AMPC

AUSTRALIAN MEAT PROCESSOR CORPORATION

RD&E PROGRAM OVERVIEW

2016–2017

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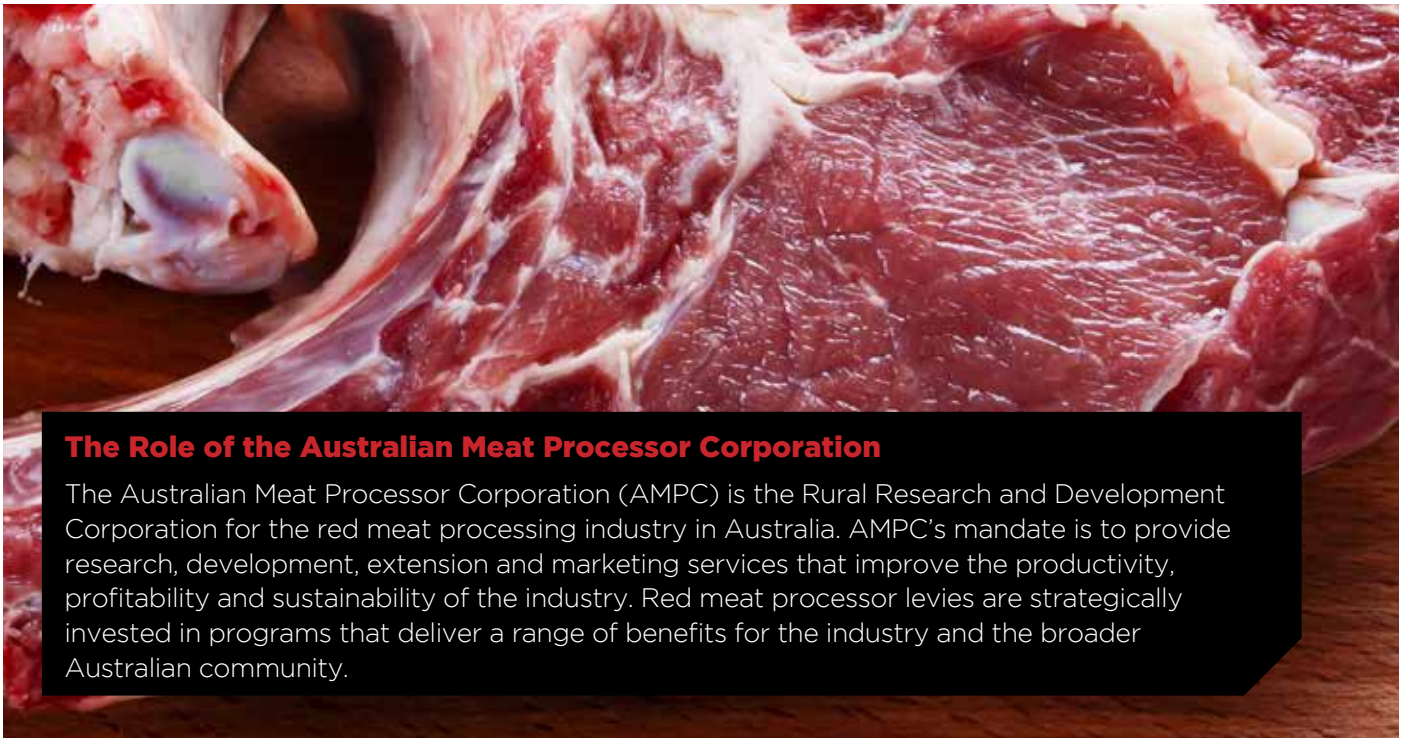
INTRODUCTION



The Role of the Australian Meat Processor Corporation

The Australian Meat Processor Corporation (AMPC) is the Rural Research and Development Corporation for the red meat processing industry in Australia. AMPC's mandate is to provide research, development, extension and marketing services that improve the productivity, profitability and sustainability of the industry. Red meat processor levies are strategically invested in programs that deliver a range of benefits for the industry and the broader Australian community.

THE PURPOSE OF THE RD&E PROGRAM OVERVIEW

The RD&E Program Overview 2016–2017 is a companion document to AMPC's 2016–2017 Annual Operating Plan.* It describes AMPC's Research, Development and Extension (RD&E) projects** in terms of associated objectives, deliverables and outcomes within this financial year.

Related documents:

- **Strategic Risks Facing the Australian Red Meat Industry:** Part of AMPC's shift towards a more long-term future orientation is the assessment of strategic risks
- **MISP 2020:** The Meat Industry Strategic Plan 2020 has developed overarching priorities for Australia's red meat industry
- **AMPC Annual Operating Plan 2016–2017:** Serves as an operational plan that describes AMPC's new activities for the year to come
- **AMPC Program Overview 2015–2016:** Certain projects in the 2016–2017 Program Overview carry on from previous years
- **AMPC Strategic Plan 2013–2017:** Sets out the strategic priorities for AMPC, which are addressed through the RD&E projects which AMPC invests in

THE ROLE OF AMPC

AMPC administers statutory levies on behalf of the red meat processing industry in Australia, as detailed in its Statutory Funding Agreement with the Australian government.

AMPC has 105 members operating in 135 meat processing establishments and represents over 97% of Australia's red meat processing capacity.

Through RD&E activities, AMPC aims to:

- Improve processor efficiency and competitiveness
- Enhance the sustainability of the red meat processing industry
- Assist in protecting and securing increased access to new markets
- Enhance industry capability and innovative capacity
- Increase overall processor productivity and performance

RD&E COLLABORATION

To achieve organisational aims, AMPC works closely with its panel of research providers to deliver many of its projects.* These providers are responsible for a range of activities and deliverables, including:

* The AMPC 2016–2017 Annual Operating Plan can be found on AMPC's website (www.ampc.com.au).

** Plant Initiated Projects (PIP) are not detailed in this document. More information can be found on AMPC's website (www.ampc.com.au)

- // Assembling internal and external expertise
- // Designing and running scientific studies
- // Securing approval and access to research facilities (laboratories, equipment, etc.)
- // Development of a comprehensive project plan, detailed methodology and budget, as well as management of delivery and documentation of cash and in-kind contributions
- // Dissemination of key research findings to the scientific community, subject to approval by AMPC
- // Preparation of progress reports against milestones, detailing findings from individual experiments**
- // Writing of a comprehensive final project report detailing methodology, data, analysis and conclusions
- // Creating communication materials, such as scientific papers, conference presentations, information brochures, snapshots, processor talks and trade articles as approved by AMPC

AMPC'S PROGRAM STRUCTURE

To deliver on its mandate, AMPC focuses its RD&E and marketing activities across three programs:

The **Core Program** represents AMPC's primary RD&E program, focused on addressing key issues facing the processors in terms of productivity, profitability, sustainability, integrity and capability. In addition to being administered and delivered by AMPC, the Core Program is also supported by a robust industry-wide consultation process aimed at identifying and delivering innovative outcomes. Funding for this program comes from processor levies, and matched government funding (where applicable). The Core Program is divided into five distinct sub-programs that are central to delivering continuous improvement and long-term sustainability to the red meat processing industry.

The **Joint Program** delivers supply chain improvements that support food safety, eating quality and increased demand for red meat. The program is collaboratively funded between AMPC and Meat & Livestock Australia (MLA), and leverages both processor and producer levies, as well as matching government funds for eligible activities.

The **Plant Initiated Projects (PIP) Program** enables processors to identify and undertake RD&E projects that generate whole-of-industry benefits by trialling and adopting new technologies at operating plants under real world conditions.

This is realised through leveraging private investment in industry RD&E.

AMPC'S FY2016–17 PROJECT PORTFOLIO

Table 1 on the next page shows AMPC's project portfolio as of 30 June 2016. Individual workstreams and projects are described in further detail in subsequent sections of this document and the complete list of providers can be found in the Appendix.

Projects have been divided into 4 categories depending on their current stage and expected outcomes for this year:

- Studies and research
- Assessment and feasibility
- Prototype and development
- Implementation and upscaling

* More information on the Portfolio Development Process and the Consultation Framework can be found on AMPC's website (www.ampc.com.au). The complete list of providers can be found in the appendix of this document.

** Milestones are agreed with AMPC during the project contracting phase. Milestone delivery is a critical metric for AMPC.

Table 1. AMPC's FY2016-17 project portfolio

	Core program					Joint Program
	P1	**P2**	**P3**	**P4**	**P5**	**P6**
	Processing Technologies	**Environment and Sustainability**	**Processing Hygiene, Quality and Meat Science**	**Capability, Extension and Education**	**Industry Improvement and Economic Analysis**	**Joint Program***
Strategic Objective	To improve productivity, operating costs and product quality by developing new technology and supporting members with implementation	To improve industry sustainability through environmental, economic and social activities	To monitor and maintain the standards of food safety, product integrity and eating experience	To spread awareness of RD&E activities and findings, by managing key relationships, investing in education and providing training	To evaluate the economic benefit of improvements resulting from RD&E investments	In collaboration with MLA, to enhance market access, expand marketing and promotion, and develop food safety and integrity systems
Workstreams	P1.1 Productivity and Quality P1.2 Sensing and Analysis P1.3 Materials Handling P1.4 Value Added P1.5 Plant Initiated Projects (PIPs)**	P2.1 Energy Efficiency P2.2 Waste Management P2.3 Water Conservation P2.4 Sustainability P2.5 Plant Initiated Projects (PIPs)	P3.1 Food Safety P3.2 Integrity Systems P3.3 Meat Science P3.4 Transformational Meat Science (TMS) P3.5 Plant Initiated Projects (PIP)	P4.1 Industry Capability P4.2 Extension Services P4.3 Scientific Education P4.4 Vocational Training P4.5 Plant Initiated Projects (PIPs)	P5.1 Industry Improvement P5.2 Economic Analysis, Data and Statistics P5.3 Industry-Wide System Improvements P5.4 Strategic Communications P5.5 Plant Initiated Projects (PIPs)	P6.1 Community and Consumer Support P6.2 Market Growth and Diversification P6.3 Supply Chain Efficiency and Integrity
Total AMPC contribution in $	$8,059,968	$2,280,033	$8,468,440	$9,920,704	$814,318	$16,394,086
Total AMPC contribution in %	17.5%	5.0%	18.4%	21.6%	1.8%	35.7%

AMPC's total financial contribution is illustrated per program. Specific projects may extend beyond the current financial year and the investment level is therefore not an isolated representation of the current financial year.

* AMPC's contribution of R&D funds to the Joint Program has been grossed to a 100%.

** Plant Initiated Projects (PIP) are not detailed in this document. More information can be found on AMPC's website (www.ampc.com.au).

PROGRAM 1: PROCESSING TECHNOLOGIES

This program aims to improve the ability of red meat processors to compete internationally, through improved yield and productivity and novel products.

Program Drivers

As illustrated in Figure 1, the projects under this program will counter potential negative impacts to the industry, while also being guided by the MISP 2020. In addition, AMPC's Strategic Plan 2013–2017 sets out a number of strategic imperatives, the following of which are addressed in Program 1 – Processing Technologies:

// Increase the productivity of red meat processors to compete on the international scene through new technologies and manufacturing practices
// Examine novel and efficient technologies and processes for whole carcase measurements and monitoring
// Develop new meat products
// Examine opportunities to value add from meat and meat products
// Enhance the adoption and commercialisation of new technologies and innovation in the industry

Program Goals

AMPC will address the above drivers in this program by achieving the following processing technology related goals:

// Discover novel processing technologies, for example around efficient whole-carcase measurements
// Enhance adoption and commercialisation of technology throughout the industry, enabling increased automation and building the foundation for continuous improvement through data analytics
// Improve materials handling to reduce waste
// Develop innovative meat products and possibilities for product differentiation through new process capabilities

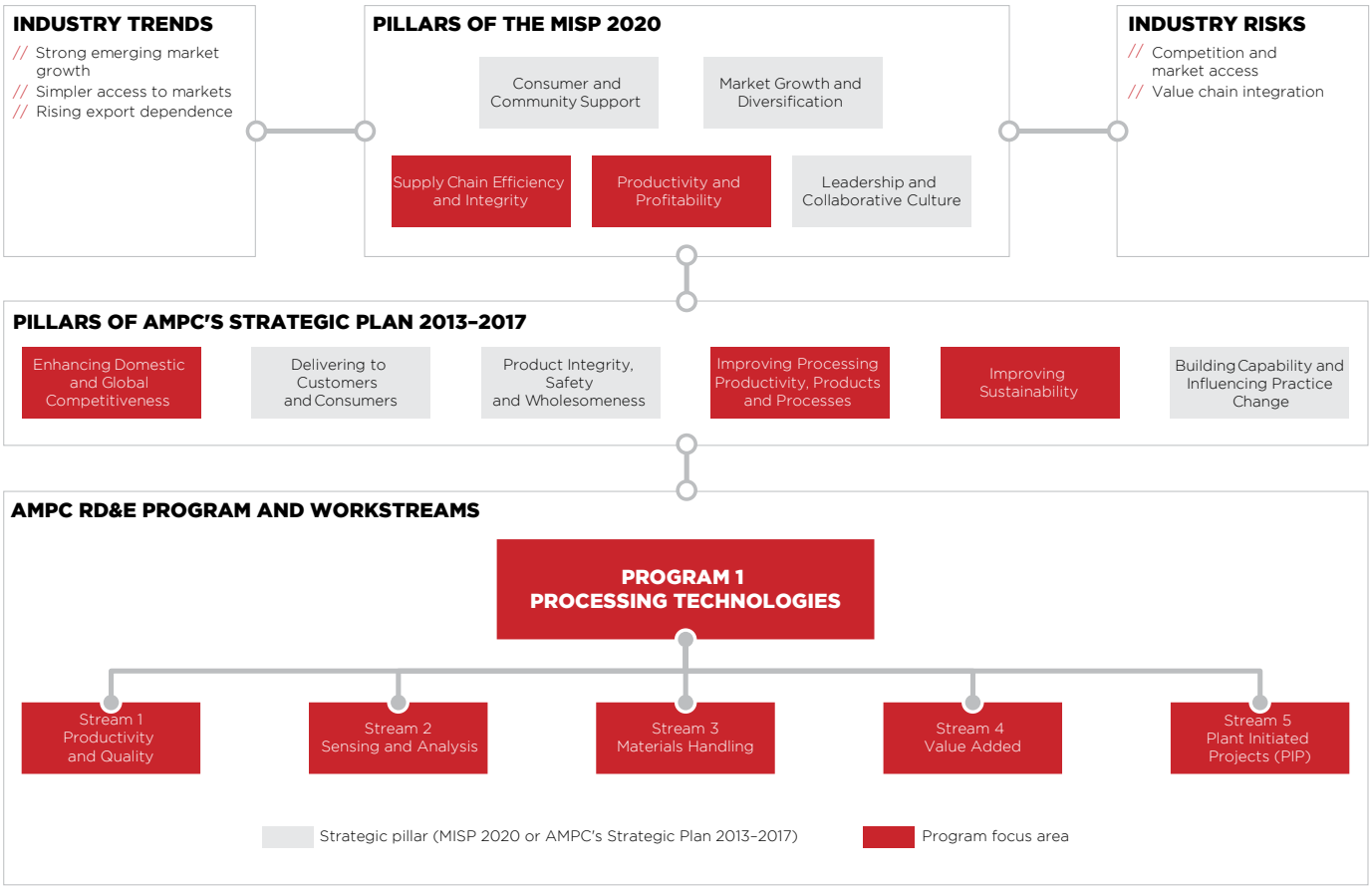


Figure 1. Elements influencing Processing Technologies projects

WORKSTREAM P1.1 PRODUCTIVITY AND QUALITY

Context: Increasing processing efficiency and productivity is important to improve competitiveness in national and international markets as well as to ensure the long-term sustainability, high-quality standards and growth of the industry.

Objective: This workstream focuses on developing and implementing technologies and solutions that automate manual tasks, increase the use of manual assist technologies, and improve resource efficiency to enhance process value and recovery.

Project Description
Studies and Research
2016-1043: Improvements to robotic bandsaw operations **Objective:** Investigate key components to assist the automated cutting process through robotic bandsaw operations and prototype experimental techniques **Expected outcomes/deliverables:** // Provision of a cohesive roadmap for automated bandsaw cutting, and a series of landmarks to be implemented in isolation to increase utility in systems that have not yet been fully automated
2016-1034: New concepts for cattle slaughtering and break-up into primal meat cuts (Stage 1: concepts creation) **Objective:** Examine new technologies to create potentially advantageous new automated concepts for cattle slaughtering and break-up into primal meat cuts **Expected outcomes/deliverables:** // Initial report and webinar presentation on potential new concepts for cattle slaughtering and break-up into primal meat cuts prior to follow-on work
Assessment and Feasibility

2016-1032: Technology evaluation for fat removal from beef striploins to achieve a uniform fat thickness
Objective: Assess the requirements for fat trimming, quantify the variability in beef striploin fat thickness, investigate technologies for trimming and assess solution(s) for economic viability
Expected outcomes/deliverables:
// Report on the state-of-the-art technology for fat trimming including quantified industry benefits
// Provision of a validated solution and experimental prototypes for fat trimming of beef striploins

2017-1022: Automatic equipment for handling the bung in the lamb slaughter process
Objective: Analyse the possibility to re-use the bung handler developed for pig slaughter for lamb processing, to reduce the amount of faecal contamination and to reduce labour cost
Expected outcomes/deliverables:
// Evaluation of how the equipment might be deployed in a lamb slaughter operation (modifications and adaptations required and associated costs)
// Assessment of the benefits in hygiene and operational efficiency that might accrue from any change in slaughter operations

2017-1054: Feasibility study into a high-volume cellular processing plant **Objective:** Determine the feasibility of a high-volume cellular processing plant utilising a mix of industrial robots, collaborative robots, special-purpose machines and human operators to complete various tasks **Expected outcomes/deliverables:** // Report detailing the viability of a high-volume cellular plant, including economic assessment

Project Description
Assessment and Feasibility (continued)
2017-1055: Detail design study for the integration of CO2 capturing and liquefaction for dry ice production in an existing meat processing facility **Objective:** Demonstrate to abattoir owners the benefit of integrating a slack gas recovery system into existing abattoir process systems **Expected outcomes/deliverables:** // Report detailing the design challenges and requirements for integration into existing abattoir systems

2017-1084: Robotic beef splitting CBA and development
Objective: Continue work performed previously on robotic beef splitting and spinal cord removal and develop viable beef slaughter automation principles
Expected outcomes/deliverables:
// Cost-benefit analysis of technical developments and impacts on beef slaughter processing facilities
// On-site beef splitting trials at a nominated beef processing facility

2017-1085: Feasibility research and evaluation of miniaturised snake robotics for spinal cord removal prior to splitting beef carcasses **Objective:** Examine the feasibility of automating the combined process of spinal cord removal and accurate splitting to reduce the manual effort required and minimise the risks of a BSE crisis **Expected outcomes/deliverables:** // Specification of the technical requirements for an automated and combined cord removal and splitting process

2017-1060: Cost-benefit analysis for combined splitting and spinal cord removal
Objective: Analyse return on investment (ROI), based on potential for adoption of beef carcase splitting automation, risks related to changing markets and country requirements around spinal cord removal
Expected outcomes/deliverables:
// Cost-benefit analysis on beef carcase splitting automation
// Risk assessment for spinal cord removal

2016-1001: Caprine and ovine 'cubing' characterisation and automation feasibility
Objective: Study the feasibility of supporting and/or automating the caprine and ovine "cubing" process in the Australian red meat industry
Expected outcomes/deliverables:
// Detailed report including field information, trial results, assessment of requirements, state-of-the-art solutions, line design with automation options, and investment levels required
// Engineering design for a machine satisfying the full requirements of the Australian meat industry

2017-1050: First feasibility of shoulder deboning based on an adaptation of an existing ATTEC machine
Objective: Consider the feasibility of adapting/adding features to the ATTEC Shoulder Machine that would reduce manual effort and assist in the deboning process
Expected outcomes/deliverables:
// Feasibility assessment of a possible solution, preferably using passive blades compliant by selective force pressure springs that self-adjust to follow the appropriate bone profiles along the deboning paths
// Design of the associated solution

Assessment and Feasibility (continued)

2017-1069: A boning line modular processing unit

Objective: Evaluate if the concept of a Modular Processing Unit (MPU), which has had compelling advantages in the manufacturing sectors, can be applied to the abattoir sector to provide specific operational functions at each workstation

Expected outcomes/deliverables:

// Assessment of the MPU concept, to determine whether it can be used in the abattoir sector

Prototype and Development

2017-1052: Automated French dressing of lamb rib rack: market confirmation of the technical and commercial suitability of an 'ideal' automated machine design followed by its prototype design and build stages

Objective: (Three-stage project with AMPC go/no-go decision)

// Stage 1: Obtain market confirmation that the automated lamb rib racks frenching machine concept is technically and commercially suitable and obtain a commitment of purchase intent

// Stage 2: Refine the machine concept, engineer and design the Prototype

// Stage 3: Build the prototype, and do testing, evaluation, development and demonstration, with a final report to AMPC

Expected outcomes/deliverables:

// Final report including prototype design, performance evaluation and associated costs

2014-1056: X-ray lamb frenching

Objective: Develop an automated solution using X-rays and a machine to automate the French lamb racks process without the downsides of current water frenching solutions

Expected outcomes/deliverables:

// Report on the automation for application to lamb frenching

// Prototype of an X-ray-enabled waterless lamb frenching solution for installation and demonstration within a domestic processing facility

2016-1011: Automated beef ribset deboning

Objective: Provide opportunities to increase yield and reduce labour in beef boning and limit associated injury risks

Expected outcomes/deliverables:

// Manufacturing and trial of a single-side prototype machine to debone the beef ribset, and assessment of labour utilisation and yield outcomes

2017-1045: Prototype development of machine to remove fat from beef striploins leaving a uniform thickness behind

Objective: Study the feasibility for sensing and separation of variable fat thicknesses and create a working prototype to improve the overall approach to fat trimming

Expected outcomes/deliverables:

// Development and implementation within Australia of a working prototype with integrated sensing to remove fat from beef striploins

Implementation and Upscaling

2017-1003: Comprehensive Internet of Things (IoT) demonstration and trial addressing a major meat processing industry opportunity

Objective: Develop and demonstrate an Internet of Things (IoT) solution for the Australian red meat processing Industry to monitor and improve productivity, safety and product integrity in meat processing plants

Expected outcomes/deliverables:

// Development and deployment of IoT solutions in AMPC industry partners' plants to provide real-time computation and visualisation of real-time KPIs and to identify productivity improvements

Implementation and Upscaling (continued)	

	**2017-1059: Tunnel boner**
	Objective: Develop and manufacture the capability of removing the femur bone from lamb or mutton hind legs while leaving the tibia bone in place
	Expected outcomes/deliverables:
	// Development and implantation of the tunnel boner machine
	// Prevent worker injuries and increase productivity

	**2014-1055: Lamb aitchboning manual assist** **Objective:** Develop a manual assist device for lamb hindquarter boning to allow the boner the freedom to concentrate on boning technique in the most ergonomic manner and thus, reduce RSI-type injuries and promote increased yield **Expected outcomes/deliverables:** // Development and installation into a domestic processing facility of an ergonomic jig enabling reduction of the physical effort required
Total AMPC contribution for workstream P1.1	**$4,983,532**

WORKSTREAM P1.2 SENSING AND ANALYSIS

Context: The Australian red meat processing industry deals with highly variable carcases in terms of their shape, size and composition. As a result, the ability to automatically measure characteristics 'online' provides an opportunity to increase overall processing efficiency and productivity.

Objective: This workstream focuses on developing and implementing systems that can effectively manage these variations to capture the necessary data and images to adjust cutting lines for automation and inform processing-related decisions according to carcase type, product specification, and customer and market requirements.

Project Description	
Assessment and Feasibility	
	**2014-1065: X-ray OCM bone, fat and muscle trials** **Objective:** Determine whether High-Definition X-Ray technology can measure objective carcase measurement (OCM) characteristics to support the cutting lines process and sensing automation and perform preliminary offline trials, analysing beef primal cuts and portions **Expected outcomes/deliverables:** // Assessment of feasibility including the quantification of the potential benefits and evaluation of economic yield from each and every carcase
	**2014-1057: Beef and lamb OCM with CT in situ further development** **Objective:** Develop computed tomography (CT) research in situ laboratory and continue work on the dual-energy X-ray system (DEXA) that can provide detailed additional information on food quality and safety as well as on supply chain algorithms **Expected outcomes/deliverables:** // Report on the dual-energy X-ray system including findings observed from in situ laboratory trials
Total AMPC contribution for workstream P1.2	**$1,156,756**

WORKSTREAM P1.3 MATERIAL HANDLING

Context: Meat processing facilities incur significant labour and other business costs associated with managing increasingly complex material handling challenges.

Objective: This workstream focuses on developing and implementing cost-effective technologies and solutions to material-handling tasks, including the load-out of carcases, picking and packing boned and sliced product (e.g. primal, sub-primal and shelf-ready portions) and cartoned meat.

Project Description	
Prototype and Development	
	**2017-1065: Development of naked primal cut recognition software** **Objective:** Develop and evaluate sensing hardware and software algorithms capable of rapidly classifying different types of red meat primal cuts to reduce the labour costs associated with identification and manual bagging and labelling **Expected outcomes/deliverables:** // Development of a preliminary software suite capable of efficiently learning and identifying primal cuts through various fuzzy logic and neural networking methods, and providing operator feedback regarding an array of profile parameters
	**2017-1064: Integrated robotic picking and packing of primal cuts** **Objective:** Design a system capable of picking and packing individual cuts (using an improved vision system developed from previous AMPC projects) to minimise labour costs and OH&S risks associated with the manual picking and packing of meat cuts after processing **Expected outcomes/deliverables:** // Development of an autonomous robotic cell capable of efficiently picking and packing primal cuts without manual intervention

	**2014-1011: Container loading pilot installation**
	Objective: Develop an automated container loading system to address issues in the shipping process, including the loss of products due to carton damage, OH&S and traceability
	Expected outcomes/deliverables:
	// Development of an automated container loading system as a proof of concept
	// Testing and in-house trials prior to further development and implementation

Total AMPC contribution for workstream P1.3	**$1,283,670**

WORKSTREAM P1.4 VALUE ADDED

Context: Exploring the potential for innovative concepts, products and technologies to add value within the processing supply chain is a key requirement to ensure productivity growth and industry competitiveness of Australian red meat processors.

Objective: This workstream focuses on transforming existing products and developing new ones in order to deliver cost-effective methods of increasing value in alignment with customer needs.

Project Description	
Research and Studies	
	**2017-1063: Value adding stage 2** Objective: Continue work performed on biomolecules to cover the demand for Australian-derived and manufactured value-added products prior to potential commercial development **Expected outcomes/deliverables:** // Creation of an extensive database of molecules, equipment and process models to ensure that revenue opportunities are defined from the perspective of a domestic meat processing facility

	**2017-1025: Upgrading of side streams – potential in lamb and beef hydrolysates**
	Objective: Study other applications of side stream products for the food industry and prepare a state-of-the-art analysis on upcycling and application of lamb and beef side streams
	Expected outcomes/deliverables:
	// Report on the possible applications of side stream products in regards to domestic market and consumers (e.g. bioactivity, antioxidants and nutrition)
	// Production of a ready-to-use catalogue for application of side stream products

Project Description	
Assessment and Feasibility	

2016-1072: Pilot study for future storage and transport for carcases using hypobaric containers
 	
Objective: Investigate the potential to extend the shelf life of lamb using a hypobaric chamber. In particular, verify that lamb meat can be safely maintained in a sophisticated hypobaric environment for 35 days without appreciable loss of weight or spoilage
 	
Expected outcomes/deliverables:
// Examination of the potential of hypobaric chambers for increasing the flexibility of supply lamb for the wet market of the Middle East
// Construction of an all-inclusive final report addressing the lack of up-to-date knowledge	

Total AMPC contribution for workstream P1.4	**$636,010**

PROGRAM 2: ENVIRONMENT AND SUSTAINABILITY

This program aims to reduce the environmental impact of the Australian red meat processing industry; in response to key strategic risks around climate change and evolving consumer expectations.

Program Drivers

Figure 2 illustrates the inputs to the program's structure, driven primarily by strategic imperatives set out in AMPC's Strategic Plan 2013-2017 as well as risks and industry trends. The strategic imperatives addressed in this program are to:

// Improve industry knowledge and capability to achieve sustainable resource management and adapt to climate change

// Examine technologies, practices and procedures that contribute to improved waste management systems and that add value to waste products

// Explore options to integrate new technologies and improve industry infrastructure

// Maintain business sustainability and ensure efficient food safety and product integrity standards

// Maintain and enhance efficient product integrity standards and quality assurance systems

In addition, the most pressing risk is the loss of social licence to operate by which the environmental downsides of the industry are currently accepted in lieu of economic and community benefits. Secondary risks and trends driving the environment and sustainability program are: increasingly stringent emissions targets; more extreme weather events; climate change, an increasingly challenging resource environment; and increasing consumer awareness.

Program Goals

The projects in this program collectively address the above drivers by aiming to:

// Reduce energy consumption and greenhouse gas emissions

// Improve industry awareness, capabilities and attitudes to adapt to climate change

// Improve waste-water management and examine technologies, practices and procedures that could capture value from waste products

// Explore options to improve industry infrastructure

// Maintain efficient food safety and product integrity controls

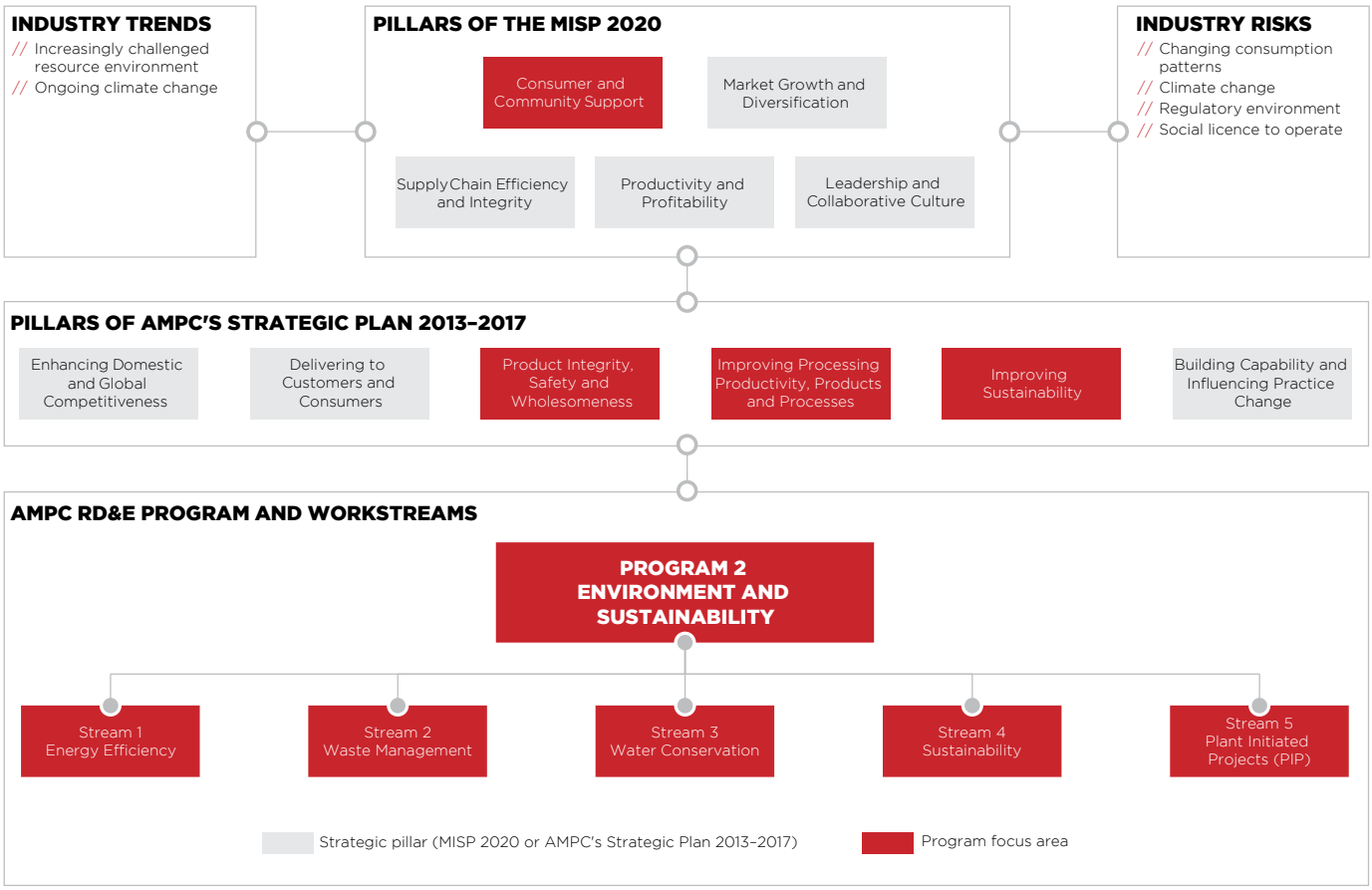


Figure 2. Elements influencing Environment and Sustainability projects

WORKSTREAM P2.1 ENERGY EFFICIENCY

Context: Red meat processing facilities consume a vast amount energy due to the need for refrigeration, steam and hot water production. This represents a significant cost as well as a source of greenhouse gas emissions. Stewardship of environmental resources has become a major priority for the red meat industry, which requires minimising the impact on the environment and managing waste and the natural resources base.

Objective: This workstream focuses on developing pioneering concepts, methodologies and products for reducing the overall energy consumption within the industry and limiting greenhouse gas emissions. It considers the use of renewable energy sources instead of relying on external energy derived from fossil fuels such as coal, gas, liquefied petroleum gas, oil or diesel.

Project Description
Assessment and Feasibility

2017-1029: Investigating steam heat recovery systems and their applicability to the red meat processing industry
Objective: Investigate the technical and commercial feasibility of novel steam heat recovery systems to provide a heat supply adequate to the requirements of Australian red meat processors, in particular superheated steam turbines for generation systems
Expected outcomes/deliverables:
// Assessment of steam heat recovery technologies and their development stages
// A cost-benefit analysis of these technologies to quantify techno-economic feasibility

Project Description	
Assessment and Feasibility (continued)	
	**2016-1002: Investigation into modular micro-turbine cogeneration and organic rankine cycle cogeneration systems for abattoirs** **Objective:** Determine how new innovative energy technologies such as micro-turbines and Organic Rankine Cycle (ORC) units can be leveraged to reduce energy costs and greenhouse gas emissions in meat processing **Expected outcomes/deliverables:** // Literature and technology reviews, feasibility studies, techno-economic assessments and cost-benefit analysis demonstrating how ORC units may be utilised
	**2016-1005: Investigation into voltage optimisation technology for abattoirs** **Objective:** Build case studies for suitable voltage optimisation technologies for the red meat industry and abattoirs in order to limit energy cost, enhance equipment performance, prolong equipment life, reduce maintenance costs and reduce greenhouse gas emissions **Expected outcomes/deliverables:** // Report on voltage optimisation technologies including a guide and a fact sheet with case studies from representative abattoirs

	**2016-1006: Investigating the potential applications for medium to high temperature solar thermal technologies at Australian abattoirs**
	Objective: Investigate the possible selection and deployment of solar thermal technology for the Australian meat processing industry as a replacement for fossil-fuelled boilers.
	Expected outcomes/deliverables:
	// Assessment of the operating conditions in representative facilities, and the possibility of supplementing, complementing or replacing existing boiler systems with solar thermal technology
	// Techno-economic analysis of the most suitable solar thermal technology for potential future application to red meat abattoirs (concept design, scope of work and cost estimate)
	// Provision of solar thermal snapshots for any facilities to perf assess the feasibility of adopting solar technology

	**2016–1008: Quantifying energy savings from in-line temperature boosting of steriliser water ring mains at abattoirs** **Objective:** Investigate and complete a desktop techno-economic analysis on the potential energy savings achievable from integrating point-of-use heating systems into existing hot water ring mains in abattoirs **Expected outcomes/deliverables:** // Fact sheet and techno-economic analysis on the energy and mass flow associated with the ring mains prior to a pilot project to install suitable in-line point-of-use heating systems at representative facilities

	**2017-1030: Validating baseline data for industry energy efficiency and development of an economic modelling tool**
	Objective: Identify and validate through a quantitative modelling tool a baseline for energy costs and consumption within different areas of meat processing facilities
	Expected outcomes/deliverables:
	// Development of an economic modelling tool to quantify energy consumption in abattoirs
	// Assessment of the applicability of real-time data feedback technologies for quantifying and optimising energy-use within different areas and technologies of red meat

Total AMPC contribution for workstream P2.1	**$348,979**

WORKSTREAM P2.2 WASTE MANAGEMENT

Context: Red meat processing is responsible for the production of liquid and solid wastes that are costly to treat and safely remove. As waste treatment technologies are currently available, they should be leveraged in abattoirs to not only reduce cost but also as an additional source of revenue by converting waste into solid and liquid biofuels, nutrients and edible or non-edible products.

Objective: This workstream focuses on developing innovative products and processes to reduce waste and transform traditional waste streams into streams that add value to the industry while reducing the impact on the environment.

Project Description
Research and Studies
2017-1032: Investigation into sensor technologies to manage waste streams and optimise the use of their by-products **Objective:** Identify, using sensor technologies, key parameters for waste stream management and for the optimisation of the treatment process **Expected outcomes/deliverables:** // State-of- the-art review of current waste stream sensor platforms and associated control systems as well as software of different types and costs

2017-1033: Crust management for optimal anaerobic digestion performance at meat processing facilities
Objective: Identify waste stream inputs and process operations before entering Covered Anaerobic Lagoons (CAL) to reduce solid load and Fat, Oil and Grease (FOG) and thus ensure CAL stability and optimal performance
Expected outcomes/deliverables:
// Report on CAL in regards to waste stream inputs including lab scale studies and site data analysis
// Establishment of key criteria for the management of CAL and FOGs in waste streams

Assessment and Feasibility
2017-1037: Assessment of smouldering as an efficient and low-cost alternative for management of agricultural solid wastes **Objective:** Demonstrate proof-of-concept for smouldering in red meat processing applications and develop an R&D pathway to commercial applications **Expected outcomes/deliverables:** // Assessment of smouldering in red meat processing applications compared to other current practices
2017-1031: Reviewing on-plant waste stream biomass co-digestion options and identifying technologies for optimum mixing, co-digestion and re-use **Objective:** Identify the quantities of solid wastes produced at a reference site and determine suitability for anaerobic digestion, co-digestion and re-use **Expected outcomes/deliverables:** // Production of a digestion and co-digestion manual which outlines the various possible technologies and determines the associated requirements (configuration, dosage rates, substrates, etc.)
2016-1012: Converting solid waste from abattoirs into hydrochar **Objective:** Develop an improved operational procedure to manage solid waste in the meat processing industry; quantify the competitive advantages of hydrochar over compost; and assess the energy gains and calorific value obtained from hydrothermal carbonisation

Project Description	
Assessment and Feasibility (continued)	

	**Expected outcomes/deliverables:**
	// Literature review, regulatory review and cost-benefit analysis of hydrothermal carbonisation
	// Preparation of five different hydrochars under different temperature conditions to select the best hydrochars that will be used as soil amendment
	// Demonstration of use of hydrochar in trials for wheat production

	**2016-1009: Investigation into rapid composting technology for treating abattoir waste**
	Objective: Evaluate available alternative rapid digestion technologies in regards to waste management that can reduce the costs for the red meat processing industry and generate new revenue opportunities through abatement projects and beneficial use of by-products
	Expected outcomes/deliverables:
	// Assessment of alternate technologies and cost-benefit analysis applied to abattoir waste management
	// Trials of abattoir waste materials involving assessment of inputs, outputs and the effectiveness of alternative rapid digestion processes
	// Evaluation of the potential applications and markets for by-products

	**2017-1039: Problem to profit: Developing a sustainable feed base from agricultural wastes using single-cell protein** **Objective:** Continue research and development on Purple Phototrophic Bacteria (PPB) in red meat processing applications in order to demonstrate its value proposition for red meat processing wastewater streams **Expected outcomes/deliverables:** // Small-scale proof-of-concept and continuous laboratory-scale operations to support a future R&D strategy for continuous process development
Prototype and Development	

	**22014-1073: Enhanced energy recovery in Australian industry through anaerobic co-digestion**
	Objective: Improve energy recovery and reduce the whole-of-life cost of treating solid slaughterhouse wastes using anaerobic co-digestion and leveraging previous research and investment by AMPC and other domestic industries
	Expected outcomes/deliverables:
	// Detailed report on how anaerobic digestion is influenced by organic wastes, individually and in combination
	// Provision of robust predictive tools to assess future co-digestion opportunities for novel mixtures
	// Study on novel co-substrates for co-digestion
	// Development of optimised dose strategies and a co-digestion manual as a decision guide
	// Full-scale co-digestion trials at partner industry sites to demonstrate the validity of anaerobic digestion and co-digestion in waste management

Total AMPC contribution for workstream P2.2	**$949,881**

WORKSTREAM P2.3 WATER CONSERVATION

Context: Red meat processing requires water to ensure high levels of food safety and hygiene are maintained. The decreasing availability and the increasing cost of water are forcing plants to reduce consumption, recycle where it is safe to do so, and consider new sources where it is available.

Objective: This workstream focuses on finding new products and processes to conserve water while delivering the highest food safety standards.

Project Description
Research and Studies
2017-1034: Investigating water and wastewater re-use and recycling opportunities using the HACCP risk management framework **Objective:** Consolidate and expand on existing industry knowledge with respect to the recycle and re-use of meat processing wastewater **Expected outcomes/deliverables:** // Publication of a guideline and template for water recycling and re-use using HACCP-based risk management as the over-arching framework
2017-1042: Investigating (waste)water re-use and recycling opportunities: Options Identification and segregation of various waste streams for recycling and re-use **Objective:** Evaluate specific water treatment options, considering raw water quality and desired end-use application; assess the cost and benefits (energy and water saving) of common abattoir wastewater treatments depending on end-use (river discharge, sewer discharge, irrigation or internal re-use as potable or non-potable water) **Expected outcomes/deliverables:** // Development of a comparison and assessment tool (including cost-benefit analysis model) for wastewater treatment and water recycling options

2017-1038: Utilisation of microalgae to purify waste streams and production of value-added products
Objective: Investigate the potential for new sources of water and new approaches for water re-use and recycle. In particular, identify different sources of water and effluents from solid waste and wastewater treatment in meat processing facilities and evaluate their potential for utilisation in a microalgae cultivation process
Expected outcomes/deliverables:
// Literature review on meat processing (waste)water sources and the existing use, re-use, collection, recycle and treatment systems with a particular focus on microalgae-based treatment
// Identification of new water sources and reconfiguration of water and wastewater streams
// Development of a mathematical model to predict the effectiveness of microalgae treatment
// Assessment and estimation of how to enhance current water management systems

2016-1021: Strategic evaluation of RD&E opportunities for water re-use and recycling at Australian abattoirs
Objective: Develop a policy framework and benchmark targets for global best practice in conservation, recycling and re-use of water during meat processing operations; develop effective R&D strategies that will enable processors to reach these targets and demonstrate efficient resource management and sustainability, while maintaining food safety and the highest quality product
Expected outcomes/deliverables:
// Report on strategic needs and opportunities to achieve water efficiency gains through re-use/recycling in Australian meat processing operations
// Overall risk/benefit assessment for identified opportunities, highlighting relevant constraints, knowledge gaps and research needs
// Approval and implementation framework for water re-use/recycling projects that follow the national validation protocols as well as the food safety and water quality guidelines
// Conceptual implementation solutions including cost-benefit analysis and payback times for typical water re-use systems

Project Description	
Research and Studies (continued)	
	2017-1035: Management, containment and re-use options for water runoff in red meat processing facilities **Objective:** Review current methods of stormwater runoff management undertaken in abattoirs in Australia and identify best practices for the management of water runoff from domestic and international abattoirs **Expected outcomes/deliverables:** // Report detailing best practice approaches available for small, medium and large-scale abattoirs in the different state regulatory environments
Total AMPC contribution for workstream P2.3	**$420,786**

WORKSTREAM P2.4 SUSTAINABILITY

Context: Economic, social and environmental challenges place an increasing pressure on the Australian red meat industry to remain productive and competitive in the international market without compromising food safety, integrity and quality.

Objective: This workstream focuses on researching new concepts, methodologies and processes that can contribute to the improvement of industry supply chain sustainability (food safety, integrity systems, animal health and welfare, biosecurity, etc.).

Project Description
Research and Studies

2017-1036: Quantitative risk analysis of the impact of climate variability on the Australian red meat processing industry
Objective: Assess the risks and opportunities associated with climate variability upon the Australian red meat processing industry in order to gauge the overall sustainability of the supply chain and identify risk mitigation strategies
Expected outcomes/deliverables:
// Assessment of climate variability upon the industry
// Results of backward scenario analysis looking at the impact of and learning from climate extremes on the meat and livestock industry
// Setting up an information program to communicate study outcomes

2017-1041: AMPC sustainability report **Objective:** Design, develop and produce the AMPC sustainability report and associated campaign **Expected outcomes/deliverables:** // Production of reports and campaigns adapted to the targeted audience (government, corporate bodies, producers, advocacy groups, etc.) to broadcast AMPC's efforts to manage industry sustainability

2016-1040: Review of percussive stunning
Objective: Determine the acceptability of percussive stunning under Australian conditions through the analysis of published information and industry data
Expected outcomes/deliverables:
// Analysis and data publication to support the use of percussive stunning as an acceptable stunning method under Australian conditions
// Review of published scientific data and industry findings to establish what issues have been encountered overseas and determine optimum stunning conditions

2016-1041: Development of reporting tools for the Australian livestock processing industry animal welfare certification system **Objective:** Establish a reporting process to address regulatory requirements and audit

duplication in the compliance area of animal welfare and to facilitate government recognition of the Australian Livestock Processing Industry Animal Welfare Certification System (AAWCS)

Expected outcomes/deliverables:

// Delivery of KPI to be reported to a central agency to demonstrate the industry's compliance with its voluntary and mandatory animal welfare standards

Total AMPC contribution for workstream P2.4	**$560,387**

PROGRAM 3: PROCESSING HYGIENE, QUALITY AND MEAT SCIENCE

This program responds to the need to ensure the continuous delivery of high-quality standards and food safety, as a key differentiator for Australian products in light of increasing competition in this space.

Program Drivers

If the industry maintains its current trajectory, the strategic risks and industry trends indicated in Figure 3 could result in a reduction of Australia's market share internationally due to the; reduced consumption of red meat overall and questions over Australia's sustainability as a global leader in red meat processing industry.

In addition, the projects in this program are aligned with the following strategic imperatives from AMPC's Strategic Plan 2013-2017:

// Expand research and development towards food safety to ensure food safety systems and practices are the landmark of Australian product
// Maintain and enhance efficient food safety and product integrity standards
// Maintain and enhance efficient product integrity standards and quality assurance systems
// Maintain and enhance world-class traceability systems
// Biosecurity, residue management and animal health standards are underpinned by sound science
// High standards of animal welfare standards are demonstrated
// Developing new meat products while delivering wholesome and consistent eating quality

Program Goals

To counter the (potential) consequences of risks and trends relating to food safety and quality and changing consumption patterns, projects in this program will expand on RD&E in food safety, to ensure systems and practices are the landmark of Australian red meat products:

// Maintaining efficient standards and quality assurance systems
// Enhance traceability systems
// Underpin biosecurity, residue management and animal health standards with scientific research
// Ensure high animal welfare standards continue to be demonstrated
// Develop new meat products

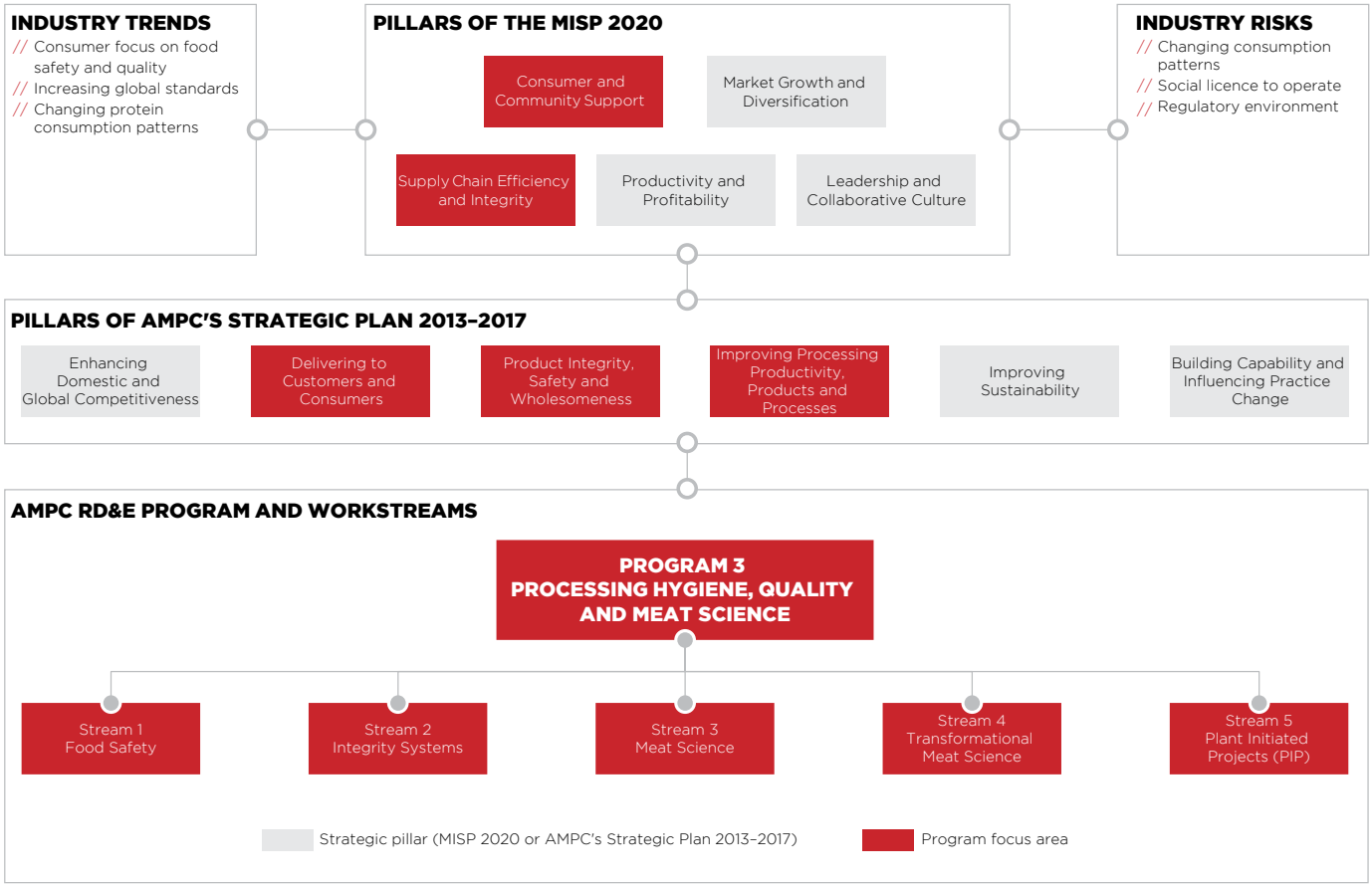


Figure 3. Elements influencing Processing Hygiene, Quality and Meat Science projects

WORKSTREAM P3.1 FOOD SAFETY

The food safety system is a critical component of the red meat supply chain and a key driver of exports. Therefore, it should deliver the appropriate level of protection to the market and ensure that this level of protection is constantly reviewed against public health data and requirements.

AMPC is undertaking a series of projects and initiatives to ensure that technologies and tools comply with industry standards, demonstrate food safety and respond to safety risks. These projects are now being managed by AMPC under the Joint Program and project outputs will be shared with MLA to maximise sharing information, lifting capability and ensuring value chain integration and benefits for the entire industry.

WORKSTREAM P3.2 INTEGRITY SYSTEMS

Context: Australia enjoys an enviable reputation in the international market for producing clean and safe premium quality meat, thanks to the integrity of its underlying system.

Objective: This workstream focuses on developing and implementing systems and technologies that ensure traceability, biosecurity, disease risk mitigation, strong animal health and hygiene, and overall meat quality standards.

Project Description	
Prototype and Development	
	**1000-0006: Sheep CRC extension FY15-FY19** **Objective:** Develop a new sheep meat measurement system that will have applications in conventional lamb grading. This is to be expanded for the prediction of eating quality depending on the cuts for new products such as yearling Merino carcases and carcases that currently fall outside normal grading specifications **Expected outcomes/deliverables:** // Development of an enhanced carcase grading system based on lean meat yield and the eating quality of different sheep meat cuts matched to domestic and key international consumers
Implementation and Upscaling	

	**3000-5105: Transmissible Spongiform Encephalopathy (TSE) freedom assurance program for business plan 2013-2018**
	Objective: Continue to develop and apply vigorous prevention measures complemented by ongoing surveillance to ensure domestic livestock continues to remain free of TSE diseases. This will enhance market confidence that Australian animals and animal products are free from TSEs through the structured and nationally integrated management of animal-related TSE activities
	Expected outcomes/deliverables:
	// Program description and annual summary of TSEFAP activity published by Animal Health Australia (AHA)
	// Annual report of TSEFAP (ARFB and IAQSS) for AHA and SAFEMEAT
	// A program homepage on the AHA website
	// Communications to all stakeholders and ad hoc reports as required

	**2017-1051: Oesophagus (and bung) heat sealing – medical tool conversion (Phase 2)** **Objective:** Eliminate the cost of sealing materials, reduce the negative consequences of plastic in rendering systems, and introduce a technology which can be more easily automated in the near future **Expected outcomes/deliverables:** // Adoption of medical sealing tools to bungs, pizzles and oesophaguses for export instead of applying plastic clips or plugs
Total AMPC contribution for workstream P3.2	**$3,587,950**

WORKSTREAM P3.3 MEAT SCIENCE

Context: Production of high-quality meat is underpinned by a robust understanding of meat properties and qualities, such as meat tenderness, colour, pH and intramuscular fat. Therefore, investments into meat science disciplines appear to be an imperative for the future expansion of quality standards for Australian meat, both nationally and internationally.

Objective: This workstream focuses on technologies and practices that help measure, monitor and improve meat qualities and properties.

Project Description	
Research and Studies	
	**2016-1190: Pilot study on design of lairage, handling and stunning facilities and the potential impact on animal welfare and meat quality** **Objective:** Investigate the extent to which abattoir facility design and animal handling behaviours increase pre-slaughter stress in sheep – which can affect meat quality and profitability – to inform the design of a subsequent study focusing on identified problem areas and the development of guidelines for the development of future facilities **Expected outcomes/deliverables:** // Literature review, scientific articles and research reports on facility design at abattoirs and the potential effect on pre-slaughter stress and meat quality
	**3000-5091: Relationship between fear of humans, temperament and handling pre-slaughter on lamb welfare and meat quality** **Objective:** Develop knowledge of the relative importance of animal and pre-slaughter conditions in domestic abattoirs to inform the direction of training and facilities modifications to improve lamb welfare and meat quality **Expected outcomes/deliverables:** // Detailed report addressing the relationship between the welfare of lambs and the quality of their meat, as well as the relationship between key animal characteristics and pre-slaughter handling
	**2013-9504: The influence of pre-slaughter stress on meat quality and carcase yield of prime lamb** **Objective:** Develop a clear understanding of the roles of acute and chronic stress on meat quality and carcase yield and underpin best practice slaughter pathways from an animal welfare point of view **Expected outcomes/deliverables:** // Industry recommendations for management concerning chronic stress (i.e. dehydration, extended curfews) and acute stress (i.e. handling leading up to stunning) in relation to optimising carcase yield, animal welfare and meat quality
	**2014-1048: Identifying storage thresholds in frozen and chilled red meat** **Objective:** Compare methods of freezing in terms of meat integrity and longevity to develop export duration thresholds and deliver high-quality products **Expected outcomes/deliverables:** // Detailed report which explores the effects of long-term freezing on red meat integrity and safety; identifies the effects of chill period duration prior to freezing on meat quality and value; and develops thresholds indicative of freeze duration and product quality

	**2016-1042: Optimising eating quality of beef steaks by using tri-gas MAP**
	Objective: Understand how the new tri-gas Modified Atmosphere Packaging (MAP) solution affects shelf-life and the organoleptic quality of domestic beef exported to Europe in comparison with traditional solutions used for retail packaging
	Expected outcomes/deliverables:
	// Results of the study and estimation of shelf-life using the new tri-gas MAP
	// Comparison of eating quality just after retail packaging and at the end of the period

Project Description
Research and Studies (continued)
Expected outcomes/deliverables (continued): // Recommendations how exported beef should be retail-packed based on shelf-life, colour stability and eating quality

2016-1077: Reduction of foodborne microorganisms using free radicals produced in situ to dissolve polymers, improve pathogen kill and retain red meat colour
Objective: Investigate the best way of generating free radicals for the purpose of removing biofilms from surfaces
Expected outcomes/deliverables:
// Final report with advice to end-users on efficacy of treatment against microbial indicators and advice on effective temperature and treatment conditions to optimise free radical generation and biofilm removal
// Estimation of cost savings in chemicals, time, labour, water usage and heat
// Advice and recommendations on effectiveness in waste streams, brine and effect on meat appearance

2017-1048: A practical means to accelerate beef ageing and sustain acceptable eating quality and safety: chilled storage temperature manipulation **Objective:** Use intelligent packaging technology to quantify beef ageing period and quality traits in situ and identify purge loss and other yield parameter associations to limit waste and increase profits **Expected outcomes/deliverables:** // Establishment of temperature-control guidelines for industry to apply when ageing beef and safety achieve improved meat quality within a reduced timeline
Assessment and Feasibility

2017-1056: Shelf-life extension of fresh meat products using High Pressure Processing (HPP)
Objective: Investigate the limits of high pressure that can be applied to fresh meat for maintaining 'acceptable' colour with no detriment on other eating quality parameters, and to determine the impact on shelf-life
Expected outcomes/deliverables:
// Development and assessment of a process to increase the shelf-life and optimal sensorial properties of fresh meat products
// HPP cost–benefit analysis for extending the shelf-life of fresh meat products while maintaining other eating quality parameters

2017-1044: Can on-site beef dark cutting evaluation (monitoring) be improved and value-added? **Objective:** Improve dark cutting evaluation precision, accuracy and whole carcase representation, and evaluate the capacity for monitored dark cutting parameters to provide additional information to industry in terms of product shelf-life, spoilage and purge characteristics **Expected outcomes/deliverables:** // Publication of a monitoring guide with tangible recommendations to include in future industry guidelines to reclaim the lost product (or slippage) from current dark cutting practices
Prototype and Development
2017-1006: Intelligent solutions for boxed beef trim export enhancement **Objective:** Facilitate the export of boxed beef trims by solving some of the technological issues associated with packaging routines (e.g mislabelling and lack of traceability of package damage)

Prototype and Development (continued)	

	**Expected outcomes/deliverables:**
	// Mapping of the entire current technological process and review of labelling practices and integrity inspection/documentation at abattoirs in numerous Australian states
	// Development of technical solutions to better facilitate the export of boxed beef trims to the USA

	**2016-1003: Sensing for offal grading and enablement of automation** **Objective:** Develop a multi-sensor grading tunnel through which the eviscera tray can pass to enable automatic selection, sorting and picking of offal. These sensors will allow information to be overlaid into a composite image that may be manually assessed by a human grader or auditor and will have future applications in carcase grading and identifying regions to be trimmed to remove contamination. **Expected outcomes/deliverables:** // Delivery of a tunnel that can be inserted around standard eviscera trays and that may also be developed to provide spatial data to robotic systems, and detect foreign bodies and contaminants
	**2014-1041: Automated visual inspection and preparation of live animals for meat processing** **Objective:** Develop technologies for automated detection of animal contamination in lairage and a high throughput cleaning station to prepare animals for slaughter in order to reduce costs, improve hygiene in slaughterhouses, improve the quality of meat, and thus enhance profitability and Australia's reputation for exporting clean products **Expected outcomes/deliverables:** // Development of a complete working prototype for automated inspection and cleaning of livestock before slaughter, which will provide a main driver for industries to embrace the new technology by seeing actual examples of the faster solution

	**2014-1063: Infra-red thermography and radio frequency identification for detection of stress in lairage**
	Objective: Develop automated systems for detection of animals in stress during lairage, focusing on beef cattle with secondary trials in sheep and goats, to enable the automated detection of at-risk individual animals and groups
	Expected outcomes/deliverables:
	// Proof-of-concept that infra-red thermography (IRT) can detect animals 'at risk'
	// Proof-of-concept that IRT combined with Radio Frequency IDentification (RFID) helps to identify individual animals and groups

Total AMPC contribution for workstream P3.3	**$3,024,538**

WORKSTREAM P3.4 TRANSFORMATIONAL MEAT SCIENCE (TMS)

Context: Unanticipated scientific findings often push the boundaries of knowledge further than planned research.

Objective: This workstream is dedicated to disruptive meat science. The projects under this workstream investigate basic meat properties (such as structure and colour at a molecular level) and research how advanced technologies can be used to improve these properties.

Project Description	
Research and Studies	
	**2013-3005: Improving beef colour at grading** **Objective:** Understand the role of muscle structure in determining beef meat colour; investigate strategies to manipulate muscle structure to improve muscle colour through pre- or post-rigor interventions; develop scientific expertise and industry capability in beef colour; and incorporate new disciplines into meat quality

Research and Studies (continued)	

	Expected outcomes/deliverables:
	// Final report providing evidence as to the effect of rigor on muscle and how this can be manipulated
	// Documentation on data and methods developed in the project to be used for subsequent assessments, research projects and modelling of muscle colour development post-rigor

	2013-5009: Muscle structure and water retention in fresh and cooked meat products **Objective:** Determine the structural basis of dimensional changes leading to weight loss on cooked meats; investigate the interventions to manipulate/minimise this; develop mathematical models for water loss during cooking; and incorporate new disciplines into meat quality **Expected outcomes/deliverables:** // Detailed report to complement existing knowledge on muscle structure and water retention in meat and recommendations to processors on how to predict product performance
	2013-5040: Optimising meat quality and functionality through novel processing interventions **Objective:** Develop processing technologies for novel, value-added red meat opportunities in order to increase the return on under-utilised low value cuts, reduce storage time for tenderisation and develop new product lines for food service and RTE **Expected outcomes/deliverables:** // Various processing options for meat supply chains, recommendations on how to increase the value and utilisation of whole carcases, and information to enhance meat industry capability on new technologies

	2013-5041: The effect of processing technologies on microbial populations impacting the shelf-life of meat
	Objective: Develop the tools and methodology to understand the molecular/genetic mechanisms that spoilage microorganisms rely on to survive innovative processing conditions and investigate the impact of these changes on subsequent survival and shelf-life
	Expected outcomes/deliverables:
	// Methods and tools developed in the project for future assessment of other innovative and future technologies and recommendations and design of further research projects in this area
	// Data generation for modelling of the shelf-life and spoilage of meat products

Total AMPC contribution for workstream P3.4	**$1,855,952**

PROGRAM 4: CAPABILITY, EXTENSION AND EDUCATION

The purpose of this program is to maximise the actual benefits resulting from RD&E projects, by ensuring project outcomes are taken up by enterprises and successfully implemented along the value chain.

Program Drivers

In the geographically dispersed red meat industry, achieving the desired outcomes from each RD&E program will require collaboration, trust and sharing of insight. This program aims to build on the expertise of people in the industry by delivering cost-effective improvement in capability, extension and education, in alignment with the following strategic imperatives from AMPC's Strategic Plan 2013-2017:

// Engage key stakeholders to create awareness and demonstrate value
// Increase industry capability and capacity
// Increase research capability and capacity
// Evaluate RD&E outcomes
// Investigate, understand, communicate and respond to changes and influences in the red meat processing industry

In addition, key strategic risks addressed are increasing competition and easier market access, losing the social license to operate and changing consumption patterns, as illustrated in Figure 4.

Program Goals

The projects in this program are a response to the above drivers, aiming to:

// Translate and communicate RD&E outputs to shareholders
// Engage key stakeholders to create awareness and demonstrate value
// Increase industry research capability and capacity
// Evaluate RD&E outcomes
// Investigate and understand matters impacting the industry

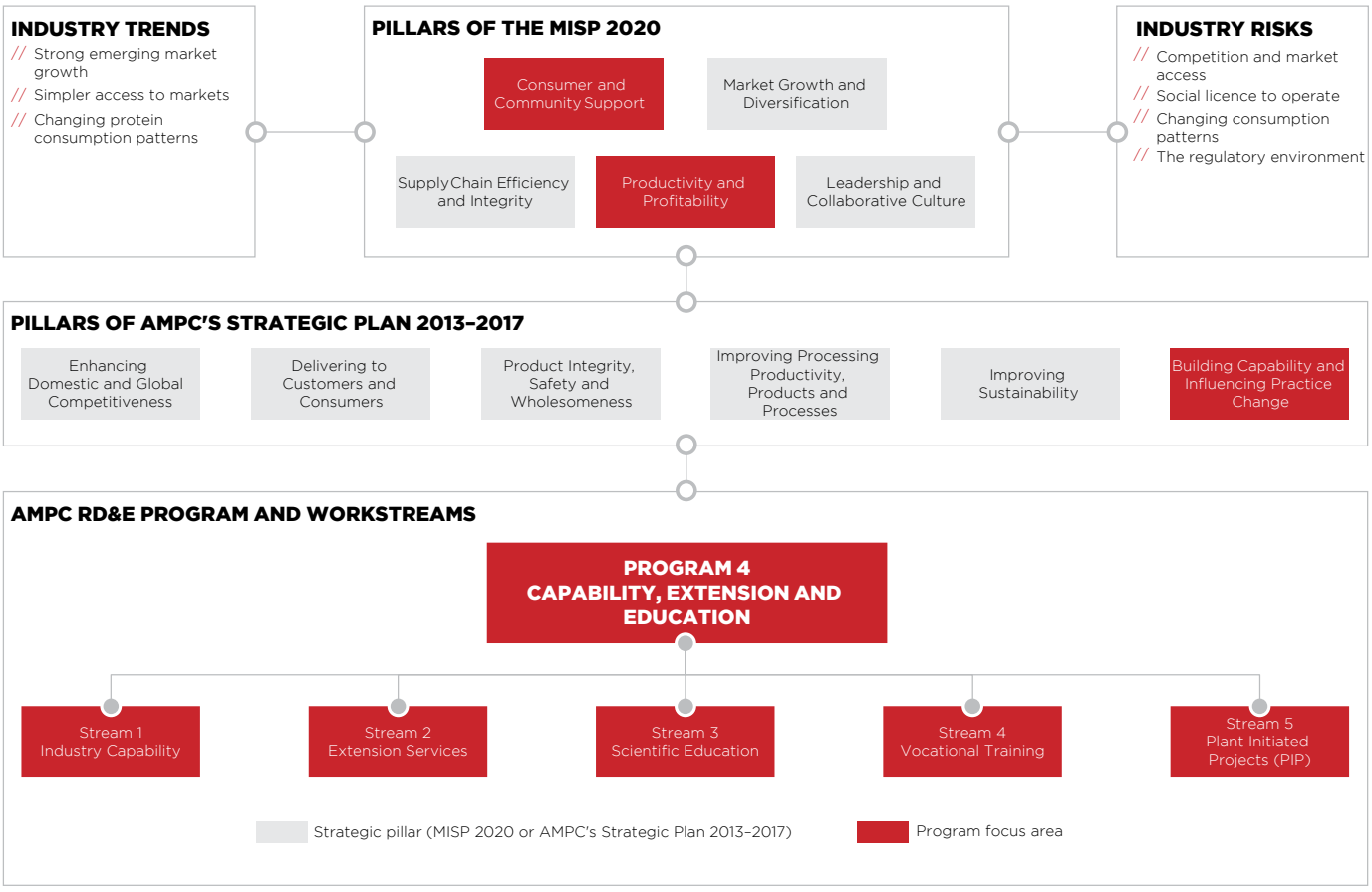


Figure 4. Elements influencing Capability, Extension and Education projects

WORKSTREAM P4.1 INDUSTRY CAPABILITY

Context: Developing capabilities within the red meat processing sector and amongst its personnel is key to its sustainability. Hence, AMPC has identified the importance of understanding the education and capability gaps that can exist among medium and small processors in order to tailor training resources accordingly.

Objective: This workstream identifies existing training, education and capability gaps and aims to develop new initiatives to fill those gaps. This will be done through both face-to-face training and online extension programs.

Project Description	
Assessment and Feasibility	
	**2017-1023: Provisional business cases to determine appropriate models for a world-class red meat processing centre of excellence** **Objective:** Build a business model for a virtual innovation centre representing the adoption arm of AMPC, in line with its innovation strategy and innovation-driven operating model to aid in accelerating incremental innovation while introducing disruptive technologies **Expected outcomes/deliverables:** // A business case for the optimum design and structure of a potential centre, including an assessment of the investment merits for each option

	**2017-1026: Analysis of the existing technologies developed in artificial intelligence and case study to develop capabilities around automated animal health assessment and meat inspection**
	Objective: Identify, through a desktop literature review of medical (and other) science and technologies fields, the emerging Artificial Intelligence (AI) and sensing technologies that may be applied towards automated assessment of pre- and post-mortem animal health in red meat processing plants
	Expected outcomes/deliverables:
	// Summary of emerging AI and sensing technologies and potential benefits for the red meat industry
	// Economic modelling and ROI of AI and sensing technologies and analysis of value created along the value chain
	// Recommendations for industry engagement

Prototype and Development	
	**2017-1020: 'Meat Matters! We all have a steak in this!': Extension of information resources on the red meat processing industry to primary and secondary schools** **Objective:** Develop primary and secondary educational resources in hard-copy and online formats to introduce young people to the red meat industry (production and processing) in Australia and the diverse careers within it **Expected outcomes/deliverables:** // Development of a series of primary and secondary educational resources: four units of inquiry and their assessment rubrics; videos for teachers, students and industry transfers; an image gallery to support students to undertake their 'student tasks'; an interactive whiteboard resource; evaluation report; an engagement and communication strategy; and metadata records
	**2017-1024: Developing a model for meat inspection and quality assurance employment outcomes for university graduates and undergraduates** **Objective:** Develop a model of meat inspection and Quality Assurance (QA) training and recruitment which can be implemented in partnership between Australian universities, the red meat industry and the Department of Agriculture and Water Resources (DAWR). This will address a meat inspector and QA recruitment problem affecting the red meat industry. The model will also provide university students with a recognised qualification which will enhance their employment opportunities

Prototype and Development (continued)

Expected outcomes/deliverables:

// Development and trial of a model of training whereby undergraduate and graduate university animal science students receive training as meat inspectors and quality assurance officers

2017-1082: Developing a model to support the employment of migrants and refugees in the Australian meat processing industry

Objective: Facilitate the successful employment of migrants as part of the domestic meat processing workforce, support meat processors to benefit from the cultural diversity of these employees, and improve the skills, knowledge and expertise of employer supervisors and managers in working with people from refugee and migrant backgrounds

Expected outcomes/deliverables:

// Identification of available government and community support services

// Development and trial of a model for employing a group of 10–15 migrants at a suitable processing site

2017-1077: An integrated scholarship program in water, water re-use and environment

Objective: Upskill the current red meat industry workforce and attract new skills through targeted education and professional development programs. This proposal aims to extend a strong existing research partnership between University of Queensland and AMPC through the development of a strategic education and extension partnership in the areas of water usage, treatment and re-use, and the environment

Expected outcomes/deliverables:

// Development of a critical mass of industry-ready students and research outcomes in the areas of water, water treatment and re-use, and the environment through industry placements, PhD scholarships, postdoctoral fellowships, vocational trainings, academic support for development, advance coursework programs, etc.

Implementation and Upscaling

2017-1015: Leveraging strategic energy projects to enhance productivity at red meat processing plants

Objective: Apply existing energy research via education and engagement activities (face-to-face demonstrations) at 'implementation ready' small and medium processors

Expected outcomes/deliverables:

// Formation of a group of 'implementation ready' small and medium processors who are ready to invest in energy productivity to improve their overall business outcomes

// Reduced energy costs per carcase processed and improved energy productivity across the sector, contributing to the 2030 National Energy Productivity target to increase energy productivity by 40%

2017-1010: Ammonia refrigeration training programs

Objective: Roll out ammonia refrigeration training programs using the model developed and trialled under the professional development program in 2015–2016, and seek to build further registered training organisation (RTO) capability during the roll-out

Expected outcomes/deliverables:

// Roll-out of three further ammonia refrigeration training programs (Southern NSW, SA and WA)

2017-1019: 'Meat. Your. Future.': promoting Australia's red meat processing industry: developing a structured approach to improving community perceptions of the industry

Objective: Redefine community perceptions of the Australian red meat processing industry, by positioning the industry as a well-respected, innovative, career-rich option

Implementation and Upscaling (continued)	

	**Expected outcomes/deliverables:**
	// A comprehensive strategic communications plan implemented in a staged and modular fashion over an 18-month period
	// Valuable contribution to the domestic economy – to ultimately attract more workers to the industry

Total AMPC contribution for workstream P4.1	**$2,388,110**

WORKSTREAM P4.2 EXTENSION SERVICES

Context: One of the main challenges identified to remain competitive in the meat industry is to ensure that the outcomes of research and development are successfully communicated and disseminated among all processors in order to promote implementation.

Objective: This workstream supports the extension and adoption strategies to ensure RD&E outputs deliver the expected value to the overall industry.

Project Description	
Assessment and Feasibility	
	**2017-1001: Meat industry efficiency and innovation capacity enhancement; benchmarking technologies and systems from the automotive industry** **Objective:** Accelerate the adoption of new technologies by benchmarking the automotive and other manufacturing industries **Expected outcomes/deliverables:** // Creation of a database for a rapid knowledge transfer in order to improve red meat industry's innovation capacity on a sustained basis. This database will generate the basis for several future research activities in line with AMPC's capability for building strategic plans)
Prototype and Development	
	**2017-1018: Development of an online virtual abattoir for education and training** **Objective:** Produce a learning tool, a web-based meat production training and educational resource, to provide an enhanced experience for learners and flexibility in associated content to target different audiences **Expected outcomes/deliverables:** // Build two virtual abattoirs (covering sheep and beef production) for training using expertise developed by the University of Melbourne
Implementation and Upscaling	

	**2017-1002: Meat industry environment network**
	Objective: Provide a means to share information on RD&E activities relating to AMPC's Environment and Sustainability RD&E Program. The purpose is to promote engagement with environment managers from processing establishments, researchers, regulators and industry consultants to ensure all parties meet new regulatory requirements and can act on the information disseminated
	Expected outcomes/deliverables:
	// Three state-based network meetings
	// Showcase clips (based on filmed site visits) including interviews with site managers and engineers for loading onto AMPC's website

	**2017-1004: Meat industry engineering network** **Objective:** Provide extension services for AMPC research and development activities: to provide plant-based engineering personnel, researchers and regulators with a forum to explain, explore and discuss issues and solutions

Implementation and Upscaling (continued)	

	**Expected outcomes/deliverables:**
	// Two meetings over a 12-month period in identified regional locations, complemented by the operation of an interactive, multi-streamed chat room or forum enabling engineers to receive real-time support
	// Identification of capability gaps, and the future qualifications and experience requirements of meat processing engineers

	**2017-1005: Meat inspection and quality assurance network** **Objective:** Develop the network as a means of distributing new information and providing extension services for AMPC RD&E activities among researchers, industry QA practitioners, trainers and regulators, and to enable discussions and explanations around the implications of new developments **Expected outcomes/deliverables:** // Promotion of industry-funded innovations and research through 14 network meetings
	**2017-1007: Meat industry training network** **Objective:** Provide the means of ensuring RD&E outcomes, innovations and new regulatory and industry requirements are communicated to State and Federal Training Authorities, embedded into industry training systems, and delivered and assessed in a consistent manner across the industry **Expected outcomes/deliverables:** // 14 state-based network meetings, including all States and Territories except the ACT

	**2017-1073: Facilitating the QCMPA network**
	Objective: Provide information on legislative and regulatory updates; disseminate recently completed RD&E outcomes; and provide small processors with the opportunity to discuss industry issues and workshop initiatives to support sustainability
	Expected outcomes/deliverables:
	// Support of the 'young guns' workshop training and two network meetings over the year
	// Face-to-face trainings of resources specifically adapted for small processors

	**2017-1028: The Australian Q Fever Register**
	Objective: Provide continued high-quality management of the Q Fever Register
	Expected outcomes/deliverables:
	// Improvements to register systems and efficiently managed register activities
	// Communications are implemented to increase awareness and the use of the Register

	**2017-1012: MINTRAC provision of extension services to red meat processors 2016–2017**
	Objective: Provide extension services to red meat processors including training advice, career services, industry education, training products and forums to support industry development
	Expected outcomes/deliverables:
	// Identification of industry innovations and requirements which require changes to training packages
	// Provision of career services to red meat processors
	// Provision of industry education and training advice to meat processing companies and State/Commonwealth government agencies
	// Distribution and updating of AMPC training products including advice on delivery strategies and assessment protocols
	// MINTRAC representation on industry-related committees, forums and conferences

Total AMPC contribution for workstream P4.2	**$1,295,489**

WORKSTREAM P4.3 SCIENTIFIC EDUCATION

Context: Improving collaboration with the government, Rural Research and Development Corporations

(RDCs), and educators can lead to significant results such as innovative developments, reduced duplication and improved efficiency.

Objective: This workstream focuses on fostering professionals who contribute to industry innovation and on investing in integrated scholarship programs that develop student skills (undergraduates, post graduates and post doctorates) and promote the intent of undertaking research careers in the red meat processing sector.

Project Description	
Prototype and Development	

	**2017-1074: Creation of an integrated scholarship program in red meat safety and microbiology**
	Objective: Provide graduates with expertise in red meat safety and microbiology; awareness of specific industry issues; and preparatory knowledge to enter the red meat processing workforce
	Expected outcomes/deliverables:
	// Establishment of an integrated scholarship scheme in red meat safety and microbiology for undergraduates, specifically post graduate coursework; PhD scholarships, and a post doctoral fellowship
	// Conducting of an annual forum to facilitate knowledge sharing among scholarship holders, partners, AMPC and the industry

	**2017-1076: Pathways to upskilling the meat industry in the production of high quality meat**
	Objective: Develop meat science skills in Masters Students, PhD students and post doctorates to facilitate long-term RD&E relating to the meat industry; to attract, recruit and train outstanding students and post doctorates in key capability gaps; and to develop a path to retain these skills in the meat industry
	Expected outcomes/deliverables:
	// Research results from one post doctorate, five PhD students, and five Masters scholarships
	// Conducting research programs on the premises of processing plants to enable rapid technology and knowledge transfer

	**2013-5045: Collaborative primary industries health and safety partnership program** **Objective:** Understand the various elements that influence WHS in the primary industries; address the barriers to the adoption of improved WHS outcomes; and assist industry to apply approaches that will deliver improved WHS outcomes within the primary industries **Expected outcomes/deliverables:** // Sustainable improvements to work health and safety outcomes in the primary industries

	**2016-1026: An integrated scholarship program in process engineering - Year 1**
	Objective: Establish a prestigious Integrated Scholarship Scheme that will educate and train the future red meat processing workforce
	Expected outcomes/deliverables:
	// Creation of a hub for process engineering and technology research
	// Support of students that undertake studies and research that are fully aligned with AMPC's strategic plan
	// Provision of ongoing educational opportunities built on a foundation of existing courses at QUT

	**2017-1027: Educational pathways: Creating a highly skilled meat industry - Year 1**
	Objective: Create a holistic educational program to develop people to have the skills and knowledge to contribute to the meat industry over the coming decades (Bachelor Degree Program and Honours Degree Program)
	Expected outcomes/deliverables:
	// Creation of a hub for process engineering and technology research
	// Support of students that undertake studies and research that are fully aligned with AMPC's strategic plan
	// Provision of ongoing educational opportunity for the benefit of the Australian meat industry

Prototype and Development (continued)	

	**2017-1075: Creation of an elite meat undergraduate scholarship program**
	Objective: Develop and retain undergraduate students in the red meat processing industry through building a critical mass of skilled workers who are offered new mechanisms such as training courses, work placement and 12-month graduate employment. The program involves seven universities around Australia (Adelaide, Charles Sturt, Melbourne, Murdoch, Sydney, New England, Queensland)
	Expected outcomes/deliverables:
	// Two scholarships to be offered annually at the seven collaborating universities, including two training scholarships
	// Over a five-year period, 130 third-year student scholarships allocated through competitive selection
	// Following graduation, each student will be employed by their industry partner in a 12-month graduate program with hands-on practical modules

Total AMPC contribution for workstream P4.3	**$4,960,095**

WORKSTREAM P4.4 VOCATIONAL TRAINING

Context: The red meat processing industry faces continual changes to regulatory requirements, which result in the need for ongoing professional development and training for employees in a context where it is difficult to attract and retain highly skilled personnel.

Objective: This workstream focuses on building and retaining capability within the red meat industry through the provision of vocational training and upskilling opportunities for plant staff.

Project Description	
Prototype and Development	

	**2017-1021: Protecting Australia's meat processing industry: crisis management and the development of a proactive approach to potential disease outbreaks and exotic species incursion**
	Objective: Provide AMPC with a training package that will equip red meat industry workers with the knowledge and skills required in the event of an Emergency Animal Disease (EAD) or an exotic species incursion
	Expected outcomes/deliverables:
	// Development of a training package in draft format, to be reviewed at a workshop with AMPC steering committee and industry representatives
	// Pilot program to test the package with a small group
	// Implementation of materials in an interactive online format, enabling staff to refresh their knowledge and understanding
	// Provision of a repository of project documentation, allowing materials revision and updates with changes to Australia's EAD response arrangements

	**2017-1013: Redeveloping the Core Unit CDs into online resources for meat processors** **Objective:** Replace the 17-year old Core Unit CDs with a series of short, sharp online films which can be used by processing companies and trainers alike to support induction, careers promotion, commencement of training, contractor information and refresher training **Expected outcomes/deliverables:** // Development and translation of at least 10 multi-language films on a series of topics agreed with meat processors: each 2 to 3-minute film will be accompanied by downloadable quizzes and worksheets available in multiple languages
	**2017-1027: Updating extension materials of interest to the red meat processing industry** **Objective:** Review, consolidate and update the wastewater management and biogas extension material and transfer the static (Word-based) resources to engaging multi-media and digital formats, readily digestible by a wide audience

Prototype and Development (continued)

Expected outcomes/deliverables:

// Consolidation and update of AMPC's two wastewater resources into one manual
// Update AMPC's two biogas guideline/manuals and various other reports
// Content transfer of the reviewed wastewater manual into three interviews/videos and three factsheets with related checklists
// Content transfer of the reviewed biogas resources into three interviews/videos and three factsheets with related checklists

2017-1017: Mobile apps development for the Australian meat processing industry

Objective: Roll out a concise training and learning system, encompassing all information and self-testing strategies required to educate and re-educate industry members, all contained in a portable interactive device

Expected outcomes/deliverables:

// Development and deployment of mobile phone training app(s) for the Australian meat industry - from concept to working example for testing, demonstration, evaluation and final release

Implementation and Upscaling

2017-1008: Meat processing professional development program

Objective: Extend research and development outcomes into daily practice and ongoing industry training programs and improve the knowledge of QA personnel in recent advancements in meat science and in quality assurance

Expected outcomes/deliverables:

// Delivery of face-to-face and online training courses to suit industry needs
// Development of pilot delivery extension forums and testing with industry and RTOs
// Fostering of consistent and high-quality technical expertise of industry practitioners
// Facilitation of early identification and addressing of critical training requirements
// Building of industry capability to incorporate new knowledge and innovations into training systems

2017-1016: Professional development training webinars for QA managers

Objective: Build QA managers, capability and expertise in industry history (i.e. why we have the rules and practices we have) and in regulatory management so they are able to identify and act on efficiencies to increase productivity and profitability

Expected outcomes/deliverables:

// Development of 'Professional Development Training Webinars' for QA staff on 'hot' industry topics

2017-1078: Australian agribusiness leadership program

Objective: Increase the pool of industry representatives who have the capability to engage in leading the industry into the future

Expected outcomes/deliverables:

// Investment in four scholarships each year for three years

2017-1083: Scholarships for the advanced diploma in meat processing

Objective: Provide access to leadership development through the advanced diploma program for meat processing employees and provide recognition of AMPC's contribution to industry leadership development though approved communication methods

Expected outcomes/deliverables:

// Awarding of up to 12 scholarships to eligible applicants

2017-1080: 2017 ABARES science innovation awards

Objective: AMPC to support and sponsor the ABARES young people in Agriculture Award, which recognises innovative scientific projects from young rural innovators that would contribute to ongoing success and sustainability of Australia's red meat industry

Project Description	
Implementation and Upscaling (continued)	
	2017-1079: Australian rural leadership program - course 24 **Objective:** Produce a network of informed, capable and ethical leaders who are able to work collaboratively to advance the interests of their industries, businesses, communities and rural Australia in general **Expected outcomes/deliverables:** // Sponsorship of one scholar from the red meat processing industry

	2016-1019: Red meat processing upskilling scholarship program
	Objective: Deliver an upskilling scholarship program for existing red meat processing employees to upgrade their current knowledge and qualifications and to network and share ideas with fellow scholarship holders and industry representatives
	Expected outcomes/deliverables:
	// 26 scholarships of $5,000 each over a five-year period
	// Provision of an online support network to scholarship recipients in completing their upskilling initiative
	// Delivery of a minimum of two recorded study skills webinars per year
	// Case studies of outcomes to be used to promote further scholarships and recognition of the program across industry

Total AMPC contribution for workstream P4.4	**$1,277,010**

PROGRAM 5: INDUSTRY IMPROVEMENT AND ECONOMIC ANALYSIS

Projects in this program aim to understand the economic impacts and levers for the industry, through economic modelling, statistical analysis, benchmarking and networked information flows.

Program Drivers

The need to closely monitor the industry's economic health and outlook results from the growth of emerging markets; changes in consumer needs; and the risk of regulatory changes (e.g. access to markets resulting from developments in Free Trade Agreements).

To prevent damages from sudden or slow influences on the industry, as illustrated in Figure 5, there needs to be an accurate understanding of the Australian industry's position within global markets; hence, economic modelling is important.

The projects in this program address the following strategic imperatives from AMPC's Strategic Plan 2013-2017:

// Investigate, understand, communicate and respond to changes and influences in the red meat processing industry
// Ensure business sustainability and continuity is enhanced
// Develop industry improvement-related research outputs packages aimed at encouraging industry
// Practice change around regulatory cost and information management throughout the supply chain

Program Goals

This program addresses the above drivers through the following aims:

// Maintain an up-to-date perspective on risks and industry trends and responses, as well as the social impact of the industry
// Facilitate collaboration through electronic means, such as animal health data sharing and economic modelling

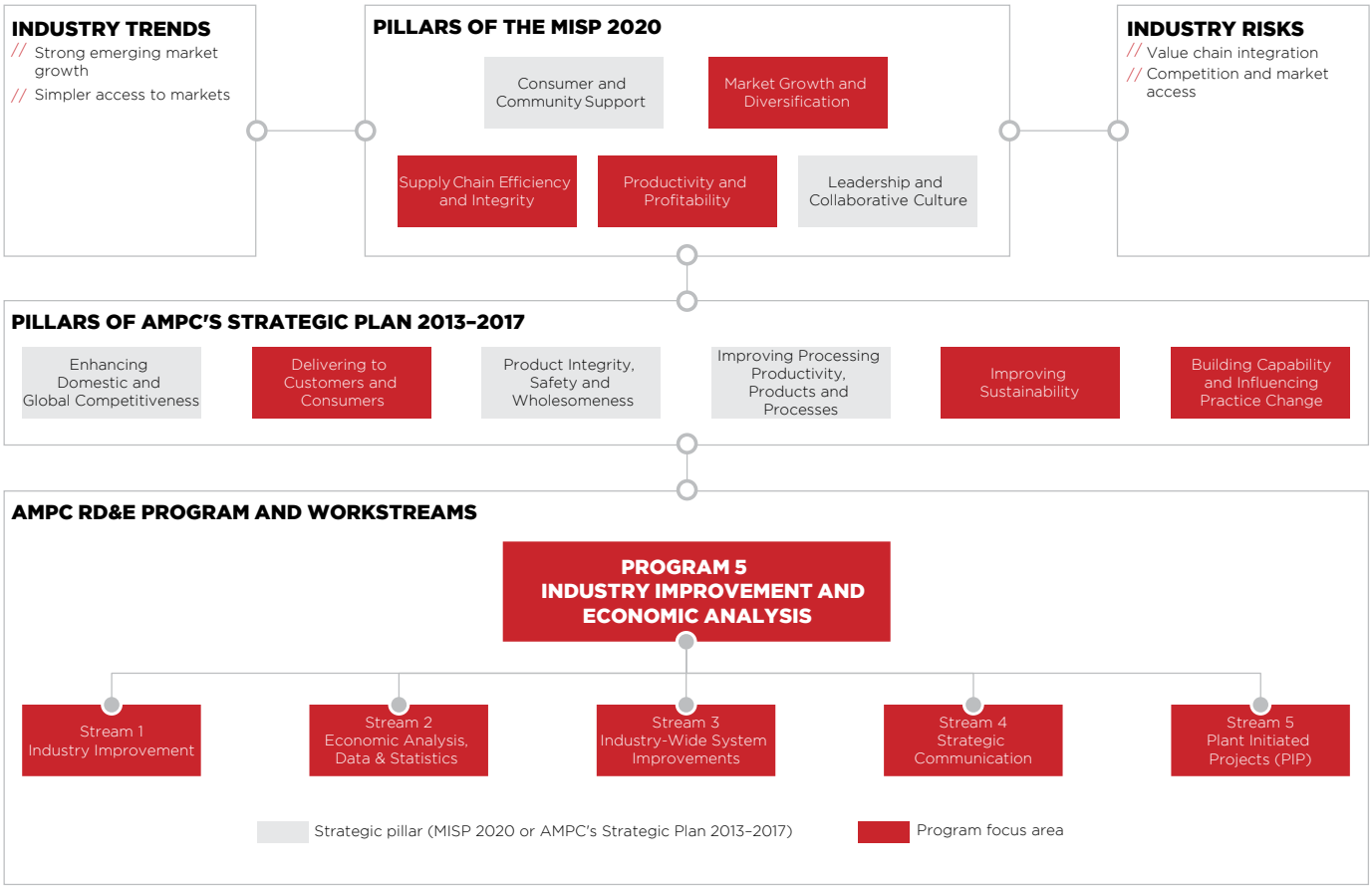


Figure 5. Elements influencing Industry Improvement and Economic Analysis projects

WORKSTREAM P5.1 INDUSTRY IMPROVEMENT

Context: As competition is growing in the meat industry, the need for competitiveness analysis, benchmarking studies and quantification of economic factors associated with regulatory compliance, industry marketing, energy policy, carbon emissions and infrastructure investment is inevitable.

Objective: This workstream focuses on performing research and analysis to help improve the overall performance (productivity, profitability and sustainability) of the Australian meat processing industry against its international competitors.

Project Description	
Prototype and Development	

	**2017-1066: Electronic data collection for meat inspection**
	Objective: Resolution of issues associated with the current data collection systems at small to medium-size processing plants to achieve:
	// Easy recording of animal health data on sheep floors to address speed-of-chain issues
	// Voice recognition
	// Automated system of alerts
	// Capability to generate automatic reports to supply chain managers, livestock buyers and QA managers
	Expected outcomes/deliverables:
	// Development and trial of a simple database for small to medium-size sheep processing plants

Total AMPC contribution for workstream P5.1	**$75,000**

WORKSTREAM P5.2 ECONOMIC ANALYSIS, DATA AND STATISTICS

Context: Understand the economic drivers of the industry, e.g. drivers of supply and demand, to best prepare for increasing competition within the red meat industry.

Objective: This workstream focuses on understanding the economic drivers of the industry and generating economic models for the red meat supply chain in order to better assess supply and demand, constraints and opportunities.

Project Description	
Assessment and Feasibility	

	**2017-1067: Investigation of options and development of models for industry supply chain information system standards and programs**
	Objective: Investigate options and develop models for industry supply chain information system standards and programs
	Expected outcomes/deliverables:
	// Definition of viable models for red meat industry supply chain information standards
	// Provision of an adoption model and framework to move the industry from the current fragmented industry supply chain information approach to a coordinated supply chain information system
	// Development of 'Australian Red Meat Industry Supply Chain Standards' workshops

	**2017-1098: Red meat industry risk analysis 2016**
	Objective: Develop a strategic risk assessment and response plan for the Australian red meat industry and review and update AMPC's Risk Management Plan
	Expected outcomes/deliverables:
	// Publication of the risk analysis for the red meat industry including industry trends and risks
	// Provision of high-level responses to address industry risks

Total AMPC contribution for workstream P5.2	**$171,400**

WORKSTREAM P5.3 INDUSTRY-WIDE SYSTEM IMPROVEMENTS

Context: The red meat industry systems have evolved over time. Ensuring its overall sustainability and continuity appears to be strategic for AMPC to maintain its competitiveness and leadership.

Objective: This workstream focuses on identifying mechanisms by which the Australian red meat processing sector can become more competitive through industry-wide system improvements with a focus on areas where industry-wide reputation is critical to export success.

Project Description	
Assessment and Feasibility	

	**2017-1062: Development of economic models for analysis of regulatory and related costs and duplication in red meat processing**
	Objective: Develop economic models for the analysis of regulatory and related costs and the duplication in red meat processing, to facilitate the achievement of both public policy and commercial cost-reduction initiatives by processors
	Expected outcomes/deliverables:
	// Options for reducing duplication and improved effectiveness
	// Sub-models to assess potential industry benefits and more broadly the economy of regulatory and quasi-regulatory changes, specifically in the areas of industry audits and export certification
	// An international cost comparison model to enable analysis of key components of processing costs in four countries, using public and private data sources

	**2017-1097: RRD4P round 2 accelerating precision agriculture to decision agriculture** **Objective:** Demonstrate evidence-based digital decision making in agriculture using big data **Expected outcomes/deliverables:** // Assessment of the potential benefits to the processing industry from data integration and information sharing within red meat value chain
Total AMPC contribution for workstream P5.3	**$480,856**

WORKSTREAM P5.4 STRATEGIC COMMUNICATIONS

Context: Managing relationships and communication with key stakeholders is a requirement to lift AMPC's visibility to the upper lever and differentiate it from other similar organisations.

Objective: This workstream focuses on producing strategic marketing communications based on a three-year plan to substantially lift AMPC's visibility, and to differentiate it from other meat industry organisations.

Project Description	
Research and Studies	
	**2017-1061: Social impact study of red meat processing in Australia** **Objective:** Identify, describe, empirically measure, and evaluate the social impact of the Australian Red Meat Processing Industry (ARMPI) in order to enhance understanding of its contributions from a social perspective in rural and regional communities **Expected outcomes/deliverables:** // Detailed report documenting the research findings of the project on the social impact of ARMPI at local, regional and industry levels
Total AMPC contribution for workstream P5.4	**$87,062**

PROGRAM 6: JOINT PROGRAM

The Joint Program is a collaboratively funded RD&E, marketing and market access program between AMPC and Meat & Livestock Australia (MLA).

Program Drivers

The diverse content of the program is a response to a comprehensive series of inputs mentioned in Figure 6 that include MISP 2020, AMPC's Strategic Plan 2013–2017, industry trends and relevant strategic risks.

Program Goals

The aims of this program are varied:

// Develop a consolidated electronic food safety and integrity system throughout the entire supply chain
// Build an evidence base of red meat health benefits and ensure its inclusion in the Australian dietary guidelines
// Develop a marketing and communications strategy to benefit public awareness
// Assess and maintain market access for Australian exports
// Strategically innovate in the value chain to improve food safety and shelf-life
// Test and develop efficient and non-intrusive techniques to measure meat quality
// Review certain regulatory standards and increase awareness among inspectors

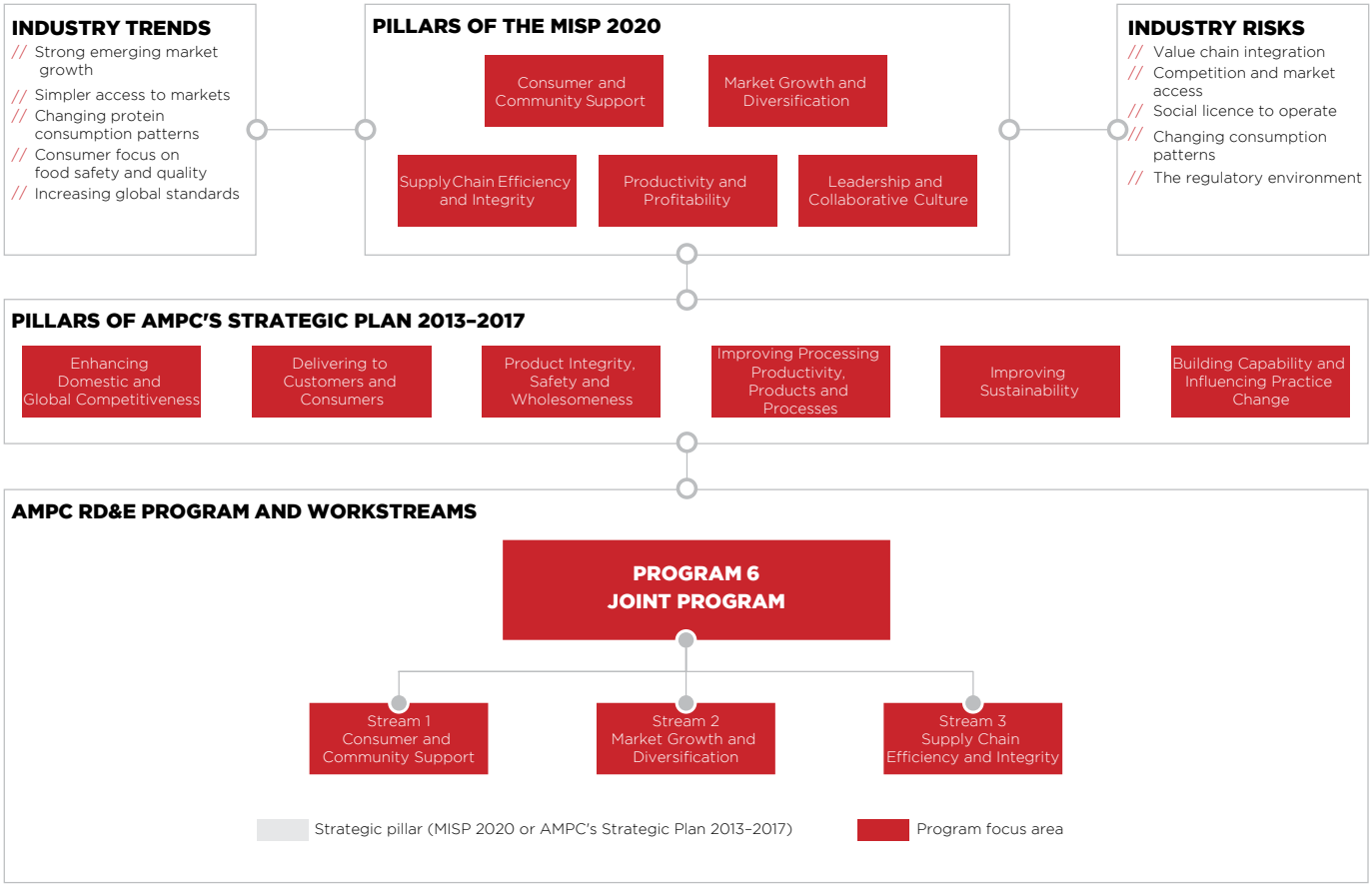


Figure 6. Elements influencing Joint Program projects

WORKSTREAM P6.1 CONSUMER AND COMMUNITY SUPPORT

Context: Societal expectations and the demographics of the community are changing both nationally and internationally and imply major shifts in demand, including an overall reduction in per capita meat consumption.

Objective: This workstream aims at enhancing and communicating the value proposition of red meat to the customers, consumers and community and demonstrating the importance of red meat in a healthy daily diet.

Area description	
Red Meat in a Healthy Diet	

Objective: Build evidence to maintain the recommendation for and inclusion in Australian dietary guidelines of red meat and raise awareness of the benefits of red meat
Expected outcomes/deliverables:
// Development of credible scientific evidence
// Development and adoption of nutrition education tools to promote and support consumption of red meat in a healthy diet	

Total AMPC contribution for workstream P6.1	**$1,042,805***

WORKSTREAM P6.2 MARKET GROWTH AND DIVERSIFICATION

Context: Strategies for unlocking market potential and research to address current or emerging market access barriers are of major importance to the red meat processing industry's sustainability, profitability and future net value.

Objective: This workstream aims to develop and deliver market insights and promote red meat nationally and internationally.

Area description
Market Access Analysis

Objective: Conduct projects that support and maintain favourable market access in the red meat industry
// Support industry and government to maintain and defend existing favourable market access conditions
// Assist in positioning Australia's red meat and livestock sector for favourable multilateral, plurilateral, bilateral and sectoral trade outcomes
// Assist with the reduction of non-tariff (technical) trade barriers
Expected outcomes/deliverables:
// Advocacy plans to support industry to reduce economic barriers and maintain favourable access conditions
// Action plans to support industry to reduce technical barriers to trade and mitigate access risks
// Research on technical barriers to the market

Innovation Insights on Product and Packaging

Objective: Use innovation insights to drive international innovation strategies and investments that increase high-value demand and build value chain capability
Expected outcomes/deliverables:
// Report detailing findings of insights research that identifies new high-value growth opportunities in emerging markets and market segments in the next three to five years
// Assessment of how value chains should be designed to capture value from future opportunities
// Development of product and packaging solutions in key opportunity areas
// Development of smart packaging concepts that deliver on food safety, provenance, traceability and shelf-life

* AMPC's contribution of R&D funds to the Joint Program has been grossed to a 100%

Area description	
Marketing and Promotion Analysis in Export Markets	

Objective: Conduct and monitor projects that directly address exports markets:
// Provide industry with timely and valuable market intelligence and consumer insights
// Support industry and government to maintain and defend existing favourable market access conditions
// Conduct brand-building activities to grow awareness of Australia's positive points of difference and build consumer loyalty
// Support brand owners in developing their brands to better differentiate them in international markets
Expected outcomes/deliverables:
// Research on market trends and competitor activities
// Detailed channel segmentation of export markets (retail and food service)
// Insights into market trends and consumer behaviour
// B2B facilitation activities to create strategic customer relationships and promote Australia's points of difference (food safety, integrity and quality)
// Execution of consumer promotional activities with strategic partners
// Support the CoMarketing Program	

Marketing and Promotion Analysis in the Domestic Market	

Objective: Conduct and monitor marketing and promotion projects directly related to the Australian red meat market:
// Develop and create promotion campaigns to increase sales impact from promotional campaigns
// Address consumer barriers to consumption by promoting red meat benefits
Expected outcomes/deliverables:
// Promotional activities targeting purchase drivers, supported by Independent Retail, National Accounts or Food Service
// Support of red meat innovation
// Consumer marketing activities across entire path to purchase to build awareness and preference for red meat
// Community education of red meat nutrition to shift attitudes and perceptions	

Total AMPC contribution for workstream P6.2	**$6,745,267***

WORKSTREAM P6.3 SUPPLY CHAIN EFFICIENCY AND INTEGRITY

Context: MLA and AMPC are working collaboratively to ensure the entire supply chain is at the leading edge of knowledge and practice in terms of safety, integrity and cost competitiveness.

Objective: This workstream focuses on conducting scientific research that supports food safety, assurance systems and meat and livestock integrity. It also invests in projects and initiatives that aim at developing new technologies that improve productivity and profitability.

Area/Project description	
Objective Measurement**	
Research and Studies	
	**2017-1040: Non-invasive prediction of dark cutting** **Objective:** Investigate the use of high-frequency ultrasound technology to estimate muscle glycogen concentration and limit the impact of dark cutting in the red meat industry **Expected outcomes/deliverables:** // Business case for the installation of high-frequency ultrasound technology to predict and limit dark cutting

* AMPC's contribution of R&D funds to the Joint Program has been grossed to a 100%

** Projects funded and managed by AMPC, outcomes shared with MLA

Research and Studies (continued)

2017-1046: Accelerated tenderisation of red meat for raw meat and food service applications

Objective: Innovatively explore emerging technologies to shorten and control the ageing process while maintaining consistent tenderness of meat (enzymatic treatment, high-pressure processing, stretching, pulsed electric field and very fast chilling)

Expected outcomes/deliverables:

// Report detailing new knowledge on the use of technology combinations to produce consistently tender meat for fresh, ready-to-eat and food service outlets

// Development of a predictive model of tenderisation and documentation of a range of options for red meat companies to accelerate and control meat tenderisation

// Collaboration with the Teagasc Meat Technology Centre of Ireland

Assessment and Feasibility

2017-1058: Contemporary chemical lean determination methods

Objective: Conduct an inter-laboratory comparison to validate the performance of methods used for Chemical Lean (CL) determination by Australian domestic and international facilities for meat export

Expected outcomes/deliverables:

// Identification of currently used methods for CL determination and associated providers

// Assessment and performance evaluation of methods used for CL analysis by domestic and international providers

// Development of a proposal for national standards for CL determination

2017-1011: Non-invasive measurement of meat quality in live animals using deep tissue raman spectroscopy

Objective: Reduce the level of dark cutting meat in Australia by developing sensor technologies that can be used to screen cattle in real time at the abattoir, either at receival, or immediately pre-slaughter. This will allow animals susceptible to dark cutting to be diverted so they can better recover their levels of glycogen

Expected outcomes/deliverables:

// Development of a novel technology combining subsurface Raman spectroscopy with nanosensors for domestic use

// Assessment of the technology as non-invasive and chemical-free for predicting meat quality

// Assessment whether this technology is suitable for real-time decision-making at the abattoir on dark meat cutting

// Construction of predictive model for qualitative and quantitative analysis of meat quality in real time using this new technology

2017-1057: Feasibility investigation for dynamic 3D-model of the carcase skeletal structure

Objective: Explore the feasibility of using an X-ray scanner at the start of the boning line to measure bone structure and construct a 3D skeletal model for each carcase. Such capability would enable the accurate location of bone structure at a downstream workstation without the further use of specific dedicated expensive X-ray scanning

Expected outcomes/deliverables:

// Feasibility assessment of dynamically manipulable 3D skeleton carcase model

2017-1070: An online system to assess beef quality characteristics

Objective: Evaluate the TenderSpecTM Beef Classification System for objective assessment of ribeye quality traits (including tenderness and marbling) in domestic beef to deliver high quality products; differentiate Australian beef in the international market; and increase processing efficiency

Area/Project description
Assessment and Feasibility (continued)

Expected outcomes/deliverables:
// Evaluation of the TenderSpecTM Beef Classification System in predicting the quality traits of beef
// Assessment of the capability of the TenderSpecTM Beef Classification System to evaluate marbling within the ribeye

Prototype and Development

2017-1100: Development and validation of a probe for measuring fat in lamb carcases
Objective: Develop automatic and accurate methods of measuring carcases for traits like farness and GR tissue depth, to aid a reduction by the red meat industry in carcase fat levels in line with domestic and international consumer demands
Expected outcomes/deliverables:
// Development of a probe to measure GR at chain speed
// Validation of the probe for robustness and accuracy
// Establishment of a pathway for commercial provision with the required technical backup

Food and Safety RD&E*
Research and Studies

2014-1069: Review of the post-mortem inspection and disposition schedules of the Australian Standard 469
Objective: Review post-mortem procedures and dispositions to improve their effectiveness, efficiency and relevance. This will assist in the preparation of technical market access cases by the Department of Agriculture to negotiate recognition with trading partners
Expected outcomes/deliverables:
// Revised inspection procedures that focus primarily on food safety risk
// Removal of procedures that create more risks than they address
// Validated, alternate risk management practices for selected conditions of public health and/or animal health significance
// Inspection procedures that optimise product utilisation
// Reduced pathways for cross-contamination by foodborne hazards at carcase dressing
// Identification of information sharing to improve supply chain efficiency

2017-1068: Process control monitoring – is there a better way?
Objective: Examine process control and food safety monitoring as it applies to the Australian meat industry in 2016 and investigate the potential of improved systems
Expected outcomes/deliverables:
// Analysis and interpretation of all domestic process monitoring data (assessment of current measurements systems and limits)
// Identification and investigation of improved monitoring systems

Assessment and Feasibility

2017-1053: Hyperspectral ZT and food safety determination (phase 2)
Objective: Detect and evaluate meat quality objectively using new hyperspectral technology, which has shown great results in identifying bile, faeces and ingesta
Expected outcomes/deliverables:
// Assessment of how the technology would operate in beef and lamb meat processing facilities at line, using preliminary findings
// Improvement of algorithm development during previous phase

*Projects funded and managed by AMPC, outcomes shared with MLA

Assessment and Feasibility (continued)

2016-1059: Impact of extended shelf life of chilled beef in overseas markets

Objective: Demonstrate that long shelf-life (> 120 days) can be attained for chilled beef under optimised conditions by interrogating the cold supply chain under real-life conditions in China. This would enhance Australia's international export competitiveness, establish collaborative links between Australian and Chinese researchers, improve scientific expertise, and enhance industry capability in the extension of beef shelf-life

Expected outcomes/deliverables:

// Recommendations and guidelines for processors and a framework for optimising product integrity, to be disseminated to the Australian beef export community and to appropriate Chinese and Asian stakeholders

Prototype and Development

2017-1009: Real-time spectroscopic system for contaminant detection in red meat

Objective: Develop and apply a monochrome imaging device which identifies the presence of pathogens and contaminants in meat to replace a variety of current techniques which require laboratory testing or clinical inspection, which are too time-consuming for modern processing facilities

Expected outcomes/deliverables:

// Design and development of a low-cost and real-time system to identify the presence of certain pathogens and contaminants in meat

2017-1049: Lab-on-a-chip system for microbial contamination

Objective: Achieve near real-time monitoring of meat contamination without the need for sample preparation or technical skills. This would reduce financial and reputational costs stemming from recall or rejection, increasing export and domestic consumer confidence in the safety and quality of meat

Expected outcomes/deliverables:

// Development of a method for a much faster detection of specific microorganisms on carcases and surfaces in red meat processing facilities, based on existing techniques under development at the University of Tasmania

2016-1326: Microplasma disinfection of meat

Objective: Investigate and develop a new method for neutralising microbial contaminants on meat surfaces by the use of electrically-generated plasmas

Expected outcomes/deliverables:

// Evidence of the new purchase, assembly and functioning of micro-discharge equipment

// Demonstration of the technology and quantification of the results (in particular, degree of inactivation of non-pathogenic microbes)

// Estimation of the operating costs of a scaled-up plant based on the power consumption and capital depreciation, to be informed by the performance of the lab-scale equipment

2017-1072: Identifying strategies for regulator awareness - Delivery model assessment, development and delivery of training to on-plant regulators on industry systems and practices

Objective: Address awareness of the Australian red meat industry's systems and practices and facilitation of regulators to implement policy, by making on-plant decisions that are practically viable

Expected outcomes/deliverables:

// Assessment of possible delivery models for trainings

// Development of training to on-plant regulators on industry systems and practices where greater regulator awareness and capability would be beneficial to the industry

// Delivery of training through the selected model chosen through the initial assessment

Area/Project description	
Prototype and Development (continued)	

2017-1071: Identifying strategies for regulator awareness - Development and delivery of workshops on industry systems and practices for regulators
Objective: Address awareness of the Australian red meat industry's systems and practices and facilitate regulators to make policy decisions that are practically viable and not cost-prohibitive
Expected outcomes/deliverables:
// Inclusion of targeted regulators in the workshops
// Provision of training on industry systems and practices where greater regulator awareness and capability would be beneficial to the industry
// Site visits to raise awareness of on-plant environment and practical information	

National Livestock Identification System (NLIS)	

Objective: Improve productivity and profitability across the supply chain through chain technologies and systems underpinning livestock and product integrity
Expected outcomes/deliverables:
// NLIS is 'fit for purpose' to underpin market access and premiums for domestic product
// RD&E undertaken to identify and implement new through-chain technologies and standards to underpin customer assurances
// Identification of the next horizon product and process integrity attributes expected by customers	

Industry Integrity Systems	

Objective: Develop integrity systems along the entire supply chain so they are capable of being electronically based and are fully integrated by 2020
Expected outcomes/deliverables:
// Development of consolidated industry integrity systems and safe meat policy structures
// Development of an enhanced integrity system interface for users that increases usability and compliance
// eNVD system that is functional and meets whole-of-chain requirements	

Total AMPC contribution for workstream P6.3	**$8,606,014***

* AMPC's contribution of R&D funds to the Joint Program has been grossed to a 100%

APPENDIX

AMPC PROJECT PORTFOLIO PROVIDERS, FY2016–17

AMPC is grateful to the many RD&E providers who have enabled the security and advancement of Australia's red meat processing industry:

- AgResearch Limited
- All Energy Pty Ltd
- Angela Colliver Consulting Services Pty Ltd
- AP Food Integrity Pty Ltd
- Applied Robotics International Pty Ltd
- Australian Animal Health Council Limited
- Australian Pork Limited
- Australian Rural Leadership Foundation Limited
- AusVet Animal Health Services Pty Ltd
- Business and Manufacturing Consultancy UK
- Biomax Technologies Pte Ltd
- BWD Creative
- Callaghan Innovation
- Cold Logic Pty Ltd
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Curtin University of Technology
- Danish Meat Research Institute
- Department of Primary Industries (NSW)
- Dr L. Hewitt
- Ecoefficiency Group Pty Ltd
- Enecon Pty Ltd
- Energetics Pty Ltd
- Environmental Engineers International PTY Ltd
- Ernst & Young
- Exos Limited
- Freshagenda Pty Ltd
- Food and Veterinary Services
- George Christofidis
- GHD Pty Ltd
- Greenleaf Enterprises Pty Ltd
- Greyshed LLC
- Joan Lloyd Consulting Pty Ltd
- Management for Technology Pty Ltd
- MAR Holding Co. Pty Ltd
- Murdoch University
- Norman Blackman
- National Meat Industry Advisory Council Limited (MINTRAC)
- Queensland University of Technology (QUT)
- Royal Melbourne Institute of Technology (RMIT)
- Rural Industries Research & Development Corporation (RIRDC)
- Scott Automation and Robotics
- Sefton and Associates Pty Ltd
- SG Heilbron Pty Ltd
- Sheep CRC Ltd
- SMEC Australia Pty Limited
- South Australian Research and Development Institute (SARDI)
- Southern Engineering Solutions Ltd
- Strategic Engineering Pty Ltd
- TenderSpec LLC
- University of Queensland (UQ)
- University of Southern Queensland (USQ)
- University of Melbourne
- University of Tasmania
- University of Sydney

AMPC

AUSTRALIAN MEAT PROCESSOR CORPORATION

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