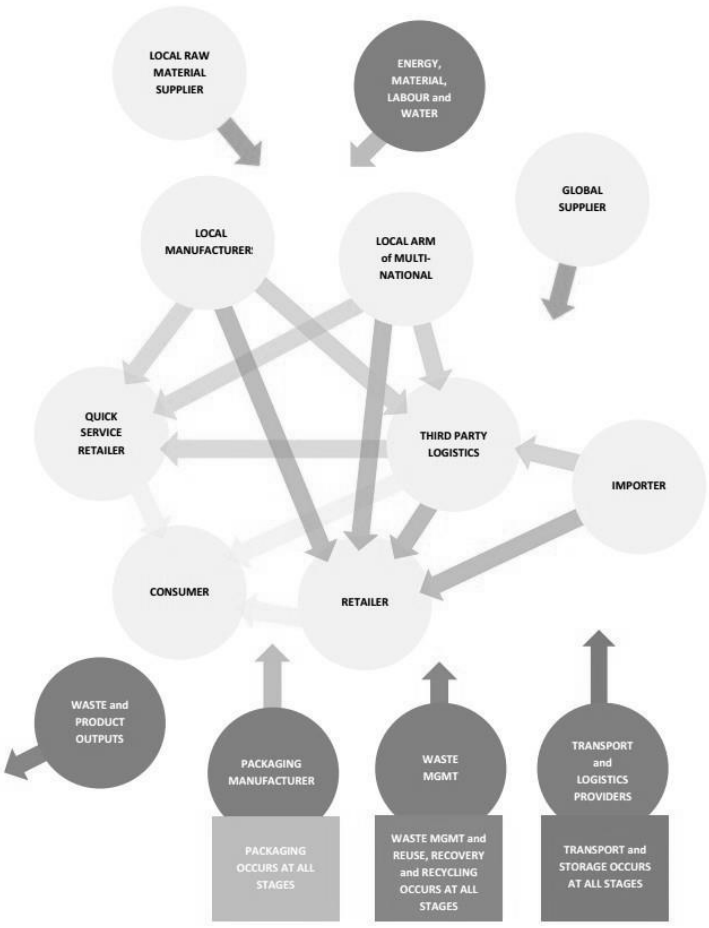

Figure 18: The Australian packaging value chain. (Source: APC 2014)

Greater collaboration on innovation between value chain stakeholders will help drive innovation and value chain participation. Business collaboration on innovation is significantly and positively associated with new-to-market innovation.

6.2 Demonstrating the benefits of value chain thinking

Case Study - Unilever – All waste has a use.

Unilever's aim is to meet the everyday needs of people globally (Unilever 2016). The organisation understands that this can only be achieved and maintained if their actions are determined by the broader principles of sustainable development. Through value chain analysis Unilever understand where they add value to consumers and can differentiate products to meet consumer needs, leading to successful value chain innovation (Boin & Phillips 2016).

Unilever adopted a zero waste model that continually reduces waste through a circular economy. Whereby, Unilever's waste becomes someone else's resource. Through this model they have achieved zero waste to landfill across more than 600 sites in 70 countries including factories, warehouses, and distribution centers (Boin & Phillips 2016).

Waste can be seen as a resource with many alternative uses, from converting factory waste to building materials to composing food waste from staff cafeterias. This has been achieved through the four 'R' approaches of reducing, reusing, recovering or recycling and supplier collaboration. Figure 19 shows how value chain innovation is resulting in zero waste to landfill.

Figure 19: Unilever Value Chain Innovation to achieve zero waste (Source: Boin & Phillips 2016)

Case study - Walmart – Asda

Asda is the second largest supermarket chain in the UK and is owned by Walmart. The business recently undertook four key steps to analyse their value chain to identify climate

risks and hotspots (Idle 2014). Asda uses these numbers and applies them to sales risk to understand where the organisation should focus its efforts to improve the resilience of their products against climate change. Please refer to figure 20 for Asda's focus areas within their value chain to mitigate identified climate risks.

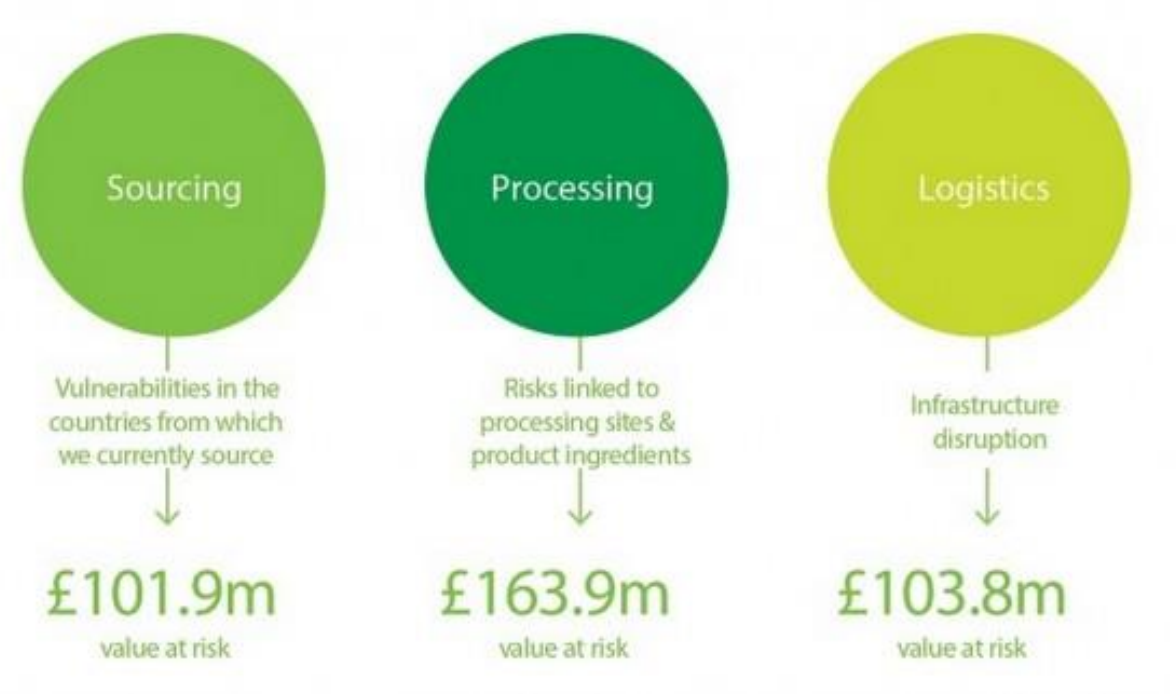

Figure 20: Asda's focus areas within the value chain to mitigate identified climate risks. (Source: Idle 2014)

The four steps taken by Asda to analyse their value chain and identify climate risks and hotspots were:

- Step 1: Mapped its entire global fresh produce supply chain applying a climate resilience framework designed to map risk across the value chain – from its suppliers to its own stores, depots and warehouses.
- Step 2: Asda applied consistent methodology to identify hotspots in the supply chain related to climate risk across a huge range of products.
- Step 3: Developing long-term relationships with stakeholders and reengineer relationships
- Step 4: Forming partnerships: The organisations work with U.K.-based Linking Environment and Farming (LEAF) is beginning to bear fruit with more farmers managing water resources more sustainably. And the Sustain & Save Exchange, its online collaboration platform hosted and facilitated by 2degrees (Asda Sustain and Save Exchange 2014), is encouraging suppliers to become more efficient, identify risks and drive out waste to create savings that the suppliers are free to keep and reinvest in further efficiency programs and technologies.

6.3 Shortlist of sustainable packaging initiatives

To guide the development of a shortlist of sustainable packaging initiatives for the Australian red meat sector, EY held a workshop with a reference group of industry stakeholders. The purpose of this workshop was to:

1. Better understand drivers and challenges facing sustainable packaging in the red meat sector
2. Define opportunities for improving sustainability outcomes in red meat packaging
3. Prioritise opportunities
4. Develop criteria for assessment.

The context for the discussion was set by EY presenting an overview of the findings of this project to date in relation to sustainable packaging. The findings include that:

- There is considerable packaging used in the distribution of red meat, not just retail
- There is a low rate of recycling for plastic packaging in the red meat sector, while recycling of cardboard is quite high
- There is limited recycled content in existing (plastic) meat packaging
- Shelf life, ease of use, cost, and presentation of meat are important factors which drive packaging selection.

A number of key drivers and challenges for the sector were identified by workshop participants. These included:

- Importance of quality, freshness and convenience of product
- The need to tell a sustainability story for red meat
- The impact of packaging cost on packaging design and selection
- Lack of strong regulatory drivers
- Challenges facing recycling of retail packaging
- Waste volumes in supply chain
- Technical challenges limit the recyclability and use of biodegradable plastics.

These are covered in more detail below:

The importance of quality, freshness and convenience of product

The industry is aware of the importance of quality, freshness and convenience of product. This awareness drives the need for adequate packaging to meet consumer needs. It is understood that wholesalers who supply major retailers are not experiencing any specific drivers to consider sustainability in wholesale red meat packaging. The reference group felt that there is need to emphasise the relationship between packaging and product quality/freshness to help consumers better understand the necessity of the packaging. Further to this, it was noted that packaging typically contributes less than 5% of total impact by weight of the packaged product and that appropriate packaging contributes to an overall reduction in food waste.

The need to tell a sustainability story for red meat

It is important that the red meat sector shows it is managing its packaging in a sustainable way. The workshop participants felt that cost pressures tended to rule out options such as recycled content.

Our research suggests that consumers are increasingly becoming more interested in packaging and the environmental impact of that packaging (Leavy 2013), in particular plastic packaging. Consumer level of concern over environmental issues tend to come in waves, triggered by an environmental event such as drought. There is also an expectation by consumers that the industry will manage the environmental impact of packaging and make incremental improvements as part of their business. Further to this, consumer goods that demonstrate commitment to sustainability tend to outperform those that do not (Adams 2014) and that 55% of consumers are willing to pay a premium for sustainable goods (Leavy 2013).

Lack of strong regulatory drivers

There may be a lack of strong regulatory drivers relating to sustainable packaging. Workshop participants questioned the effectiveness of regulatory drivers, such as the Australian Packaging Covenant (APC) and the National Environmental Protection Measure (NEPM), to drive change toward greater consideration of sustainability in packaging design for the red meat sector. Landfill levy price varies greatly across the states and territories which results in mixed drivers for the diversion from landfill through recycling; this is particularly the case for Queensland where is currently no landfill levy.

While sustainably regulatory drivers were questioned, the strength of food standards regulation was considered to be strong and not-negotiable for the red meat packaging.

Challenges facing recycling of retail packaging

While much of the plastic used for retail meat packaging is technically recyclable, kerbside collection varies across local councils, dependent on technology available and market demand for the types and quality of plastics used. Overall, the result is low recycling rates for retail meat packaging.

Waste volumes in the supply chain

The volumes of waste produced in the supply chain may be higher than at the end of the chain because downstream processors receive packaged product from upstream suppliers. They generate additional volumes of packaging waste as product is repacked following processing (McKinna 2006).

Technical challenges limiting the use of biodegradable plastics

Sustainable packaging alternatives such as bioplastics create a strong barrier but they break down easily and may comprise the quality and shelf life of the product (Wolford 2015). Bioplastics may be used in conjunction with other (non-bio) plastics to take advantage of their technical properties. However, this may comprise the potential for recycling of retail and wholesale packaging.

Summary of workshop outcomes

Based on the drivers and challenges identified above, workshop participants were asked to identify and discuss potential opportunities to improve sustainable packaging outcomes in the red meat sector. A number of opportunities were identified including:

- Messaging regarding sustainable packaging in the red meat sector
- Improving packaging efficiency across the sector
- Managing waste distribution (wholesale) packaging across the sector
- Increasing recycling rates for retail meat packaging.

These have been arranged into the following key themes below as summarised in figure 21.

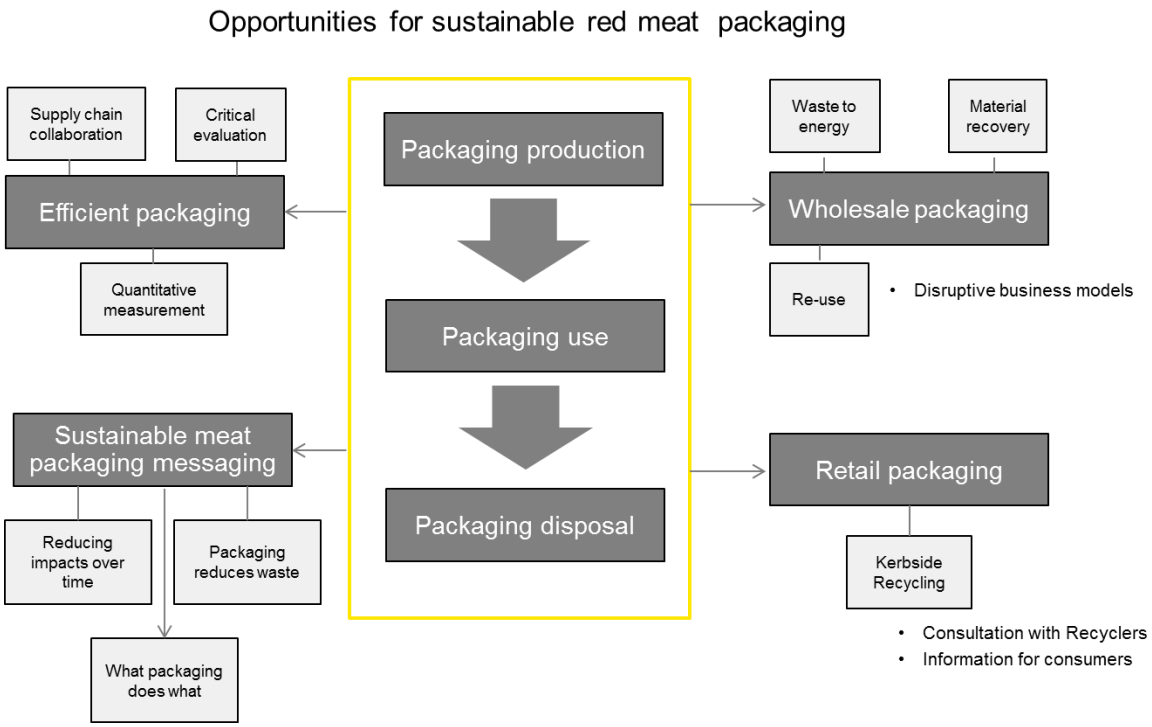

Figure 21: Opportunities for sustainable red meat packaging

EY further unpacked the above opportunities to identify options or approaches that may contribute to the achievement of the project objective. Table 13 lists the identified opportunities and the different approaches.

Table 13: Identified opportunities and approaches for MLA

ID	Opportunity Area	Type of Innovation	Approach
1	Reducing the use of existing packaging through collaboration between sector participants and the sharing of best practice guidance.	Operational	Reduce excess packaging in the value chain by encouraging collaboration between value chain participants to evaluate existing packaging types, flows and identify waste hot spots. This will focus on 'low hanging fruit' changes which could be implemented with minimal changes to packaging materials or the introduction of new technology. Findings would be distributed through production of best practice guidelines. A core working group would drive the following: • Mapping of relationships in the value chain • Detailed mapping of packaging used • Assessment and analysis of primary, secondary and tertiary packaging across the value chain • Developing and distributing best practice guidelines to reduce packaging across the sector Once the MLA core working group (CWG) is established it could also drive opportunities for less immediate change, for example packaging optimisation (matching packaging to requirements).
2	Re-usable meat packaging - Wholesale	Operational	**Wholesale:** Adopt a reusable packaging system for packaging (business to business packaging) to reduce disposable packaging use. This could include: • Re-use of existing packaging e.g. cartons • Re-usable packaging to replace cartons • Re-usable packaging to replace vacuum packs
3	Re-usable meat packaging - Retail	Operational	**Retail:** Develop a system whereby consumers bring their own re-useable packaging for red meat. Retailers to display meat in reusable trays with liners in a manner which doesn't impede quality, freshness and shelf-life. In some cases the traditional butcher's paper model may be appropriate to improve consumer re-use of

			packaging.
4	Increasing recycling rates for currently recycled wholesale packaging	Operational	**Wholesale:** Increase recycling rates of existing recyclable packaging (e.g.: clean PE film and cardboard) through a focus on improved on site recovery and sorting of plastics/ cardboard (for example through staff training, improved infrastructure).
5	Increasing recycling rates through sustainability messaging to consumers	Operational	**Retail:** Provide messaging to consumers on how to recycle existing red meat packaging. E.g.: what types of packaging is recyclable, whether to wash it or not etc. Focuses on optimizing recycling of existing consumer packaging. Messaging could also cover topics including the importance of packaging for red meat and the advantages of different packaging types.
6	Recycling of multi-layer packaging - wholesale	Technology	**Wholesale:** Develop systems and processes for recycling vacuum bags used in the wholesale sector. This focuses on dealing with existing multilayer plastics.
7	Recycling of multi-layer packaging - retail	Technology	**Retail:** Support the development of systems for improved identification and sorting (and potential recycling) of flexible packaging captured through kerbside recycling systems.
8	Removing meat contamination from recyclable plastics	Technology	**Wholesale:** Support the development of systems to treat wholesale plastic waste contaminated with meat residues, to facilitate further processing and recycling. This mainly applies to plastic (e.g. PE film) that is currently recyclable. For example through support for cleaning plant/ technologies.
9	Using plastic packaging as an energy source in the meat sector - On site	Technology	**Wholesale:** Adopt on-site, small scale waste to energy conversion for plastic waste to use as solid fuel for meat processing plants (small scale).
10	Using plastic packaging as an energy source - Off site	Technology	**Wholesale**: Adopt off-site waste to energy conversion for plastic waste to use as fuel for either processing plants (small or large scale) or other uses (e.g. large scale waste to energy).

11	Using plastic packaging to create other fuels (liquids, gas)	Technology	**Wholesale**: Adopt materials to oil/ diesel systems to capture energy from plastics packaging waste at suitable sites across the value chain.
12	Developing alternatives to multilayer meat packaging to aid recycling	Technology	Support the development of suitable single layer (or other approaches) packaging which meets quality, integrity and freshness of product, requirements (and is compatible with existing packaging systems)
13	Developing alternatives to multilayer meat packaging to enable composting	Technology	Support the development of biodegradable plastic packaging or edible film in the industry and suitable composting systems infrastructure (without compromising quality, integrity and freshness of product.)

6.3.1 Developing the assessment criteria

A multi criteria analysis (MCA) approach was used to assess the opportunities. Seven different criteria were established to cover the range of factors against sustainable packaging opportunities need to be considered. Table 14 lists the identified criteria that will be used to compare different options contributing to meeting the objective. Each criterion must be measureable, in the sense that it must be possible to assess, at least in a qualitative sense, how well a particular option is expected to perform in relation to criterion. The criteria was developed after consultation with industry (including the workshop), by drawing on internal expertise and discussions with MLA.

Table 14: Identified criteria to measure opportunities

Criteria	Type of Criteria	Weight	Description
Size of market/ opportunity	Economic	20	The direct measurement of the size of the market of the opportunity analysed in the order of $100m, $10m, $1M.
Relevance to sector	Economic	10	To determine which area of the value chain the opportunity will impact whether it is whole of sector, key stakeholders, and minor stakeholders or if it sits outside the sector.
MLA influence		10	To determine the extent that MLA can influence the opportunity through its research, development, extension, and marketing activities
Stage of technology	Economic	15	To measure the stage of technology the opportunity will be analysed dependent on whether the technology is ideation, research and development phase, commercial viable international market or commercially viable in Australia.
Cost benefit to MLA levy payers	Economic	15	To determine if there is likely to be an economic benefit to MLA levy payers whether the opportunity adds significant costs to levy payers, has no impact or saves them significant costs.
Scale of Sustainability/ environmental benefit	Environmental	15	To determine the size of the impact as a result of the volume of the packaging used for the opportunity, no benefit and small volumes to significant benefit and large volumes.
Social licence to operate	Social	15	To determine the value of the opportunity to consumers and how it will benefit them whether it would be worse for consumers (require significant behavioural change), have no change or would positively benefit consumers.

Note: While the assessment was based on three levels “high, medium, low”, scores 1-5 were assigned during the assessment to allow for greater differentiation where required. For example a score of 4 would be assigned if the opportunity rated higher than medium (score 3) but did not reach high (score 5).

6.3.2 Overall assessment of opportunities against criteria

Engagement with industry experts

Discussions were held with industry experts to gain a better understand of the factors which would influence the viability of each opportunity. Results of these discussions informed the MCA analysis, and formed the basis of building the business case for preferred options.

A summary of the industry consultation conducted relevant to the MCA analysis is included in table 15 below:

Table 15: Industry consultation summary

ID	Industry/ Topic	Engagement Type	Summary of topics covered
A	Plastics Packaging	Phone, emails	Overview of packaging types used in meat packaging, packaging performance measurement, typical costs for packaging, composition of materials in plastic packaging, recycling of flexible plastics, factors impacting the viability of bio plastics, potential areas to reduce packaging impacts. Detailed analysis of trends in packaging including volumes, costs, changes since 2006.
B	Plastics recycling	Phone	Minimum volumes required for collection, economics (they pay for plastic), plastic types collected, specifications, limitations for collection of lower value materials (contaminated, wrong plastic type).
C	Plastics recycling	Meeting phone, emails	Kerbside recycling, closed loop systems, limitations to recycling existing packaging, issues with cross contamination due to incompatible plastic types, differences between claims made by manufacturers vs recyclers experience. Difficulty recycling flexible films (detection, contamination). Need for testing each packaging type.
D	Plastics recycling	Phone, emails	Overview of plastic decontamination (meat residue) technology. Overview of decontamination and recycling business model, relationship between waste levy and viability of plastics recycling. Difficulties recycling multilayer plastic.
E	Energy from waste	Phone, emails	Overview of small scale energy from waste technology, viability of different options, considerations, limitations.
F	Re-usable packaging	Email	Request examples of case studies on re-usable packaging in the US. Responded that no examples existed that they were aware of. Agreed that cleaning

ID	Industry/ Topic	Engagement Type	Summary of topics covered
			meat packaging was a barrier.
G	Meat processor	Phone, emails	Quantities of packaging types used (data supplied), packaging choice, trends in industry (toward smaller packaging, customised to buyer needs). Re-use of existing cartons where possible.
H	Retailer	Phone	Contacts within sector, high level sustainability drivers. Discussion of further contacts.
I	Governme nt	Phone, emails, meeting	Government initiatives regarding resource recovery Initiatives to promote resource recovery, issues around contamination. Contacts in sector who may recover flexible plastic

Additional desktop research

Industry discussions were verified through further desktop review. This ensured that there was sufficient understanding of each topic area, and that information used for the assessment was balanced (refer to topical background in Appendix A).

Results of MCA analysis

Each opportunity was assessed using the multi criteria analysis (MCA) approach to develop a ranked list of opportunities. Full details of the MCA analysis, can be found in Appendix C

6.3.3 Ranked list of opportunities

Opportunities were scored and ranked to identify the priority opportunities for further development. The highest score was 4.1 and the lowest score was 2.2.

Top three ranked opportunities

The top three ranked opportunities based on this assessment are:

- Encouraging collaboration, and best practice, in the value chain to reduce packaging use (ID1)
- Re-usable meat packaging - Wholesale (ID2)
- Increasing recycling rates through sustainability messaging to consumers (ID5)

Table 5 provides the ranked list of all opportunities.

Table 5: Ranked list of identified opportunities

ID	Opportunity Area	Overall Score
1	Reducing the use of existing packaging through collaboration between sector participants and the sharing of best practice guidance.	4.1
2	Re-usable meat packaging - Wholesale	3.6
5	Increasing recycling rates through sustainability messaging to consumers	3.5
12	Developing alternatives to multilayer meat packaging to aid recycling	3.4
13	Developing alternatives to multilayer meat packaging to enable composting	3.4
7	Recycling of multi-layer packaging -retail	3.1
6	Recycling of multi-layer packaging -wholesale	2.9
3	Re-usable meat packaging - Retail	2.8
10	Using plastic packaging as an energy source - Off site	2.7
8	Removing meat contamination from recyclable plastics	2.5
4	Increasing recycling rates for currently recycled wholesale packaging	2.5
11	Using plastic packaging to create other fuels (liquids, gas)	2.2
9	Using plastic packaging as an energy source in the meat sector - On site	2.2

6.3.4 Verification of MCA assessment

In order to ensure that the MCA assessment resulted in the best outcome for MLA's sustainable packaging strategy, the results were sense checked using the following process.

- Feedback was received from MLA following the submission of the Milestone Two Report
- The rankings were assessed by independent packaging expert Andrew Sweatman who was engaged by EY on this project.

No major changes to the ranking of the opportunities resulted from this process.

7 Appendix C: Multi-Criteria Analysis

Figure 22 and table 16 show the multi-criteria analysis spreadsheet and assessment. The spreadsheet can be provided to MLA upon request.

Figure 22: EYs Multi-Criteria Analysis Spreadsheet

ID	Opporutnity	Type of innovation	Description	Size of market/ opportunity	Score	Relevance to sector	Score	MLA leverage	Score	Stage of technology	Score	Cost benefit to MLA levy payers/sector	Score	Environmental benefit	Score	Consumer perception	Score	Final Score
				The direct measurement of the size of the market of the opportunity analysed in the order of $100m, $10m, $1m.	weighting	To determine which area of the value chain the opportunity will impact whether it be whole of sector, key stakeholders, minor stakeholders or if it sits outside the sector.	weighting	To determine the extent that MLA can influence the opporunity through its research, development, extension, and marketing activities	weighting	To measure the stage of technology the opportunity will be analysed dependent on whether the technology is ideation, research and development phase, commercial viable international market or commercially viable in Australia.	weighting	To determine if there is likely to be an economic benefit to MLA levy payers whether the opportunity adds significant costs to levy payers, has no impact or saves them significant costs.	weighting	To determine the size of the impact as a result of the volume of the packaging used for the opportunity, no benefit and small volumes to significant benefit and large volumes.	weighting	To determine the value of the opportunity to consumers and how it will benefit them whether it would be worse for consumers (require significant behavioural change), have no change or would positively benefit consumers.	weighting	
				High: Significant volumes or costs affected ($100 million) Med: Moderate volumes or costs affected ($ 10 million) Low: Volumes of waste or costs affected less than $1 million	20%	High: Has impacts across the value chain Med: Has impacts across a limited part of the value chain Low: Main effects are outside the value chain.	10%	High: Direct influence over opportunity as it lies directly in scope of MLA's traditional R,D and E activities. Med: Some influence over opportunity but external factors are significant Low: Very low capacity for MLA to influence as stakeholder are outside sector, very large (beyond scope of MLA funding), not in Australia.	15%	High: No technological barriers, technology commercial available or not relevant to outcome Med: Technology commercially available but needs further implementation / technology available but yet to be implemented in Australia	15%	High: Reduces costs directly and significantly Med: May reduce costs/ no direct impact on costs likely Low: Adds costs to MLA Levy payers	15%	High: Clear environmental benefits Med: Limited environmental benefits/ benefits unclear Low: Likely to lead to high environmental impact	15%	High: Strong reputation or CSR advantages for red meat sector, directly relevant to consumers Med: A strong CSR story to tell but not directly relevant to consumers Low: Difficult story to tell consumers/ no story to tell.	15%	
1	Reducing the use of existing packaging through collaboration between sector participants and the sharing of best practice guidance.	Operational	Reduce excess packaging in the value chain by encouraging collaboration between value chain participants who will evaluate existing packaging types and flows to identify waste hot spots. This will focus on 'low hanging fruit' changes which could be implemented with minimal changes to packaging materials or the introduction of new technology. Findings would be distributed through production of best practice guidelines. A MLA task force would drive the following: Mapping of relationships in the value chain Detailed mapping of packaging used Assessment and analysis of primary, secondary and tertiary packaging across the value chain Developing and distributing best practice guidelines to reduce packaging across the sector Once the MLA task force is established it could also drive opportunities for less immediate change, for example packaging optimisation (matching packaging to requirements)	Significant: Small percentage reductions can lead to significant cost or volume reductions. For example 10% improvement = $44m saving	4	High: Relevant across the entire value chain, wholesale and retail, domestic and export.	5	High: This opportunity is concerived as a within sector initiative which lies directly within MLA's R,D and E scope.	4	High: Does not rely on new technology	5	High: Reduces cost directly. Each 1% saved is over $1 million across the sector	4	High: Sustainability benefits proportional to cost savings i.e.: reduces materials impacts directly. Reducing packaging is the preferred sustainable packaging strategy.	4	Medium: Reducing packaging use across the value chain will be a good story to tell. Savings in wholesale packaging no relevant to consumers.	3	4.1
2	Re-usable meat packaging - Wholesale	Operational	**Wholesale** Adopt a reusable packaging system for packaging (business to business packaging) to reduce disposable packaging use. This could include: • Re-use of existing packaging e.g. cartons • Re-usable packaging to replace cartons • Re-usable packaging to replace vacuum packs	Medium: Cartons cost the sector over $250m per year. A 10% reduction would save $15m	4	High: Mostly relevant where regular shipments between businesses (wholesale, wholesale to retail), especially using cartons. Re-usable packaging not likely to be relevant to export sector (return costs)	4	High: Research within sector, workign directly with sector to encourage and facilitate re-usable packaging is within scope of MLA influence	4	High: Technology already exists/ technological barriers relatively minor. E.g.: washing technology	4	Medium: May reduce costs to sector. Some risk to this e.g.: upfront costs/ possible downside costs e.g. washing, transport over long distance.	3	Medium: If replacing cartons, environmental benefit is limited by existing high recycling rate. Typical long distances in Australian industry may offset other benefits	3	Medium: Not directly relevant to consumers (wholesale packaging)	3	3.55
5	Increasing recycling rates through sustainability messaging to consumers	Operational	**Retail:** Provide messaging to consumers on how to recycle existing red meat packaging. E.g.: what types of packaging is recyclable, whether to wash it or not etc.. Focuses on optimising recycling of existing consumer packaging. Messaging could also cover topics including the importance of packaging for red meat and the advantages of different packaging types.	Small to medium: The total market is large as it affects all retail packaging, although messaging alone may not lead to significant change.	3	High: Very relevant to sector due to packaging being a significant component of sector	4	High: Directly in scope of MLA marketing (as discussed in workshop) to create messaging. Communication through retail brands requires external stakeholders (e.g: retailers).	4	While there would be some R and D to determine correct message	4	Would not directly reduce costs for MLA levy holders. Would generate value through improved reputation.	3	Limited benefit due to limitations of recycling existing packaging . (May increase amount of material in recycling bins but not total volume of materials recycled)	3	Medium: Its part of a broader strategy. Would need to be supported by broader initiatives to improve recycling of retail packaging.	3	3.35
7	Recycling of multi layer packaging - retail	Technology	**Retail:** Support the development of systems for improved identification and sorting (and potential recycling) of flexible packaging captured through kerbside recycling systems.	Significant . Flexible plastic a growing market not just for red meat sector	4	Low to med: Affects retail sector of market. Only a relatively small part of retail market currently. Mainly benefits LG and recyclers directly.	2	Industry discussions with recyclers indicated that improving identification and sorting R and D could undertaken and therefore is something MLA could support. However, further solutionsm, for example recycling, are likely to be developed by multi-national plastics suppliers and therefore outside the scope of MLA R and D.	3	Low to med: Research ongoing. Trials overseas.	2	Low to medium: Would not directly reduce costs for MLA levy payers	2	High: Significant due to increasing use of flexible films in packaging	4	High: A strong CSR message. Directly relevant to consumers.	4	3.1
12	Developing alternatives to multilayer meat packaging to aid recycling	Technology	Support the development of suitable single layer (or other appropaches) packaging which meets quality, integrity and freshness of product, requirements (and is compatible with existing packaging systems)	High : Huge opportunity worldwide. >$100m	5	Medium: Most of the opportunity sits outside the sector e.g. other markets. Other proteins.	3	Industry discussions found that development of suitable plastics to replace multilayer plastics is a significant technological challenge likely to be undertaken by multi-national companies. This is beyond the scope of MLA R and D (large R and D spend required)	1	Low: Significant technological barriers. No evidence it is possible due to barrier properties etc. Would not necessarily be easily recycled.	1	Low: Would reduce landfill costs. Currently around $2.5 million per year. Would have cost benefits in terms of reputation of red meat. Offset by large R and D cost and likely more expensive packaging (med term)	1	High: Due to significant broader implications of technology to other markets, sectors. Limited by uncertainty over technology used in production	4	High: Creating recyclable packaging would be a strong story to tell, directly relevant to MLA levy payers.	5	3.05
13	Developing alternatives to multilayer meat packaging to enable composting	Technology	Support the development of biodegradable plastic packaging or edible film in the industry and suitable composting systems infrastructure (without compromising quality, integrity and freshness of product.)	High : Huge opportunity worldwide. >$100m	5	Medium: Most of the opportunity sits outside the sector e.g. other markets. Other proteins.	3	Industry discussions found that development of suitable plastics to replace multilayer plastics is a significant technological challenge likely to be undertaken by multi-national companies. This is beyond the scope of MLA R and D (large R and D spend required)	1	Low: Significant technological barriers. No evidence it is possible due to barrier properties etc. Described by the packaging supplier as a sheer bullet. Would not necessarily be easily recycled.	1	Low: Would reduce landfill costs. Currently around $2.5 million per year. Would have cost benefits in terms of reputation of red meat. Offset by large R and D cost and likely more expensive packaging (med term)	1	High: Due to significant broader implications of technology to other markets, sectors. Limited by uncertainty over technology used in production	4	High: Creating compostable/ edible packaging would be a strong story to tell, directly relevant to MLA levy payers.	5	3.05
4	Increasing recycling rates for currently recycled wholesale packaging	Operational	**Wholesale:** Increase recycling rates of existing recyclable packaging (e.g.: clean PE film and cardboard) through a focus on improved on site recovery and sorting of plastics/ cardboard (for example through staff training, improved infrastructure).	Small: There are only 3000 tonnes of non recycled cardboard and 2500 tonnes of PE films (some of which is already recycled) across the sector.	2	Medium: Relevant as these materials are com monly used across the sector	3	High: Industry focused, directly within scope of MLA influence (assumes waste is captured within the sector)	5	Not technology focused. Does not rely on new technology	4	Would reduce landfill costs by 1500,000 across the sector if 100% recycling rate. More likely to achieve half that. some benefit from improved sustainability reputation of sector.	2	Small but measurable.	3	Medium: The story is good but the volumes limit the significance	3	3
10	Using plastic packaging as an energy source - Off site	Technology	**Wholesale**: To adopt off-site waste to energy conversion for plastic waste to use as fuel for either processing plants (small or large scale) or other uses (e.g. large scale waste to energy).	Low to medium: Limited to 11000 tonnes of plastic waste per year across Australia. Limited by access to facilities.	2	Medium: Would only be relevant to specific part of the value chain. But more options than on site treatment.	3	Further research on the viability of energy from waste for managing waste packaging is something that MLA could influence. But significant external factors limit scope for MLA to influence (regulatory, composition of plastics)	3	Medium: Technology exists but technologically complex (emissions) and low implementation in Australia. Materials e.g. vacuum bags with might be a barrier (e.g.: PVC content)	3	Med: May be a cost neutral benefit if sent offsite. Where facilities exist within reasonable distance	3	Med: Energy use from waste is lower on the waste management hierarchy than re-use or recycling. However better than sending waste to landfill	3	Low to medium: "Burning plastic "A tricky message to sell to consumers. Waste to energy not well established/ accepted in Australia.	3	2.8
8	Removing meat contamination from recyclable plastics	Technology	**Wholesale:** Support the development of systems to treat wholesale plastic waste contaminated with meat residues, to facilitate further processing and recycling. This mainly applies to plastic (e.g. PE film) that is currently recyclable. For example through support for cleaning plant/ technologies.	Small: The capacity to decontaminate plastic packaging will aid recycling. However recycling is limited to single layer PE liner bags (2500 tonnes per annum across Australia). Important technology though.	2	Med: Relevant due to prevalence of liner bags (in cartons)	3	Industry discussions with recyclers indicated that systems are available to decontaminated plastic waste within Australia. MLA could support further development and implementation and uptake of this technology through its R,D and E programs.	4	Med-High: Dry cleaning technology for decontamination exists. Cost could be a barrier.	3	Med: Currently viable in some states (NSW). Limited by transport logistics in other states. Large upfront cost ($5-10 million) Contaminated single layer very small volume overall for sector	4	Low: As this is only limited to contaminated single layer films (small quantities) this would not make a significant change	1	Medium: A small step in the right direction.	3	2.75
3	Re-usable meat packaging - Retail	Operational	**Retail:** Develop a system whereby consumers bring their own re-useable packaging for red meat. Retailers to display meat in reusable trays with liner s in a manner which doesn't impede quality, freshness and shelf-life. In some cases the traditional butcher's paper model may be appropriate to improve consumer re-use of packaging.	Medium: The sector spends $120 million on retail packaging. A 10% reduction would save $12m	3	Medium: Relevant to sector but mainly the retail, consumer sector	3	Med: Relies on cooperation with retailers.	3	Very low: No evidence of technology to facilitate reusable retail packaging and provide shelf life required. Significant R and D required.	1	Low to med: Would reduce packaging costs. However, would only reduce costs by around 50c per kilo meat sold.	2	Med: Not clear that it would save significant volumes of packaging due to shelf life requirements	3	High: Strong sustainability message	4	2.7
6	Recycling of multi layer packaging - wholesale	Technology	**Wholesale:** Develop systems and processes for recycling vacuum bags used in the wholesale sector . This focuses on dealing with existing multilayer plastics.	High: Significant worldwide but limited in Australia to 8000 tonnes of vacuum bags per year. Significant market outside red meat sector included i.e. its a global issue	4	High: Relevant but mainly relevant to wholesale sector, Could benefit other markets, proteins	4	Research could be undertaken to better understand the problem within scope of MLA: R, D and E. However, finding a solution is outside MLA influence (recyclers, packaging suppliers) due to high technical barriers. R and D on this is occuring outside Australia by major plastics manufacturers.	1	Low: Significant technological barriers. Described by the packaging industry as 'long term'	1	Med: Reduce cost by only 10.5 million over sector (landfill). High upfront costs/ R and D. Benefits other sectors	1	Medium: 8000 tonnes of non recycled tonnes is about 5% of total flexible plastic waste in Australia. Unresolved technology may be energy intensive/ unknown impact.	3	Medium: This would solve a problem for industry but this is not visible to consumers. However good CSR message.	3	2.5
9	Using plastic packaging as an energy source in the meat sector - On site	Technology	**Wholesale**: To adopt on-site, small scale waste to energy conversion for plastic waste to use as solid fuel for meat processing plants (small scale).	Low to medium: Due to Total plastic packaging waste in wholesale sector 11,000 tonnes across Australia. Severe restrictions on site choice due to viability requirements. E.g.: fuel source, landfill costs, volumes on site.	2	Low to med: Would only be relevant to specific part of the value chain. Not core business for sector if outside sources of waste used. I.e. the meat sector is not a waste to energy processor.	2	Further research on the viability of energy from waste for managing waste packaging is something that MLA could influence. But significant external factors limit scope for MLA to influence (regulatory, composition of plastics)	3	Medium: Technology exists but technologically complex (emissions) and low implementation in Australia. Materials e.g. vacuum bags with might be a barrier (e.g.: PVC content)	3	Low to med: Energy produced from available waste may not benefit processors due to high upfront cost, marginal volumes and high on-going costs e.g.: emissions monitoring for an 1500,000 per year.	2	Med: Energy use from waste is lower on the waste management hierarchy than re-use or recycling. However better than sending waste to landfill	3	Low to medium: "Burning plastic "A tricky message to sell to consumers. Waste to energy not well established/ accepted in Australia.	2	2.4
11	Using plastic packaging to create other fuels (liquids, gas)	Technology	**Wholesale**: To adopt materials to oil/ diesel systems to capture energy from plastics packaging waste at suitable sites across the value chain.	Significant: Large market overall due to amount of plastic waste available. Limited in Australia due to total plastic waste in wholesale sector 11,000 tonnes across Australia.	3	Low to med: While relevant to sector due to difficulty disposing of waste, making oil from plastic waste is not core business for sector.	2	Further research on the viability of energy from waste for managing waste packaging is something that MLA could influence. But significant external factors limit scope for MLA to influence (regulatory, composition of plastics)	3	Technology exists in feasibility stage OS. Commercially operating plant in US. 60 Tonnes per day. (Vadxx)	2	Med: May be a cost neutral benefit if sent offsite. Where facilities exist within reasonable distance	3	Low to medium: Energy intensive process. Conversion of plastic to oil less efficient than plastic to plastic.	2	Medium: If viable would be a good story to tell.	3	2.6

Table 16: Ranked opportunities and basis of assessment from the MCA

ID	Opportunity Area	Basis of assessment in MCA phase.
1	Reducing the use of existing packaging through collaboration between sector participants and the sharing of best practice guidance.	Description: Reduce excess packaging in the value chain by encouraging collaboration between value chain participants who will evaluate existing packaging types and flows to identify waste hot spots. This will focus on 'low hanging fruit' changes which could be implemented with minimal changes to packaging materials or the introduction of new technology. Findings would be distributed through production of best practice guidelines. • Size of market was estimated using the data in table 4 as $430 million being the total cost of packaging used in the domestic sector. The export market would also be a potential market. • The relevance to the sector was assessed as high due to packaging being used across the red meat sector, resulting in any savings applying to a wide range of potential value chain participants. • The leverage of MLA was rated as high due to packaging approach being assessed by the project team as suitable for MLA to administer through its Research Development and Extension programs. • The stage of technology was assessed as high due to the approach not requiring the development or adoption of any specific technology. • The cost benefit to the red meat sector was assessed as high based on desktop research which found that companies typically save 1% of turnover through waste minimization, (which includes reducing packaging costs) (WRAP (UK) and through two separate industry discussions (ID: A,H) which indicated that reducing packaging use through simple analysis and collaboration was an opportunity they would expect to lead to savings. • The environmental benefit was assessed at high based on the waste management hierarchy which ranks reducing packaging as the most effective option (refer p X). Reducing packaging has the advantage of reducing environmental impacts in the production and disposal stages of packaging, as well as in transport (less weight transported). This benefit was not quantified at this point. • Social licence to operate benefits were assessed as medium due to the packaging reductions in the wholesale value chain not being directly relevant to consumers and therefore less likely to impact the red meat sector's reputation.
2	Re-usable meat packaging - Wholesale	Description: Adopt a reusable packaging system for packaging (business to business packaging) to reduce disposable packaging use. This could include, Re-use of existing packaging, re-usable packaging to replace cartons, re-usable packaging to replace vacuum packs. • The size of the market was estimated based on data in table 4, which shows that cartons cost the domestic meat sector in excess of $150m per year. It is acknowledged that other packaging types could also be re-used (for example plastic packaging). • The relevance to the sector was assessed as high based on packaging being used across the value chain (in particular cartons). • The leverage of MLA was rated as high based on packaging being used within he value chain, which is the audience of MLA. • The stage of technology was assessed as high due to the use of technology established in this and other sectors (re-usable crates). Technology was also seen as something that may enable re-usable packaging (internet of things) where it may otherwise have been unviable. This was based on general industry knowledge and discussion in the stakeholder workshop. • The cost benefit to the sector was estimated as medium based on an assessment of possible savings, against upfront costs, transport distances, and costs associated with cleaning, maintaining re-usable meat packaging. These were not quantified for the MCA assessment. This assessment was based on desktop research (XYZ), and industry discussion. • The environmental benefits of re-usable packaging were qualitatively assessed as medium taking into account the resources to produce, transport, and wash re-usable packaging. An additional factor was that environmental benefits of replacing fibreboard with re-usable cartons must also take into account that 90% of cartons are currently recycled.

3	Re-usable meat packaging - Retail	Description: Develop a system whereby consumers bring their own re-useable packaging for red meat. Retailers to display meat in reusable trays with liners in a manner which doesn't impede quality, freshness and shelf-life. In some cases the traditional butcher's paper model may be appropriate to improve consumer re-use of packaging. • This size of the market for this opportunity was estimated using the data in table 4 for retail packaging to be approximately $120 million per year and 7679 tonnes. • The relevance to the sector was assessed as medium based on being only relevant to the retail sector. • The stage of technology of re-usable retail packaging was rated as low due to no precedence for re-usable retail packaging and the challenges of maintaining existing shelf life with a re-usable packaging option. This assessment was based on knowledge of shelf life of meat packaging gained through desktop research to complete this project. • Cost benefit to the red meat sector was assessed as low due to the relatively low cost of packaging relative to meat prices ($0.25-0.50 per kg meat), and that retail packaging disposal costs are borne by the consumer (kerbside collection). This information was obtained through industry discussion (ID: A) It was acknowledged that this would be a highly visible strategy which may increase the social licence to operate of the sector, but also that there were potential risks (contamination, health risks) depending on the model chosen. • Environmental benefit was assessed as medium due to uncertainly of environmental benefits (how to provide adequate shelf life, potential for waste) • Social licence to operate advantage was assessed as high due to the high level of innovation leadership messaging that the initiative could generate for the sector (assuming risks are contained).
4	Increasing recycling rates for currently recycled wholesale packaging	Description: Increase recycling rates of existing recyclable packaging (e.g.: clean PE film and cardboard) through a focus on improved on site recovery and sorting of plastics/ cardboard (for example through staff training, improved infrastructure) • The size of the market for was estimated using the data in table 4 at 3000 tonnes of non-recycled cardboard and 2500 tonnes of PE film assuming a 90% recycling rate for cardboard and zero recycling of PE film (McKinna 2006). • The relevance to the sector was assessed as high due the widespread use of cardboard cartons and plastic wrap across the sector. • The leverage of MLA was rated as high since this was an initiative that is internal to the red meat value chain. • The stage of technology was assessed as high due to the technology to recycle the materials concerned being commercially available. • The cost benefit to the red meat sector was determined by calculating potential waste management savings based on the quantities involved. Even assuming a 100% recycling rate, landfill cost savings were estimated at $500,000 per year across the sector (based on landfill costs of $100 per tonne for this material). It was estimated that it would cost the industry more than this amount (new equipment etc) to increase recycling rates of cardboard and PE film significantly, and that 100% was unachievable. This meant that the opportunity was assessed as being unlikely to be cost effective for the sector. An offset based on the minor benefit in sustainability reputation for the sector was taken into account. • The environmental benefit was qualitatively assessed as medium due to the volumes concerned, but it is recognized that achievements would be measurable. • The social licence to operate benefits was qualitatively assessed as positive. Consumer's value recycling, but the size of the benefit is not significant due to the small volumes concerned.

5	Increasing recycling rates through sustainability messaging to consumers	Description: Provide messaging to consumers on how to recycle existing red meat packaging. E.g.: what types of packaging is recyclable, whether to wash it or not etc.. Focuses on optimising recycling of existing consumer packaging. Messaging could also cover topics including the importance of packaging for red meat and the advantages of different packaging types. • Size of market was estimated using data in table 4 as $120 million dollars and 7679 tonnes per year based on total retail packaging costs in the sector. However the potential market size was moderated by taking into account that only limited types of packaging are recyclable (ie only certain rigid packaging). The primary market for this packaging is supermarkets which account for 70% of sales. • The relevance to the sector was assessed as high due to the • The stage of technology was assessed as low based on • Cost benefit to the red meat sector was qualitatively assessed as low due to the sector not bearing the cost of waste disposal for retail/consumer packaging. However this was offset by the benefits that increased recycling rates would be expected to have on the environmental performance reputation of the sector. • Environmental benefit was assessed at medium due to limitations on what actually gets recycled (market value of recycled plastics) assessed based on industry knowledge and discussions. • Social licence to operate benefits were rated as medium as while the initiative relates directly to consumers, it focuses on existing packaging and therefore is subject to the limitations of existing packaging.
6	Recycling of multi-layer packaging - wholesale	Description: Develop systems and processes for recycling vacuum bags used in the wholesale sector. This focuses on dealing with existing multilayer plastics. • Size of market was estimated using data in table 4 as approximately $127 million and 8600 tonnes per year for vacuum bags used in the wholesale sector. The rating for size of the market also took into account the worldwide significance of developing a system to recycle multilayer plastic. • The relevance to the sector was assessed as low based on the lack of influence MLA would have over developing a recycling system for multilayer packaging. • The stage of technology was assessed as low based on the basis that the technology for recycling multilayer plastic is yet to be developed past a research and development phase. Some pilot programs are in place to separate multilayer packaging but these were not expected to be available in Australia in the foreseeable future. This assessment was based on discussions with industry (ID: A,D). • Cost benefit to the red meat sector was assessed as low based on comparing potential research and development costs (based on level of technical readiness, and the potential for higher material costs (at least initially), against savings from reduced cost of sending packaging waste to landfill and social licence to operate benefits to the sector. Savings to the sector from reduced landfill costs were estimated at $2.5 million assuming landfill costs of $300 per tonne. Estimates for landfill costs were based on desktop research and industry conversation (ID: D) • Environmental benefit was assessed as medium due to uncertainty regarding the process that would be used (and its energy intensity, emissions, waste generated etc). • Social license to operate benefits were assessed as medium as it is a positive news story for the industry but is not directly relevant to consumers.

7	Recycling of multi-layer packaging - retail	Description: Support the development of systems for improved identification and sorting (and potential recycling) of flexible packaging captured through kerbside recycling systems. • Size of market was estimated as high due to multilayer plastics growing in significance for packaging, especially if the global market is considered. • The relevance to the sector was assessed as low based on only being relevant to limited part of the sector (flexible retail packaging). • The leverage of MLA on the initiative was rated as low based on industry discussions with recyclers (ID: C) indicated that while improving identification and sorting R and D could undertake further solutions, for example recycling, are likely to be developed by multi-national plastics suppliers and therefore outside the scope of MLA R and D. • The stage of technology was assessed as low based on no commercial available technology available for recycling multilayer plastic based on discussion with industry (ID: A,D). • Cost benefit to the red meat sector was assessed as low based on very high research and development costs and relatively small volumes. • Environmental benefit was assessed at high due to the potential to the potential to increase recycling of multilayer film (currently very low) determined through industry discussion. • Social licence to operate benefits was assessed as high due to solving a high profile waste problem directly relevant to consumers. This was based on industry knowledge.
8	Removing meat contamination from recyclable plastics	Description: Support the development of systems to treat wholesale plastic waste contaminated with meat residues, to facilitate further processing and recycling. This mainly applies to plastic (e.g. PE film) that is currently recyclable. For example through support for cleaning plant/ technologies. • Size of market was estimated using data in table 4 to calculate the amount of contaminated material that is otherwise recyclable. As this mainly applies to PE film (being a single layer), this was estimated to be 2500 tonnes per year. • The relevance to the sector was assessed as high based on widespread use of PE film with potential for meat contamination. This was based on discussions with industry (ID: D) • The leverage of MLA was assessed as high based on discussions with recyclers indicating that systems are available to decontaminated plastic waste within Australia, the MLA could support (ID:D) • The stage of technology was assessed as high due to the technology (dry cleaning) being used commercially. • Cost benefit to the red meat sector was assessed based on comparing recycling costs with landfill costs. While discussions with industry found that recycling was cost effective compared to landfill, viability is limited due to varying costs of landfill across Australia, together with logistical factors such as transport. • Environmental benefit was assessed at low due to decontamination of plastic not addressing larger issue of recycling multilayer film, and therefore the small volume of waste concerned. • Social licence to operate benefits was assessed as medium due to the initiative only addressing a small volume of waste.

9	Using plastic packaging as an energy source in the meat sector - On site	Description: Adopt on-site, small scale waste to energy conversion for plastic waste to use as solid fuel for meat processing plants (small scale). • Size of market was estimated using data in table 4 as 11,000 tonnes of plastic waste per year from the wholesale sector. • The relevance to the sector was assessed as medium based on waste to energy being very site and operation specific. This was based on industry discussion (ID: E) • The leverage of MLA was rated as medium based on an assessment that the determining the viability of waste to energy could be R and D that MLA could support but significant external factors (regulation, composition of plastics) limit scope for MLA to influence outcomes. • The stage of technology was assessed as medium based on there being technology commercially available but that significant technical restraints exist (emissions, types of suitable plastics for fuel). This information was based on industry discussions (ID: E) • Cost benefit to the red meat sector was assessed as medium based on the variation of viability based on specific site and operation conditions (fuel type and cost, waste volumes, landfill costs etc.) high upfront costs, and high on going costs e.g. emissions monitoring estimated at $300,000 per year. This rating takes into account that under the right conditions waste to energy could have return lower than one year. Under different conditions, the return could be over ten years. Based on industry discussions (ID: E) • Environmental benefit was assessed as medium due to energy from waste potentially conflicting with waste recycling, and level of potential emissions. Based on industry discussions (ID: E) • Social licence to operate benefits were assessed as low to medium due an assessment that consumers may not see waste to energy for plastics as an attractive option.
10	Using plastic packaging as an energy source - Off site	Description: Adopt off-site waste to energy conversion for plastic waste to use as fuel for either processing plants (small or large scale) or other uses (e.g. large scale waste to energy). Offsite recycling includes sending plastic waste to large centralized plants or other facilities which can accept a wide range of films (such as cement kilns). There are a very limited number of these facilities in Australia. • All aspects were rated the same as for ID 9 ‘on-site’ waste to energy except that the use of an offsite waste to energy facility would reduce site oriented restrictions, and reduce up front, and ongoing emissions costs, improving the cost benefit to the red meat sector. • The information for this assessment was obtained through detailed communication with an industry energy expert and limited desktop research
11	Using plastic packaging to create other fuels (liquids, gas)	Description: Adopt materials to oil/ diesel systems to capture energy from plastics packaging waste at suitable sites across the value chain. • All aspects were rated the same as for ID 10 ‘off-site’ waste to energy. • Note that no know facility to convert waste plastic to oil or gas is operating in Australia. • The information for this assessment was obtained through detailed communication with an industry energy expert and limited desktop research.

12	Developing alternatives to multilayer meat packaging to aid recycling	Description: Support the development of suitable single layer (or other approaches) packaging which meets quality, integrity and freshness of product, requirements (and is compatible with existing packaging systems) • Size of market was estimated as high due to the global significance of developing a single layer plastic which could replace existing multilayer packaging. This was a qualitative assessment based on industry knowledge. • The relevance to the sector was assessed as medium based on the opportunity being relevant to a large number of applications, not just red meat. This means that others, rather than MLA would benefit from development • The leverage of MLA was rated as low based on an assessment that MLA would not be able to significantly influence outcomes due this type of R and D being mainly something that multinational plastics corporations undertake. • The stage of technology was assessed as low based on there being no commercially available technology to leverage any R and D or adoption. • Cost benefit to the red meat sector was assessed as low based on the high R and D costs and relatively low costs savings. Cost savings are restricted to landfill cost savings. The Australian red meat sector is only a small part of the market for this material worldwide. It was felt that it was unlikely MLA would become involved as a supplier of alternative plastics, therefore economic gain via this avenue would not be realised. • Environmental benefit was assessed as high based on the widespread positive implications of such a material being available. (assumes avoided material to landfill) • Social licence to operate benefits was assessed as high due to the significance of the new material to packaging.
13	Developing alternatives to multilayer meat packaging to enable composting	Description: Support the development of biodegradable plastic packaging or edible film in the industry and suitable composting systems infrastructure (without compromising quality, integrity and freshness of product.) • The assessment was based on the similar factors as ID 12 above.

8 Appendix D: Programme 1 "Innovation Platform" Economic analysis assumptions and data

EY conducted a high level cost benefit analysis (CBA) to determine the minimum benefit that MLA could achieve from programme 1 for its levy payers. It is essential that MLA undertake independent costing and verification of these assumptions before any commitment is made.

Purpose

The high level CBA is assessing the Cost and Benefits from the perspective of the MLA and its members (Levy payers). Reducing packaging use across the wholesale value chain could reduce the cost of product through to end markets providing a benefit to levy payers by contributing to red meat's competitive advantage. However, it is understood that a reduction in costs for packaging may not flow through to the levy payers.

The costs and benefits applied do not include inflation. We have applied a 5% discount to the costing to reflect current interest rates.

Our CBA was performed on basis of the assumptions documented in table 17.

Table 17 Cost Benefit Analysis assumptions for programme 1

Assumption	Description
Discount rate	A 5% discount rate has been applied to reflect current interest rates which that may impact the program.
Appraisal period (years)	The analysis has been performed across five years from current year (year 0) through to 2020 (year 4).
Current cost of packaging in the wholesale value chain	Calculated cost of wholesale packaging set out in table 1 of this report.
Staff costs	Estimate of MLA staff time, based on $150,000 per year, which includes salaries and on costs.
Consultancy costs	Based on estimate of approximate scale of external work required set at a typical consultancy rate.
Sponsoring awards (service cost)	Based on EY past experience sponsoring awards. $5000-$10000.
Cost reduction in wholesale packaging	WRAP (UK waste reduction scheme) found that companies typically save 1% of turnover through waste minimization, which includes reducing packaging costs (Envirowise 2005). This provided a guide to understand the cost reduction that could be achieved for MLA. This is assuming reduced packaging use is directly related to reduce packaging costs. A conservative estimate of 0.25% packaging reduction was applied to the current cost of wholesale packaging.

Summary of the results of the Analysis

Present Value of Benefits	$947,665
Present Value of Costs	$660,009

Benefit Cost Ratio	1.4
Net Present Value	$287,656

It is estimated that the direct costs to conduct the program would average to $183,000 per year for four years (2016-2020) amounting to approximately $735,000. Based on the above figures, a benefit cost ratio of 1.4:1 is achieved.

This ratio does not include the savings associated with implementing the re-usable packaging and waste to energy opportunities. However, the research will inform the best approach to implement these initiatives and result in further savings.

Summary of assumed costs

These costs are based on the assumptions listed in table 17 above.

Costs		**Staff**		**External (consultant + service costs)**
Costs for Phase 1 (year 0)	$	80,000	$	230,000
Costs for Phase 2 (year 1)	$	110,000	$	75,000
Costs for Phase 3 (year 2)	$	70,000	$	75,000
Costs for Phase 4 (year 3)	$	60,000	$	75,000
Costs for Phase 5 (year 4)	$	0	$	5,000
sub total	**$**	**280,000**	**$**	**435,000**
total			**$**	**735,000**

Feasibility study of re-usable packaging

The focus of phase two is a study into the feasibility of re-usable packaging across the sector. A budget of $60,000 has been estimated for this study which will also draw on research conducted in phase 1 (year 0). It is acknowledged that re-usable packaging is only viable in certain circumstances and that the Australian red meat sector may not find the approach viable. For this reason cost benefits associated with re-usable packaging have not been calculated. However, two industry studies (StopWaste Partnership & RPCC 2008; Ultratainer 2016) were analysed to understand and demonstrate the potential cost benefits of re-usable packaging. Overall, the studies show that re-usable packaging can achieve a benefit cost ratio of between 4 and 6.

Re-usable packaging example	**Example A**	**Example B**
Annual cost of one -use containers	$3,472,125	$745,125
Annual cost of re-usable containers	$2,854,510	$468,810
Initial investment	$760,000	$203,000
savings year one (gross)	$617,615	$276,315
savings year one (net)	-$142,385	$73,315
savings over 5 years (net)	$3,088,075	$1,178,575
Benefit cost ratio based on 5 years		
benefit	$3,088,075	$1,178,575
cost (initial investment)	$760,000	$203,000
ratio	4.06	5.81

Feasibility study of energy from waste

The focus of phase three is a study into the feasibility of waste to energy as a means to reduce waste to landfill in the sector. A budget of $60,000 has been estimated for this study

which will also draw on research conducted in phase 1 and 2. Discussion with industry energy experts indicated that energy from waste can have a payback period ranging from less than one year, to over ten years (provided suitable conditions are met).

9 Appendix E: Programme 2 - “Consumer messaging” Economic analysis assumptions and data

A high level cost benefit analysis (CBA) was undertaken to determine the minimum benefit that MLA could achieve from programme 2. It is essential that MLA undertake independent costing and verification of these assumptions before any commitment is made.

Purpose

The high level CBA is assessing the cost and benefits of the programme. Packaging is the first contact point between the red meat products and consumers, making it a powerful point of influence on reputation and value. Sustainable packaging will add value and reduce risks to the red meat brand. Research has shown that sustainable packaging can help retailers and brand owners achieve an increase in net sales of 1-4% and an increase in their margins (Adams 2014).

Consumers can be price sensitive when it comes to meat purchasing. As such meat is price elastic to reflect consumer demand. The high level cost benefit analysis has not taken the elasticity of meat price into account as it was not possible to adequately cost the impact of this based on limited data available.

The costs and benefits applied do not include inflation. We have applied a 5% discount to the costing to reflect current interest rates.

The CBA was performed on basis of the assumptions documented in Table 18.

Table 18 Cost Benefit Analysis assumptions for programme 1

Assumption	Description
Discount rate	A 5% discount rate has been applied to reflect current interest rates which that may impact the program.
Appraisal period (years)	The analysis has been performed across five years from current year (year 0) through to 2020 (year 4).
Brandowner costs (assessment)	In order to determine eligibility to carry the Australian Recycling Label, packaging needs to be assessed using the PREP software. There is a subscription fee for using this software, based on company turnover, of up to $7000 for larger companies. An allowance also needs to be made for the labour component of the assessment. Initial discussions with Planet Ark indicated that this may only take 30 minutes if all information is available. However it is difficult to determine an accurate figure due to uncertainty over packaging types, number of suppliers, availability of information, and whether discounts can be sought from Planet Ark to reduce overall costs. Due to the difficulty calculating an accurate

	figure it was decided that an estimate of $100,000 for the sector would be a safe estimate of costs that the brand owners would incur in the assessment phase. However this would need to be confirmed with Planet Ark (if their label is used). We have assumed that implementation costs for brandowners would typically decrease 25% from year 4 onwards YoY.
Brandowner costs (licensing)	There are licensing costs associated with adopting a labelling scheme such as the Australian Recycling Label of up $15,000 per year for brand owners with product revenue of $1 billion or more, or $25,000 for turnover of $10 billion. To obtain an estimate of costs it was assumed that there were around 10 major brand owners in the red meat sector (with sales around $1 billion each) and several smaller ones. Based on this assumption, a figure of $165,000 is considered reflective of the potential costs but would have to be confirmed with Planet Ark if their label was used. It is also possible that a reduced 'industry rate' could be negotiated if licencing fees were a barrier. We have assumed that implementation costs for brandowners would typically decrease 25% from year 4 onwards YoY.
Staff costs	Estimate of MLA staff time, based on $150,000 per year, which includes salaries and on costs.
Additional packaging costs (based on increased sales)	This is an estimated calculation based on 1% increase in packaging as a result of increased sales (refer increase in sales below). We assumed that additional packaging costs would be incurred at 10% from phase 3 (year 2), 50% from phase 4 (year 3) and 90% from year 4 onwards YoY.
Consultancy costs	Based on estimate of approximate scale of external work required set at a typical consultancy rate.
Current sales (baseline)	Australian sales of red meat through supermarkets, based on 2012 volumes (Barker, 2012) calculated using 2015 prices (MLA, 2016) were approximately $8.5 billion. The size of the red meat consumer red meat market in Australia is similar in 2015 compared to 2012 (MLA website). Although

	prices vary each year this has not been taken into account for the analysis, as 2015 prices were used (the most recent available).
Increase in sales	While it is difficult to quantify increase sales through sustainability branding, market research (Stora Enso, 2015; Adams, 2014) show that sales increases of 1-4% can be achieved. To be conservative 1% was used to calculate the value of any sales increase with the benefit to producers calculated on a retail yield of 38% (Australian Beef Association (2015). It is acknowledged that sales increases based on sustainability reputation are difficult to assess and that benefits may not flow through to producers. We have assumed that in Phase 3 (Year 2) - practical actions are implemented by 10%, Phase 4 (Year 3) - practical actions are implemented 50%, ongoing (Year 4 onwards) - practical actions implemented 90%.
Limitations	This strategy does not rely on implementing significant changes to existing packaging. Any on-pack messaging will either occupy space on existing packaging labelling, or involve only modest changes to packaging (addition of an in-mould logo). Discussions with an industry packaging expert found that this cost was not a barrier to implementation. Costs associated with minor changes to packaging tend to be a one off cost and can be timed to coincide with packaging revamp timelines to reduce costs. A staged roll-out has been proposed to allow for this.

Summary of the results of the Analysis

Present Value of Benefits	$36,331,150
Present Value of Costs	$2,913,250
Benefit Cost Ratio	12.47
Net Present Value	$33,417,900

The benefit to the red meat sector is through improved environmental reputation, leading to increased red meat sales. While difficult to quantify, the value to producers of this program, through increased red meat sales, is estimated at up to $36 million over the life of the

program (4 years) a 10% implementation rate in phase 3, 50% implementation rate in phase 4 and 90% implementation rate ongoing. The cost to administer the program will be approximately $200,000 per year for four years, and there will be costs of around $2 million for the brand owners. The benefit cost ratio for this programme is estimated at 12.5:1.

Summary of assumed costs

These costs are based on the assumptions listed in table 18 above.

Costs	Staff	External (consultant + service costs)	Brand owner implementation	Additional packaging
Costs for Phase 1 (year 0)	$ 105,000	$ 155,000	$ 0	$ 0
Costs for Phase 2 (year 1)	$ 130,000	$ 85,000	$ 0	$ 119,976
Costs for Phase 3 (year 2)	$ 80,000	$ 206,000	$ 265,000	$ 599,879
Costs for Phase 4 (year 3)	$ 75,000	$ 51,000	$ 265,000	$ 1,079,782
Costs for year 4 onwards YoY	$ 56,000	$ 38,250	$ 198,750	$ 1,079,782
sub total	**$ 446,250**	**$ 535,250**	**$ 728,750**	**$ 1,799,637**
total				**$ 3,509,887**