AgEcon
RESEARCH, DEVELOPMENT & EXTENSION SERVICES

AMPC ex-post analyses 2026-2028

Summary of results for the Year 1 sample

November 2026

Client: Australian Meat Processor Corporation (AMPC)

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Table of Contents

Executive summary *3*
Background 3
Methodology 3
Results 3
Introduction *5*
Population & sample selection *5*
Defining the eligible population 5
Sample selection criteria 6
Sample selection process 6
General evaluation method *7*
Summary of qualitative impact analysis *8*
Impact enablers 8
Economic impacts 8
Socio-economic impacts 9
Socio-environmental impacts 9
Summary of quantitative impact analysis *11*
Impact criteria by investment 11
Investment criteria for the aggregate investment 11
Comparison with historical impact assessment results 12
Sensitivity testing 13
Implications and learnings *15*
Discussion of common themes across the impact assessments 15
Summary of Monitoring and Evaluation recommendations across the impact assessments 16
References *18*
Glossary of economic terms *19*
Appendix A. Summary of identified impacts by cluster *20*
Appendix B. Confidence in impact pathway identification and quantification *21*

Executive summary

Background

The Australian Meat Processor Corporation (AMPC) engaged Ag Econ to undertake independent ex-post impact assessments of a sample of research, development and adoption (RD&A) investments over a three-year period from 2026 to 2028. The assessments aim to quantify the economic returns from AMPC investments, identify broader industry impacts and provide evidence to inform future investment decisions and monitoring and evaluation (M&E) activities. This report presents the findings from the first year of assessments, summarises the economic returns across the sampled investments, and identifies common factors influencing the realisation of industry benefits.

Methodology

The eligible investment population was established in consultation with AMPC investment managers, with related projects grouped into clusters and assessed against the specified eligibility criteria. Five clusters were randomly selected for Year 1, with their scope refined to include projects contributing to a common impact pathway: Waterless Lamb Frenching, Anaerobic Co-Digestion, STEC Testing, Exoskeleton Safety Technology and Modular Horizontal Automation. Each assessment followed the Council of Rural Research and Development Corporations (CRRDC) guidelines, combining qualitative impact pathway analysis with quantitative cost-benefit analysis. Costs and benefits were expressed in 2025–26 present values using a 5% real discount rate, with benefits projected for up to 30 years from the final investment year. Monte Carlo sensitivity analysis, using 10,000 simulations per investment, was also undertaken to assess uncertainty in individual and aggregate economic returns.

Results

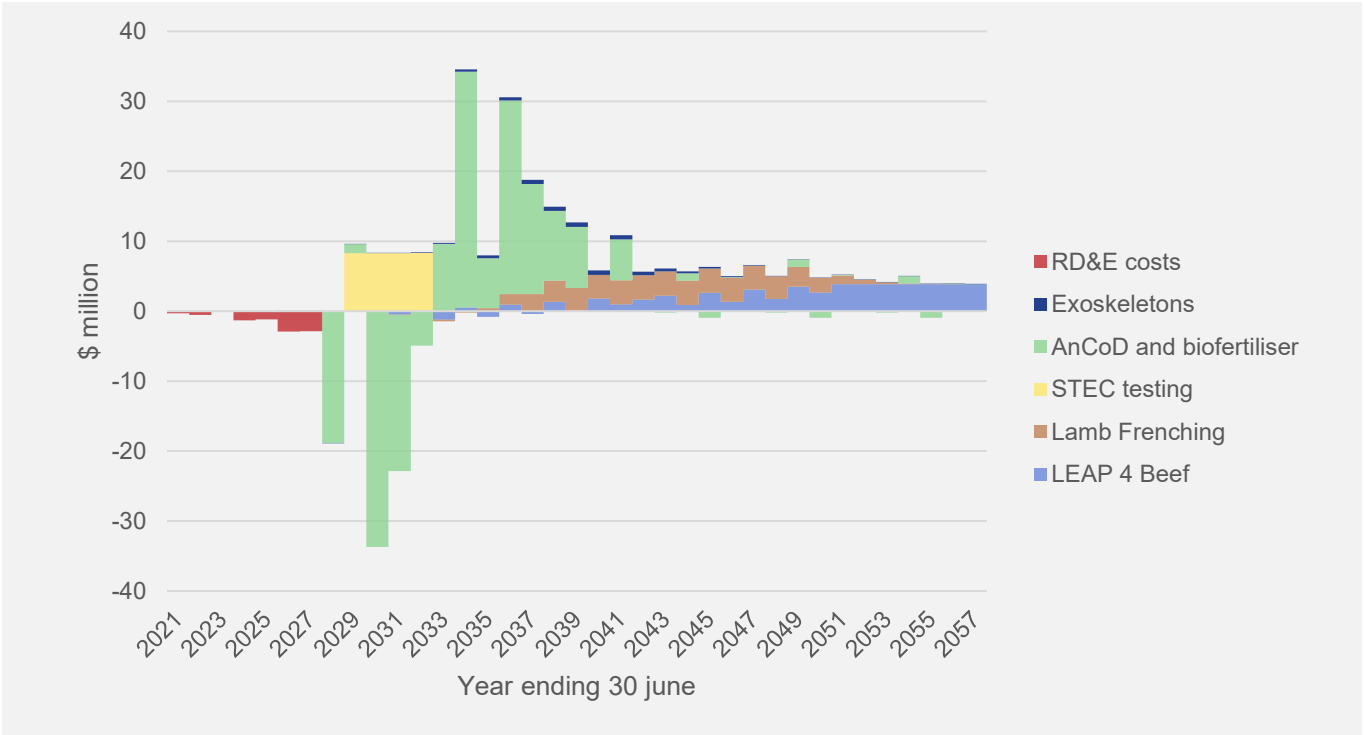
The five investment clusters generated an estimated $77.69 million in discounted benefits from $9.35 million in investment costs, resulting in a net present value (NPV) of $68.33 million and a benefit-cost ratio (BCR) of 8.31 to 1 (Table E1). Sensitivity analysis indicated that the aggregate returns remained positive across all 10,000 simulations, with a mean BCR of 9.29 and a 90% simulation interval of 6.26 to 12.89. At the individual investment level, Anaerobic Co-Digestion exhibited the greatest uncertainty, with 18% of simulations producing a BCR below 1.0, compared with less than 1% of simulations for each of the other four investments.

TABLE E1. IMPACT CRITERIA BY INVESTMENT

Investment cluster	PVC $m	PVB $m	NPV $m	BCR # to 1	IRR %	MIRR %
Waterless Lamb Frenching	$2.14	$20.83	$18.69	9.73	19%	12%
Safety Technology – Exoskeletons	$0.65	$6.32	$5.67	9.68	17%	10%
STEC Testing	$0.49	$26.63	$26.13	53.94	139%	19%
Anaerobic Co-Digestion	$1.77	$8.61	$6.85	4.88	7%	7%
Modular Horizontal Automation	$4.30	$15.30	$11.00	3.56	11%	6%
Total Year 1 sample	**$9.35**	**$77.69**	**$68.33**	**8.31**	**15%**	**7%**

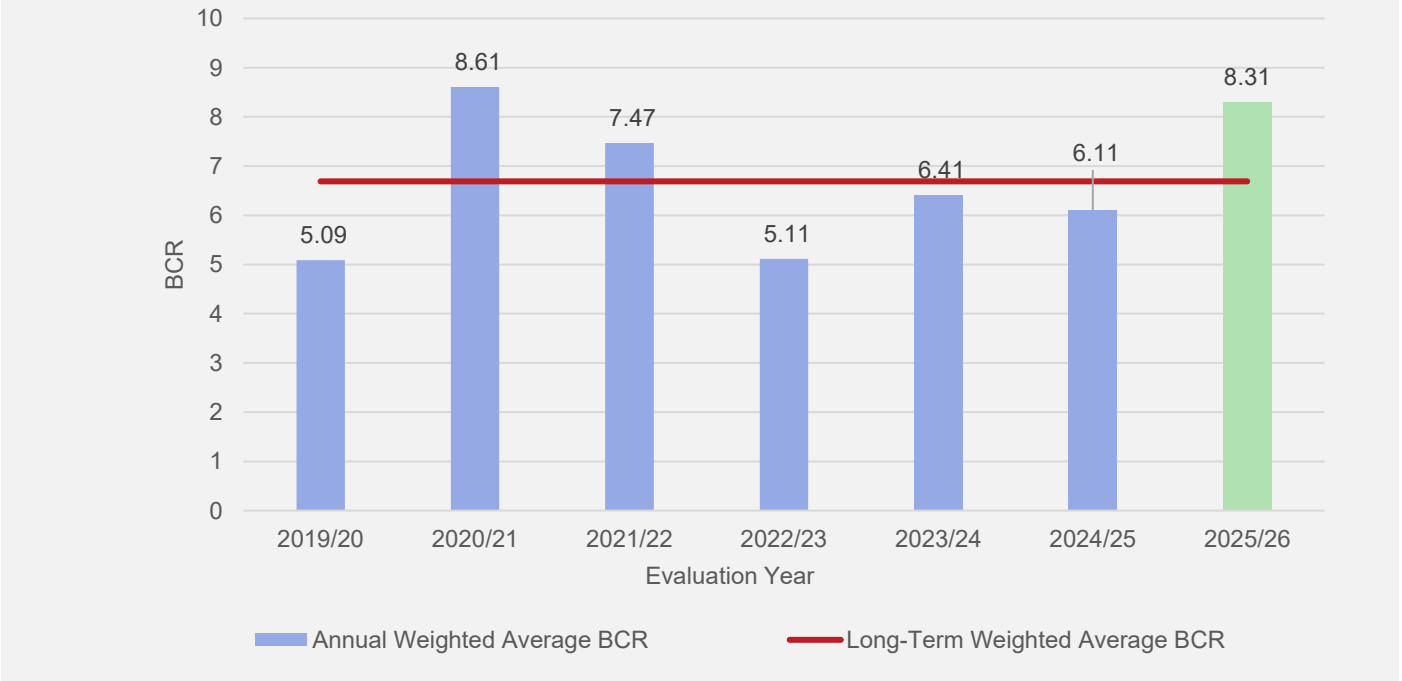
The annual cash flows presented in Figure E1 illustrate differences in the timing and pattern of benefits across the five investments. STEC Testing generates relatively early benefits through the accelerated adoption of improved testing technology, while benefits from Waterless Lamb Frenching, Modular Horizontal Automation and Exoskeletons increase progressively as industry adoption expands. Anaerobic Co-Digestion exhibits a different cash flow pattern, with substantial negative incremental cash flows in the early years as investment brings forward capital expenditure relative to the without-investment scenario. These are followed by positive incremental cash flows as facilities in the without-investment scenario incur their capital costs and the benefits of earlier adoption are realised. The results highlight the importance of adoption timing in determining both the magnitude and distribution of economic returns.

FIGURE E2. NOMINAL CASHFLOWS FOR THE TOTAL YEAR 1 SAMPLE



The Year 1 BCR of 8.31 exceeds the long-term weighted average of 6.69 across AMPC's 2019–20 to 2025–26 impact assessment samples and is the second-highest annual BCR over that period (Figure E2). These results represent projected economic returns rather than benefits already realised, particularly for technologies still requiring commercialisation and industry adoption.

FIGURE E2. IMPACT CRITERIA BY INVESTMENT



The assessments demonstrate the potential for AMPC investments to generate substantial economic benefits. However, much of the estimated benefits are prospective, with several technologies requiring further development, commercialisation, regulatory approval and evidence of adoption. The results therefore reflect the potential value of AMPC's investments rather than benefits already realised by industry, reinforcing the importance of monitoring beyond project completion to establish whether the projected returns are achieved.

Introduction

The Australian Meat Processor Corporation (AMPC) is an industry owned organisation that manages the investment of industry levies and Government funds into research, development and extension (RD&E) and marketing to create enduring profitability for Australian meat processors.

Impact assessment plays a vital role in the RD&E lifecycle. To ensure that investments align with processor needs and deliver tangible returns, AMPC has established a robust performance and impact measurement framework to:

- Determine whether investments are delivering measurable value to levy-paying processors and other stakeholders.
- Inform decision-making around optimal portfolio allocation and refinement.
- Meet its obligations under the Primary Industries Research and Development Act and the Statutory Funding Agreement.
- Communicate the return on investment to stakeholders, including processors, government, and research partners.

In line with this ongoing program of impact assessment, AMPC engaged Ag Econ to undertake independent ex-post impact assessments of a sample of RD&E investments over a three year period.

This report presents the method of sample selection and analysis for the Year 1 sample, a summary of the aggregate results, and a discussion of the key findings that can inform future RD&E impact assessments.

Population & sample selection

Defining the eligible population

The population of AMPC investments from which the impact assessment sample was drawn was established through a process of grouping related projects into investment clusters. Meetings were held with each AMPC investment manager to identify projects addressing common research objectives, technologies or industry challenges. This process identified 25 investment clusters, comprising 311 individual projects. The cluster-based approach recognised that industry impacts often arise from a series of related investments, with individual projects contributing to different stages of research, development, demonstration and commercialisation. Assessing these investments collectively allowed the full research pathway, associated costs and attributable impacts to be considered.

The eligible population of investment clusters was then defined according to the following criteria:

1. Included projects completed in the 2024 or 2025 financial years (a completed project was defined as an RD&A investment where a final deliverable had been submitted and subsequently accepted by AMPC by 30 June of that year).
2. Included AMPC levy funds.
3. Enabler investments were excluded as these investments do not directly deliver industry impacts but support core RD&A through knowledge transfer and adoption, industry research capability, and background data and insights. These investments were considered as enabling expenses for core RD&A, with their costs and contributions to impact to be apportioned as appropriate.
4. Had not previously been subject to impact assessment. Clusters containing individual projects that had previously undergone impact assessment were excluded to avoid duplication of previously assessed investments and impacts.

Based on the above, the initial population of projects had a total funding value of $86.9 million. Marketing projects were subsequently excluded, reducing the eligible population funding value to $83.0 million, of which $72.9 million represented AMPC funding, $2.9 million in-kind contributions, and $7.6 million other cash contributions.

Sample selection criteria

The sample of investment clusters to be subjected to impact assessment (evaluation) was selected against the following criteria:

1. Investment clusters must be randomly selected from the eligible population (defined above).
2. The sample must represent at least 10% of the total $72.9 million AMPC research funding in the eligible population (in adherence with the CRRDC Guidelines (2025)).

Following the selection of investment clusters, further meetings were held with AMPC investment managers to refine the scope of each impact assessment. While projects had initially been grouped according to common research areas, not all projects within a cluster necessarily contributed to the same impact pathway. Consequently, only projects contributing to the specific impacts being assessed were included in the final investment scope.

For example, the Energy cluster included investments across several energy-related technologies. However, the impact assessment focused specifically on anaerobic co-digestion, as these projects represented the largest investments within the cluster. This approach ensured that each assessment captured the collective costs and benefits of related investments contributing to a common impact, while excluding projects with distinct impact pathways.

Sample selection process

The sample selection used a spreadsheet with the project code, AMPC research funding value, Program Area, and cluster for each of the projects in the eligible population. A random number function was then applied to each cluster and clusters sampled until the Sample Selection Criteria (described above) were met. Following the initial selection, the scope of each cluster was reviewed with AMPC investment managers to confirm which projects contributed to a common impact pathway. This refinement resulted in a final Year 1 sample of five investment clusters, comprising 19 projects and $7.30 million in AMPC funding, equivalent to approximately 10% of the eligible funding population.

Two of the five selected clusters, Waterless Lamb Frenching and Modular Horizontal Automation, were from the Automation, Processing & Efficiency Program Area. While both were retained in the Year 1 sample in accordance with the random selection process, this Program Area will be excluded from selection in subsequent years to support greater balance across investment types over the three-year evaluation program.

TABLE 1. STRATIFIED, RANDOM SAMPLE FOR YEAR 1

Project code	Project name	Program Area	Start date	End date	AMPC funding ($m)
Automated waterless lamb frenching: $1.46 million					
2021-1183	Waterless Mechanical Lamb Frenching – Stage 3 – Alpha Prototype	Automation, Processing & Efficiency	2020/21	2024/25	$1.13
2023-1030	Waterless Lamb Frenching Concept Trials – Curious Creations	Automation, Processing & Efficiency	2022/23	2022/23	$0.02
2024-1020	Waterless Lamb Frenching Prototype	Automation, Processing & Efficiency	2023/24	2023/24	$0.08
2025-1048	Waterless Lamb Frenching Production Prototype (Stage 3)	Automation, Processing & Efficiency	2024/25	2025/26	$0.23
Energy – anaerobic co-digestion: $1.29 million					
2024-1003	Anaerobic Co-Digestion (AnCoD) Pilot Demonstration Program	Energy, Emissions & Decarbonisation	2023/24	2025/26	$0.93
2024-1019	Integrated Bioresource Recovery Facility: Novel FEED Study, Stage 2	Energy, Emissions & Decarbonisation	2023/24	2023/24	$0.31
2024-1092	Bioresource Recovery Centres: EU Technology Scan, Site Visits and Case Studies	Energy, Emissions & Decarbonisation	2023/24	2024/25	$0.05
Food safety – STEC testing: $0.17 million					

2024-1103	dd-Check STEC Solution evaluation for use in export meat testing	Food Safety	2024/25	2025/26	$0.11
2025-1055	STEC and HACCP seminars for exporters to US	Food Safety	2024/25	2024/25	$0.06
Safety technology – exoskeletons: $0.68 million					
2022-1072	Implementing exoskeletons in meat processing	Safety & Wellbeing	2021/22	2021/22	$0.23
2025-1047	Exoskeleton implementation project	Safety & Wellbeing	2024/25	2026/27	$0.31
2025-1050	Ironhand glove configuration and implementation project	Safety & Wellbeing	2024/25	2024/25	$0.14
Modular Horizontal Automation: $3.69 million					
2024-1070	LEAP 4 Beef – Module L4B01 Project 1 – Steps Required to Enable Adoption	Automation, Processing & Efficiency	2023/24	2023/24	$0.06
2024-1088	LEAP 4 Beef – Project 0 (Stage 1) for Various Modules	Automation, Processing & Efficiency	2024/25	2024/25	$0.05
2025-1043	LEAP4Beef – Module L4B06 Project 0 – Chuck Chining Cell Concepts	Automation, Processing & Efficiency	2024/25	2024/25	$0.08
2025-1044	LEAP4Beef – Module L4B02 Project 1 – Cube Roll Chining Cell Pre-production Concept Prototype	Automation, Processing & Efficiency	2024/25	2024/25	$0.06
2025-1052	LEAP4Beef – Module L4B03 Project 1 – Fore Cutting Cell Pre-production Concept Prototype	Automation, Processing & Efficiency	2025/26	2026/27	$1.13
2025-1121	LEAP4Beef – Module L4B01 Project 3 – Beef Striploin Automated Chine Removal Extended Use Readiness for Data Collection (Beta Prototype)	Automation, Processing & Efficiency	2025/26	2026/27	$0.24
2026-1020	RCBS Beef Strip Loin Demo Campaign	Automation, Processing & Efficiency	2025/26	2026/27	$2.08
Total Sample					**$7.30**

General evaluation method

The impact assessment built upon the general evaluation guidelines that are now well entrenched within the Australian primary industry research sector including Research and Development Corporations, Cooperative Research Centres, State Departments of Agriculture, and some universities. The approach included both qualitative and quantitative descriptions that are in accord with the impact assessment guidelines of the CRRDC (CRRDC 2025).

The general method that informed the impact assessment approach was as follows:

1. Review project documentation and map the impact pathway using a logical framework covering activities, outputs, outcomes and impacts. This included identifying economic, environmental and social impacts, as well as other related investments that contributed to the same pathway.
2. Consider the broader program context by identifying likely follow-on investments. The cluster-based approach to sample selection already accounted for preceding and concurrent investments with common objectives and impact pathways. However, the detailed impact assessments provided an opportunity to identify likely follow-on investments that could contribute to the commercialisation, adoption and eventual impact of the research.
3. Collect and validate data from project documents, other relevant sources and RD&E stakeholders. Actual data were used where available, estimates were applied where data gaps existed, and stakeholder consultation was used to validate the logical framework, clarify assumptions and reduce uncertainty or bias.
4. Quantify attributable impacts using cost-benefit analysis over a maximum 30-year period from the final year of project investment, applying a 5% real discount rate. Standard investment criteria were reported for each assessment and for the combined Year 1 sample, including NPV, BCR, IRR and MIRR.
5. Test sensitivity and uncertainty in the results, including the effect of varying key assumptions and model inputs. Monte Carlo modelling was used to assess the combined effect of variable ranges across 10,000 simulations.

6. Discuss the implications of the findings for stakeholders and identify recommendations for improved data collection, monitoring and evaluation to support future impact assessments.

Summary of qualitative impact analysis

This section summarises the qualitative findings from the five randomly selected AMPC investment clusters, identifying twelve common impact themes across economic, socio-economic and socio-environmental impacts, as well as impact enablers. The latter recognise investments that support future benefits by advancing technologies towards commercial readiness, generating evidence to support adoption or addressing implementation barriers. The impacts, presented by investment in Table 2, include both demonstrated outcomes and potential longer-term benefits dependent on further technology development, commercialisation and industry adoption.

Impact enablers

1. Technology readiness and adoption: Several investments supported future impacts by advancing technologies towards commercial readiness, demonstrating their technical feasibility or generating evidence to support industry adoption. Modular Horizontal Automation developed and tested automated cutting and chining technologies, with further development required before several modules can be commercially adopted. Similarly, Waterless Lamb Frenching progressed automated frenching technologies through successive prototype development and testing stages. Anaerobic Co-Digestion generated technical, engineering and regulatory knowledge to support future investment in bioresource recovery facilities, while Safety Technology provided evidence and practical guidance on the suitability and implementation of exoskeleton technologies in meat processing.

Economic impacts

1. Labour productivity and processing costs: Reduced labour requirements and improved processing efficiency were identified as potential benefits of the two automation investments. Waterless Lamb Frenching could reduce the labour required for manual frenching operations through the adoption of automated equipment. Similarly, Modular Horizontal Automation could reduce labour requirements for cutting, chining and boning operations, while reducing processors' reliance on experienced manual processing workers. Both investments have the potential to improve processing productivity and reduce labour costs, subject to successful commercialisation and adoption.
2. Product yield and value recovery: Improved recovery of higher-value meat products was identified as a potential impact of the two automation investments. Modular Horizontal Automation could increase the value of saleable meat recovered per animal through more accurate and consistent cutting and chining, allowing additional meat to remain on higher-value primals rather than being sold as lower-value trim. Waterless Lamb Frenching could improve product consistency and recovery of saleable meat through more accurate frenching and improved recovery of intercostal meat. These benefits would increase the value of meat produced from existing livestock throughput.
3. Energy and waste management costs: Reduced energy and waste management costs were identified as potential benefits of Anaerobic Co-Digestion. The technology could enable processors to generate electricity and thermal energy from biogas produced through the digestion of organic processing wastes, reducing expenditure on purchased electricity and fuels. Processing organic waste streams on-site could also reduce the costs associated with off-site waste transport, treatment and disposal. The scale of these savings would depend on biogas production, energy requirements, existing waste management arrangements and the commercial performance of the technology.
4. Biofertiliser production: Anaerobic Co-Digestion identified opportunities to generate additional revenue through the processing and sale of digestate-derived biofertiliser products. Recovery of nutrients from organic processing wastes could create commercially valuable products for agricultural use, improving the overall economics of bioresource recovery facilities. Realisation of these benefits would depend on further processing requirements, regulatory approval, product quality and the development of commercial markets for biofertiliser.

5. Avoided product downgrades: The Food Safety investment identified potential economic benefits from reducing unnecessary potential-positive STEC screening results. More accurate screening through dd-Check technology could reduce the number of manufacturing beef lots diverted from higher-value export markets to lower-value domestic markets. This would allow a greater proportion of export-eligible beef to retain its export value, subject to regulatory approval and commercial adoption of the testing technology.
6. Workplace injury costs: Reduced workplace injuries were identified as a potential economic benefit of Safety Technology, Waterless Lamb Frenching and Modular Horizontal Automation. Exoskeleton technologies could reduce the incidence of musculoskeletal injuries associated with physically demanding processing tasks, while automation could reduce exposure to repetitive knife work and hazardous cutting equipment. Fewer injuries could reduce direct injury-related costs, including medical treatment, rehabilitation and compensation claims. Workplace injuries can also require processors to engage replacement workers, pay overtime or incur additional labour expenditure to maintain production while injured employees are unable to work. Reducing the frequency and duration of injuries through exoskeleton adoption could lower these additional wage costs.
7. Workers' compensation insurance premiums: Reduced workers' compensation premiums were identified as a potential benefit of Safety Technology. By reducing the incidence and severity of workplace injuries, exoskeleton adoption could lower the number and cost of compensation claims, with a proportion of these savings passed through to processors through lower insurance premiums. The extent of this benefit would depend on the relationship between claims experience and premium calculations under the relevant workers' compensation arrangements.

Socio-economic impacts

1. Worker health, safety and wellbeing: Improved worker health and safety was a key potential impact of three investments. Safety Technology aimed to reduce the physical demands of repetitive bending, lifting and forceful gripping through the adoption of exoskeleton devices, potentially reducing musculoskeletal injuries and improving workers' wellbeing. Waterless Lamb Frenching and Modular Horizontal Automation could reduce exposure to repetitive knife work, bandsaws and physically demanding manual processing tasks. These improvements could also support workers' longer-term quality of life and capacity to remain in the workforce.
2. Industry confidence and reputation: Improved confidence in Australian red meat was identified as a potential impact of Food Safety and Anaerobic Co-Digestion. The Food Safety investment supported industry capability to meet international food safety requirements, helping maintain confidence among regulators, customers and consumers in the integrity of Australian meat exports. Anaerobic Co-Digestion could strengthen industry reputation through the adoption of more sustainable processing technologies and improved resource management practices.

Socio-environmental impacts

1. Greenhouse gas (GHG) emissions: Reduced greenhouse gas emissions were identified as a potential benefit of Anaerobic Co-Digestion. Adoption of the technology could reduce reliance on fossil fuel-based electricity and thermal energy by converting organic processing wastes into biogas. Additional emissions reductions may arise from improved organic waste management and the substitution of conventional fertilisers with recovered nutrients. The scale of these benefits depends on the configuration, performance and adoption of commercial systems.
2. Resource efficiency and waste reduction: Improved resource utilisation was identified across Anaerobic Co-Digestion, Waterless Lamb Frenching and Modular Horizontal Automation. Anaerobic co-digestion could divert organic processing wastes from conventional disposal pathways and recover valuable energy and nutrients through biofertiliser production. Waterless Lamb Frenching could improve utilisation of animal products through greater recovery of saleable meat, while Modular Horizontal Automation could reduce the quantity of higher-value meat downgraded to lower-value products through more precise cutting. These impacts support more efficient use of resources within meat processing operations.

TABLE 2. IDENTIFIED AND QUANTIFIED IMPACT AREAS BY PROJECT—INCLUDING DIRECT AND INDIRECT IMPACTS

Project cluster	Technology readiness and adoption	Economic impacts							Socio-economic impacts		Socio-environmental impacts	
		Labour productivity	Product yield and value	Energy and waste costs	Biofertiliser	Avoided product downgrades	Workplace injury costs	Insurance premiums	Health, safety and wellbeing	Industry reputation	GHG emissions	Resource efficiency
Waterless Lamb Frenching	✓	✓	✓				✓		✓			✓
Anaerobic Co-Digestion	✓			✓	✓					✓	✓	✓
STEC Testing						✓				✓		
Exoskeletons	✓						✓	✓	✓			
Modular Horizontal Automation	✓	✓	✓				✓		✓			✓

GREEN cells denote impacts that were quantified.

Summary of quantitative impact analysis

The quantitative analysis applied the RDC cost-benefit methodology outlined in the CRRDC Guidelines (2025). Total investment costs included AMPC, research partner and industry collaborator contributions, including both cash and in-kind funding. All costs were standardised to 2025–26 dollars using the Implicit Price Deflator for Gross Domestic Product (ABS 2026), and costs and benefits were discounted to 2025–26 present values using a 5% real discount rate. The analysis covered the investment period and projected benefits for up to 30 years from the final year of investment, although actual adoption and impact periods were occasionally shorter.

Results are presented for each of the five investment clusters and the aggregate Year 1 sample. Baseline estimates used the best available evidence from project documentation, industry data and stakeholder consultation, while uncertainty was tested using Monte Carlo analysis. As several technologies remain under development or are yet to be commercially adopted, the quantified benefits largely represent projected future impacts, conditional on successful commercialisation and industry adoption.

Across the five investment clusters, 30 potential impacts were identified, of which 11 (37%) were classified as valued in the individual assessments. The remaining 19 impacts were not valued due to insufficient evidence on their magnitude, uncertainty around commercialisation and adoption, or difficulties establishing attribution. Where identified impacts could not be quantified, the individual assessment reports provide detailed reasoning for their exclusion.

Impact criteria by investment

Table 3 presents the economic results for each of the five investment clusters. The present value of investment costs (PVC) ranged from $0.49 million for STEC Testing to $4.30 million for Modular Horizontal Automation, while the present value of benefits (PVB) ranged from $6.32 million for Safety Technology to $26.63 million for STEC Testing. All five investments generated positive estimated economic returns, with individual net present values (NPVs) ranging from $5.67 million to $26.13 million.

STEC Testing generated the highest BCR (53.94), reflecting substantial potential industry benefits relative to its comparatively small investment cost. Waterless Lamb Frenching (9.73) and Safety Technology (9.68) also generated relatively high returns, while Anaerobic Co-Digestion (4.88) and Modular Horizontal Automation (3.56) generated lower, but still positive, estimated returns. These differences reflect the nature and scale of the technologies, their capital requirements and the timing and extent of anticipated industry adoption.

TABLE 3. IMPACT CRITERIA BY INVESTMENT

Investment cluster	PVC $m	PVB $m	NPV $m	BCR # to 1	IRR %	MIRR %
Waterless Lamb Frenching	$2.14	$20.83	$18.69	9.73	19%	12%
Safety Technology – Exoskeletons	$0.65	$6.32	$5.67	9.68	17%	10%
STEC Testing	$0.49	$26.63	$26.13	53.94	139%	19%
Anaerobic Co-Digestion	$1.77	$8.61	$6.85	4.88	7%	7%
Modular Horizontal Automation	$4.30	$15.30	$11.00	3.56	11%	6%
Total Year 1 sample	**$9.35**	**$77.69**	**$68.33**	**8.31**	**15%**	**7%**

Investment criteria for the aggregate investment

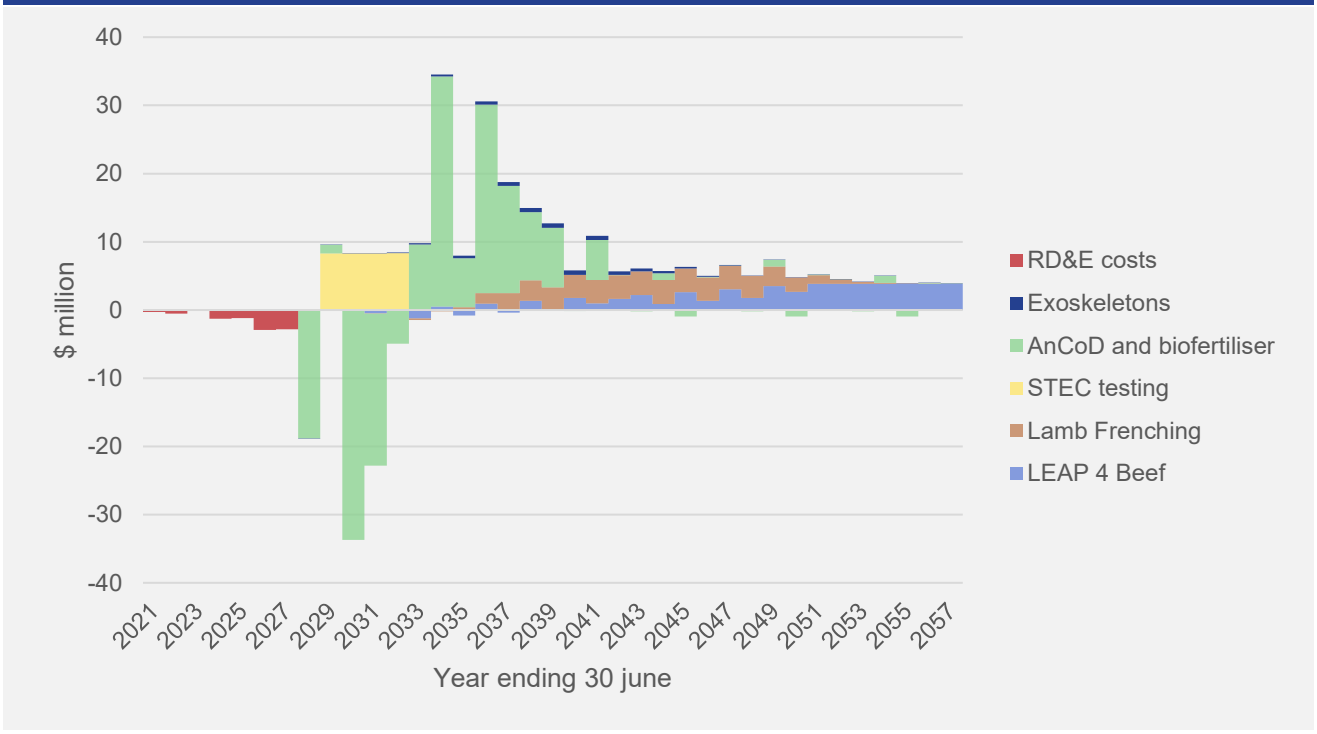
Across the five investment clusters, the total PVC was $9.35 million and the total PVB was $77.69 million, generating an aggregate NPV of $68.33 million and a BCR of 8.31 to 1. The aggregate investment also generated an internal rate of return (IRR) of 15% and a modified internal rate of return (MIRR) of 7%. Table 4 presents the aggregate economic results at five-year intervals, extending to 30 years after the final year of investment. Approximately 33% of total discounted benefits are projected to accrue by year 10, increasing to 68% by year 15, 83% by year 20 and 94% by year 25. The aggregate NPV becomes positive by year 10, with benefits continuing to accrue over the remainder of the assessment period.

TABLE 4. BASELINE RESULTS FOR THE TOTAL INVESTMENT							
Impact metric	Years after last year of investment						
	0	5	10	15	20	25	30
PVC ($m)	$9.35	$9.35	$9.35	$9.35	$9.35	$9.35	$9.35
PVB ($m)	−$0.01	−$38.51	$25.48	$52.70	$64.73	$72.87	$77.69
NPV ($m)	−$9.36	−$47.86	$16.13	$43.35	$55.37	$63.52	$68.33
BCR	0.00	−4.12	2.72	5.64	6.92	7.79	8.31
IRR	–	–	10%	14%	15%	15%	15%
MIRR	–	–	7%	8%	8%	7%	7%

The annual cash flows for the total Year 1 sample are shown in Figure 1, highlighting the timing and magnitude of projected benefits relative to RD&E investment costs. Benefits from STEC testing are concentrated in the earlier years, reflecting the potential for rapid adoption of improved screening technology and immediate reductions in product downgrades. In contrast, benefits from automated lamb frenching, Modular Horizontal Automation and safety technology accrue more gradually as technologies are commercialised and adopted across processing facilities.

Anaerobic co-digestion has a distinct cash flow profile, with substantial negative incremental cash flows during the initial adoption period, followed by large positive cash flows as processors in the without-investment scenario undertake equivalent capital expenditure at a later date. These fluctuations reflect the high capital costs of anaerobic co-digestion infrastructure and the benefits of accelerating its adoption. Overall, the results demonstrate that the timing of benefits varies considerably across the sample, with the largest annual impacts concentrated in the 2030s and smaller, sustained benefits continuing over the longer term.

FIGURE 1. NOMINAL CASHFLOWS FOR THE TOTAL YEAR 1 SAMPLE

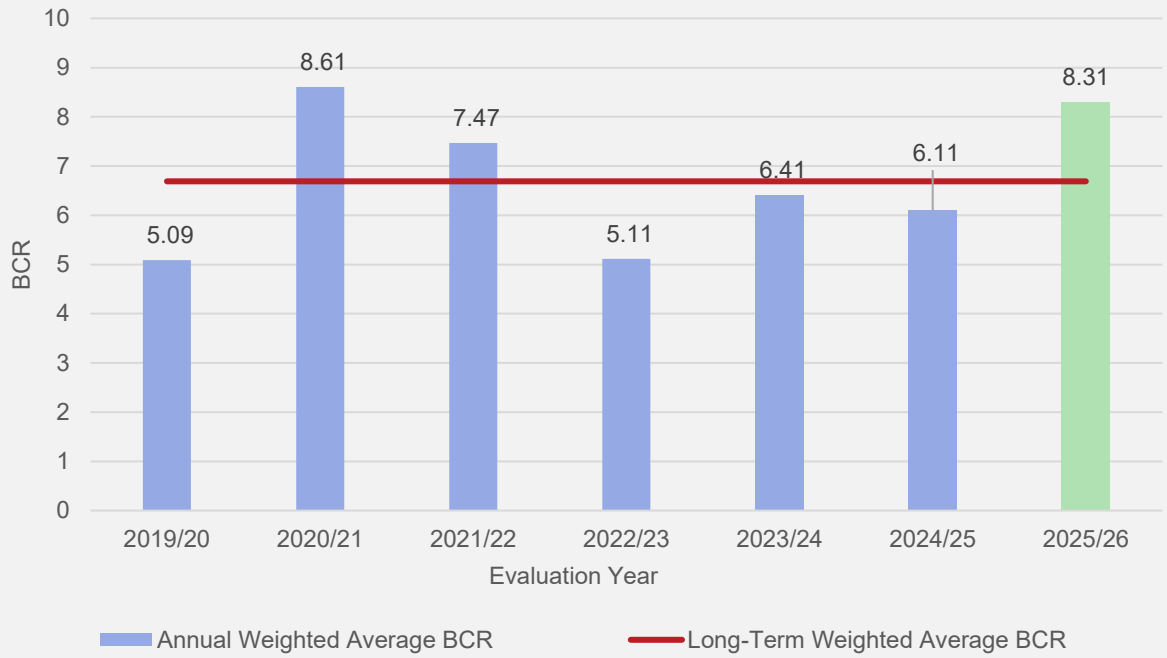


Comparison with historical impact assessment results

The economic returns estimated for the Year 1 sample are consistent with the positive returns reported through AMPC's previous impact assessments. Across the seven annual samples assessed between 2019–20 and 2025–26, the combined present value of investment costs was $39.80 million, generating estimated benefits of $266.24 million and an NPV of $226.43 million. This represents a long-term weighted average BCR of 6.69. As shown in Figure 2, the 2025–26 sample exceeded the long-term weighted average with a BCR of 8.31 to 1, and representing the second-highest annual BCR over the seven-year period behind 8.61 in

2020-21.

FIGURE 2. ANNUAL AND LONG-TERM WEIGHTED AVERAGE BENEFIT-COST RATIOS



Sensitivity testing

Monte Carlo sensitivity analysis was undertaken for each of the five project clusters by using 10,000 simulations to assess uncertainty in the estimated economic returns. Each analysis varied key model assumptions within defined ranges to estimate the distribution of possible BCRs, with results shown in Table 5.

Four of the five clusters produced BCRs above 1.0 in more than 99% of simulations. Anaerobic Co-Digestion exhibited the greatest downside uncertainty, with 18.2% of simulations producing a BCR below 1.0. This reflects the substantial capital investment required for adoption and the importance of assumptions regarding the timing and scale of adoption.

TABLE 5. SENSITIVITY ANALYSIS BY INVESTMENT CLUSTER

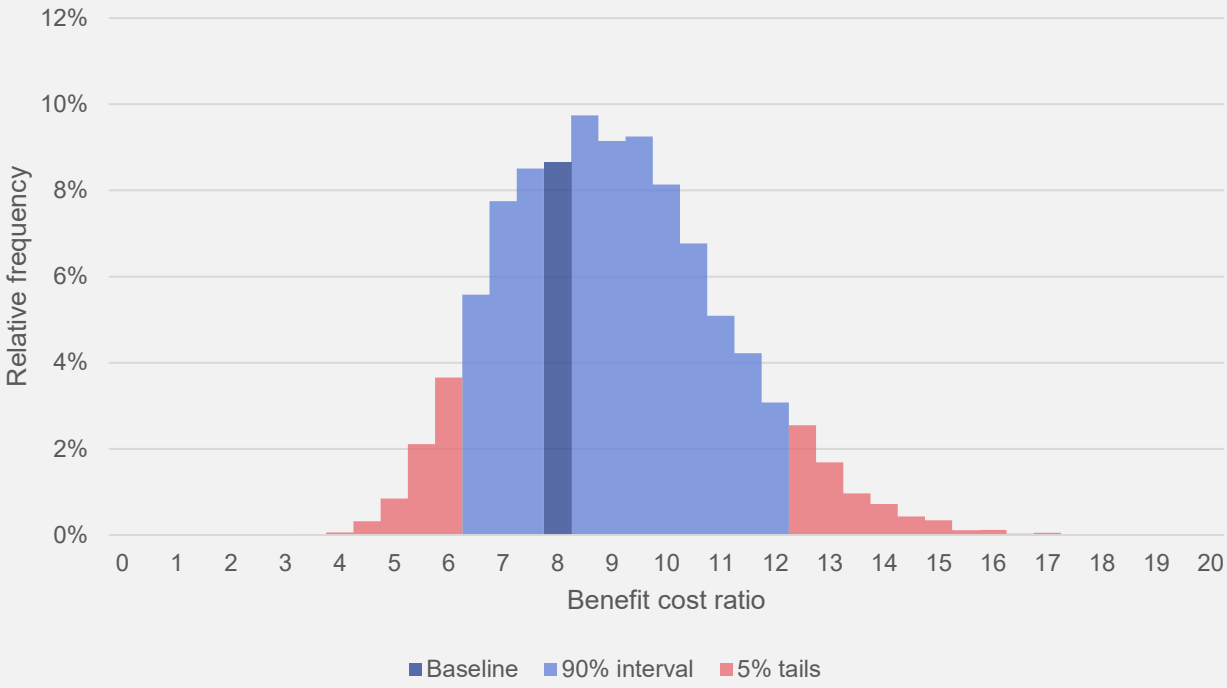
Project cluster	Baseline BCR	Mean BCR	90% simulation interval	BCR below 1.0
Waterless Lamb Frenching	9.73	8.78	4.82–14.02	0%
Exoskeleton Safety Technology	9.68	9.88	5.39–15.50	0%
STEC Testing	53.94	77.76	33.59–136.14	0%
Anaerobic Co-Digestion	4.88	4.29	0.00–10.07	18.2%
Modular Horizontal Automation	3.56	3.65	1.61–6.48	0.6%

Indicative aggregate sensitivity analysis was completed to assess uncertainty in the economic returns of the five investment clusters collectively. Rather than developing a separate sensitivity model for the entire portfolio, the analysis drew on the 10,000 Monte Carlo results already generated for each investment cluster. These results already capture the uncertainty associated with the different technologies. Each individual portfolio simulation involved randomly selecting a BCR from each cluster's simulation, then calculating a combined BCR by weighting each cluster according to its discounted investment costs. The process was repeated 10,000 times to reflect different combinations of outcomes across the five investments. This approach provides an indication of whether the portfolio's overall economic returns remain positive when some investments perform better or worse than expected, with results shown in Figure 3.

The analysis produced a mean aggregate BCR of 9.29 and a 90% simulation interval of 6.26 to 12.89. All

10,000 aggregate simulations produced a BCR above 1.0, suggesting that the sampled portfolio is relatively resilient to uncertainty in individual investment outcomes. This reflects the contribution of several investments with consistently positive economic returns, which offset the greater downside uncertainty associated with anaerobic co-digestion.

FIGURE 3. INDICATIVE AGGREGATE SENSITIVITY ANALYSIS



Implications and learnings

Discussion of common themes across the impact assessments

The five impact assessments demonstrate the diversity of pathways through which AMPC research and development can generate economic benefits for the Australian red meat processing industry. While the investments addressed different industry challenges, their economic value was generally derived from improving the efficiency of existing processing activities, reducing avoidable costs and losses, or accelerating the adoption of technologies that would otherwise take longer to reach industry.

A key finding is that the scale of economic benefits depends on both the value of improvements at individual facilities and the potential for adoption across industry. STEC testing demonstrates how relatively targeted improvements can generate substantial aggregate benefits when applied to high-volume processing activities, without requiring significant capital investment. Conversely, technologies such as Waterless Lamb Frenching and Anaerobic Co-Digestion require substantial upfront investment, with economic returns more dependent on facility characteristics, commercial feasibility and investment timing. These differences reinforce the need for investment-specific adoption assumptions rather than applying common adoption trajectories across the R&D portfolio.

The assessments also highlight the importance of the stage of technology development and commercialisation in determining the likelihood and timing of economic benefits. Several investments have demonstrated technical feasibility or generated evidence supporting future adoption, but their full economic value remains dependent on further development, regulatory approval, commercial availability or implementation by processors. Consequently, a substantial proportion of the estimated benefits are prospective rather than already realised. This creates an important distinction between demonstrating the potential economic value of R&D and establishing that this value has been captured by industry.

Another important finding concerns the contribution of R&D to accelerating industry change. In several assessments, the principal benefit was not necessarily the introduction of an outcome that would never otherwise occur, but bringing forward its availability or adoption. This was relevant to STEC testing, Anaerobic Co-Digestion and Safety Technology, where the timing of technology adoption influenced the incremental benefits attributable to AMPC investment. It reinforces the importance of defining credible without-investment scenarios and distinguishing benefits attributable to AMPC from those arising through broader commercial and industry developments.

Worker health, safety and wellbeing emerged as an important area of potential economic benefit that was not fully captured in the assessments. Three of the five project clusters identified benefits associated with improving worker safety or reducing workplace injuries. However, limited industry data on injury incidence, severity, days lost to injury and staff turnover associated with poor working conditions constrained the ability to quantify these outcomes. Improved collection of this information, alongside evidence on how new technologies affect worker wellbeing, would enable more comprehensive valuation of avoided injury costs, reduced absenteeism and improved workforce retention. This would strengthen future impact assessments and provide a clearer understanding of the broader economic value of AMPC investments in worker health and safety.

Overall, the findings suggest that the economic performance of AMPC's R&D portfolio depends as much on the translation of research outputs into industry adoption as on the technical performance of the research itself. This places particular importance on commercialisation pathways and processor engagement. AMPC's industry segmentation data proved particularly valuable in developing realistic adoption assumptions that account for differences in processor size, capacity and investment readiness. The AMPC extension officer also has an important role in facilitating industry engagement, identifying adoption opportunities and monitoring the uptake of research outcomes. Continued monitoring of adoption and realised benefits will be necessary to validate the prospective estimates and establish the extent to which the economic potential identified through these assessments is ultimately achieved.

Confidence in impact pathway identification and quantification

A useful way to interpret the five impact assessments is to distinguish between two related questions. The first is whether the pathway to impact can be identified with confidence: that is, whether the sequence from

R&D activities to outputs, adoption, operational change and industry impact is clear, plausible and supported by evidence. The second is whether the resulting impacts can be quantified with confidence: that is, whether changes in productivity, operating costs, product value, worker wellbeing or environmental outcomes can be measured using reliable data and credible assumptions regarding adoption and attribution.

Across the five assessments, the pathways to impact were generally well defined. Each investment addressed an identifiable industry challenge and had a plausible mechanism for generating economic benefits. However, confidence in quantification varied, particularly where technologies had not yet been commercially adopted or where evidence on industry-wide adoption and operational outcomes was limited. The assessments can be broadly distinguished into three categories.

- **Clear impact pathways and relatively strong measurement confidence.** STEC Testing and Exoskeleton Safety Technology had the strongest evidence supporting quantification, with well-defined mechanisms for generating benefits and supporting data on industry conditions and technology performance. For STEC Testing, laboratory trials demonstrated the performance of the dd-Check technology, while industry data provided a basis for estimating the costs of potential-positive results and product downgrading. For Exoskeleton Safety Technology, evidence of industry adoption was provided by an exoskeleton supplier and the AMPC extension manager, while workplace injury prevalence data from state workers' compensation schemes and insurance premium information supported the valuation of avoided injuries. Although uncertainty remains regarding the extent of future adoption and the magnitude of benefits, both assessments had relatively strong evidence supporting their impact pathways and economic assumptions.
- **Clear impact pathways but moderate measurement confidence.** Waterless Lamb Frenching had an identifiable pathway to economic benefit through reduced labour requirements and improved processing efficiency. However, quantification relied more heavily on assumptions regarding commercial technology performance, equipment costs and industry adoption. While consultation with technology developers and processors provided evidence to inform these assumptions, further validation of equipment performance under commercial operating conditions is required.
- **Clear but more conditional impact pathways with greater measurement uncertainty.** Anaerobic Co-Digestion and Modular Horizontal Automation had credible pathways to industry benefit, but their economic performance was particularly dependent on further technology development, regulatory requirements and future adoption. For Anaerobic Co-Digestion, conditional adoption is already occurring, although broader commercial uptake remains dependent on facility suitability. Regulatory approval is also required before digestate can be commercially used as a biofertiliser product, creating additional uncertainty around the realisation of these benefits. Modular Horizontal Automation was the least technologically mature of the five investments, with further development and commercial validation required before widespread adoption can occur. Consequently, its economic benefits relied more heavily on assumptions regarding future technology performance, commercialisation and adoption, with limited observed industry outcomes available to validate the estimates.

The investments are classified against these two criteria in *Appendix B. Confidence in impact pathway identification and quantification*.

Summary of Monitoring and Evaluation recommendations across the impact assessments

The five impact assessments highlight the importance of strengthening M&E beyond the completion of R&D projects to capture technology commercialisation, industry adoption and realised benefits. While the assessments identified credible pathways to economic impact, many of the estimated benefits remain prospective and depend on successful commercialisation and uptake by processors. Several common priorities emerged across the assessments:

- Monitor commercialisation and technology readiness. Track progress towards commercial availability, including technology performance, equipment costs, regulatory approvals and implementation requirements. This is particularly important for Modular Horizontal Automation, which remains at an earlier stage of technology readiness, and Waterless Lamb Frenching, where commercial equipment performance and costs require further validation.

- Track industry adoption. Establish consistent monitoring of the number and characteristics of processors adopting technologies, including adoption timing, scale of implementation and reasons for non-adoption. AMPC's existing processor segmentation data provides a valuable foundation for this work, while the AMPC extension manager has an important role in identifying adoption opportunities, maintaining contact with processors and collecting evidence of actual uptake.
- Improve worker health, safety and wellbeing data. Strengthen the collection of workplace injury incidence, severity, lost working days, absenteeism and staff turnover associated with working conditions. Linking these measures to technology adoption, alongside workers' compensation and insurance premium data, would support more comprehensive valuation of health and safety benefits across relevant investments.
- Monitoring regulatory and commercial barriers. Track progress towards regulatory approvals and other external requirements that influence technology adoption or the realisation of benefits. This includes approval of STEC testing technologies and regulatory arrangements governing the commercial use of digestate as a biofertiliser. While AMPC has limited influence over these regulatory outcomes, monitoring their progress will enable AMPC to respond promptly and support rapid industry adoption once approvals are secured.

References

Australian Bureau of Statistics (ABS). 2026. Australian National Accounts: National Income, Expenditure and Product, December 2025.

Council of Rural Research and Development Corporations (CRRDC) 2025. Cross-RDC Impact Assessment Program: Guidelines. Canberra: Council of Rural Research and Development Corporations.

Glossary of economic terms

Attribution	Often, many factors will contribute to the outcomes and impacts identified in an impact assessment, notably preceding research that was leveraged, concurrent collaborating research, and necessary follow-on research. It would be misleading to apportion all of the impacts to any one contributing factor. As such, an estimate is made regarding the proportion of the total impact that can be attributed to the investment being assessed.
Benefit-cost ratio (BCR)	The ratio of the present value of investment benefits to the present value of investment costs.
Cost-benefit analysis (CBA)	A conceptual framework for the economic evaluation of projects and programs in the public sector. It differs from a financial appraisal or evaluation in that it considers all gains (benefits) and losses (costs), regardless of to whom they accrue.
Direct Effects	Impacts generated for the funding industry as a result of adoption of the RD&E outputs and recommendations.
Discounting and Present Values	The process of relating the costs and benefits of an investment to a base year to reflect the time value of money or opportunity cost of RD&E investment. The analysis applies a real discount rate of 5% in line with CRRDC Guidelines (CRRDC 2025) with results sensitivity tested at discount rates of 3% and 7%.
Economic Equilibrium	Due to a market's underlying supply and demand curves, changes in supply will have an impact on price and vice-versa. The Economic Equilibrium is the point at which market supply and price are balanced. Estimating the magnitude of market response to changes in supply or demand is a complex and demanding task that is considered beyond the scope of most CRRDC Impact Assessments (CRRDC 2025).
Internal rate of return (IRR)	The discount rate at which an investment has a net present value of zero, i.e. where present value of benefits = present value of costs.
Modified internal rate of return (MIRR)	The internal rate of return of an investment that is modified so that the cash inflows generated from an investment are re-invested at the rate of the cost of capital (in this case the discount rate).
Net present value (NPV)	The discounted value of the benefits of an investment less the discounted value of the costs, i.e. present value of benefits - present value of costs.
Nominal and real values	Nominal values reflect the actual values in a given year (e.g. contracted RD&E expenses). These are converted to real (inflation adjusted) values to make them comparable across time.
Spillover Effects	Impacts generated for stakeholders who did not fund the RD&E, including other agricultural industries, consumers, communities, and the environment.

Appendix A. Summary of identified impacts by cluster

Table A1 provides a summary of the Economic, Social and Environmental impacts identified for each cluster. It also highlights where an investment was identified as being an impact enablers, which is an “upstream” investment that provides outputs or services to support the generation of impact through follow-on investments.

TABLE A1. SUMMARY OF IMPACTS BY PROJECT

Cluster name	Impact enabler	Economic impacts	Social impacts	Environmental impacts
Waterless Lamb Frenching	Technology development and commercial readiness	Labour productivity; product yield and value recovery; reduced workplace injury costs	Worker health, safety and wellbeing	More efficient use of animal products and reduced product losses
Anaerobic Co-Digestion	Technical feasibility, engineering design and evidence supporting commercial adoption	Reduced energy costs; reduced waste disposal costs; biofertiliser revenue	Increased confidence in Australian red meat and improved industry reputation	Reduced GHG emissions; resource efficiency and waste reduction
STEC Testing	-	Avoided product downgrades; maintained access to premium export markets	Increased confidence in Australian red meat; greater resilience of Australia's export system	-
Exoskeleton Safety Technology	Technology evaluation, implementation guidance and support for industry adoption	Reduced workers' compensation insurance premiums; reduced additional wage costs associated with injuries; improved workforce productivity and retention	Improved physical health and quality of life; improved psychological wellbeing; greater participation in family and community activities	-
Modular Horizontal Automation	Technology development and commercial readiness	Labour productivity; product yield and value recovery; reduced workplace injury costs; potential economic benefits from additional automation modules	Improved worker health and safety; improved employment opportunities and job quality	More efficient use of animal products and reduced product losses

Appendix B. Confidence in impact pathway identification and quantification

The five investment clusters from the Year 1 sample are classified against two related, but distinct, questions. The first is whether the pathway to impact can be clearly identified with confidence. The second is whether there is sufficient data to quantify the pathway to impact with confidence.

TABLE B1. IMPACT ASSESSMENT CONFIDENCE MATRIX

Assessment	Confidence pathway can be identified	Confidence pathway can be measured	Basis for classification / weakness
Waterless Lamb Frenching	High	Moderate	Clear pathway from automation to reduced labour requirements, supported by processor consultation and prototype testing. Labour savings can be estimated, but commercial performance, adoption and potential changes in meat recovery remain uncertain.
Anaerobic Co-Digestion	High	Low	Technical feasibility, engineering studies and economic modelling establish a credible pathway to energy savings, reduced waste costs and biofertiliser revenue. Measurement depends on facility-specific commercial feasibility, capital and operating costs, and future adoption. Biofertiliser benefits also depend on regulatory approval.
STEC Testing	High	High	Clear pathway from improved testing accuracy to fewer unnecessary product downgrades, supported by laboratory testing and industry data on testing volumes and product values. The principal uncertainty is the timing of regulatory approval and adoption by laboratories.
Exoskeleton Safety Technology	High	High	Clear pathway from reduced physical demands to fewer workplace injuries, supported by implementation evidence, processor engagement and available injury and insurance data. Adoption has commenced at some facilities, although long-term reductions in injury incidence have yet to be demonstrated.
Modular Horizontal Automation	High	Low	Clear potential pathway from automated cutting and chining to improved meat yield and reduced labour requirements. However, the technologies remain at an early stage of commercial readiness, with limited observed performance data. Benefits depend heavily on further development, commercialisation and adoption assumptions.

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