FINAL REPORT

An Impact Assessment of Investment in FRDC Project 2016-261:

Investigating the Use of Trace Element Profiles to Substantiate Provenance for the Australian Prawn Industry

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The Fisheries Research and Development Corporation plans, invests in and manages fisheries research and development throughout Australia. It is a statutory authority within the portfolio of the federal Minister for Agriculture, Fisheries and Forestry, jointly funded by the Australian Government and the fishing industry.

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In submitting this report, the researcher has agreed to FRDC publishing this material in its edited form.

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Abbreviations

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ACPF	Australian Council of Prawn Fishers
APFA	Australian Prawn Farmers Association
BCR	Benefit-Cost Ratio
CBA	Cost-Benefit Analysis
CRRDC	Council of Rural Research and Development Corporations
FRDC	Fisheries Research and Development Corporation
GVP	Gross Value of Production
IRR	Internal Rate of Return
MSC	Marine Stewardship Council
NSW	New South Wales
PVB	Present Value of Benefits
RD&E	Research, Development and Extension
RDC	Research and Development Corporation

Executive Summary

This report presents an impact assessment of investment in Fisheries Research and Development Corporation (FRDC) Project 2016-261: *Investigating the Use of Trace Element Profiles to Substantiate Provenance for the Australian Prawn Industry*. The assessment was completed as part of a cost benefit analysis for inclusion in the FRDC 2022/23 Annual Report. The assessment was made up of six FRDC RD&E projects.

The impact assessment followed 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 includes both qualitative and quantitative assessment components that are in accord with the impact assessment guidelines of the Council of Rural Research and Development Corporations.

Project 2016-261 research has delivered a scientifically robust, legislatively supported method of establishing the provenance of Australian prawns. With this technology in place, prawn fishers and farmers will have access to a tool to deter substitution and protect the price premium Australian product enjoys in both domestic and export markets.

The investment has led to a range of potential economic and social impacts. Importantly, Project 2016-261 contributed to:

- Protection of the price premium realised by Australian prawn fishers and farmers for their product (i.e., avoided income loss).
- Increased researcher capacity in relation to trace element profiling and its application to food provenance.
- Improved regional community wellbeing through spillover benefits from more productive and profitable prawn fishing and farming businesses.
- Potential increase in consumer trust for Australian prawn products.

Total funding for the Project was $0.54 million (present value terms) and produced total expected net benefits of $3.12 million (present value terms). This produced an estimated net present value of $2.58 million, a benefit-cost ratio of 5.8 to 1, an internal rate of return (IRR) of 31.9%, and a modified IRR of 11.8% (over 30 years, using a 5% discount rate and 5% finance rate).

Given the conservative assumptions made and the fact that a number of impacts were not valued in monetary terms, the investment criteria reported are likely to be an underestimate of the true performance of the investment in Project 2016-261. The positive results should be viewed favourable by FRDC, the Australian Government, industry, and other RD&E stakeholders.

Keywords

2016-261, Provenance, Australian Prawns, Wild Caught, Farmed, Trace Element Profiles, Evaluation, Impact Assessment, Cost-Benefit Analysis

Introduction

The Fisheries Research and Development Corporation (FRDC) required a series of cost benefit analyses of selected RD&E investments (projects) for inclusion in the FRDC 2022/23 Annual Report. The assessments were completed to contribute to the following FRDC evaluation reporting requirements:

- Reporting against the FRDC 2020-2025 RD&E Plan and the Evaluation Framework associated with FRDC's Statutory Funding Agreement with the Commonwealth Government.
- Annual Reporting to FRDC funding partners and other stakeholders.
- Reporting to the Council of Rural Research and Development Corporations (CRRDC).
- Reporting RD&E impact and performance to FRDC levy payers and other fisheries and aquaculture stakeholders as well as the broader Australian community.

In August 2023, FRDC commissioned ACRE Economics Pty Ltd and associates to undertake cost benefit analyses (CBAs) of six RD&E projects funded under the FRDC 2020-2025 RD&E Plan and completed in the years ended 30 June 2017 to 2021. The projects were selected by FRDC and spanned the organisation's current RD&E Programs and Strategic Outcomes. The sample selected (six projects) comprises a relatively small proportion of the FRDC's total RD&E investment (~5%) of the relevant population and may, therefore, not be fully representative of the entire RD&E Portfolio. However, the projects evaluated provide insight into the activities and outputs associated with each of FRDC's RD&E Programs, and the outcomes and impacts (and benefits) created. In turn, this will enable communication of benefits of FRDC RD&E to the FRDC Board, funding partners including the Commonwealth, industry, and other stakeholders.

The six projects selected by FRDC for evaluation in calendar 2023 were:

1. 2016-224: *Boosting fisher returns through smart value adding and greater use of underutilised species*
2. 2016-261: *Investigating the use of trace element profiles to substantiate provenance for the Australian prawn industry*
3. 2017-242: *Our Pledge: Australian seafood industry response to community values and expectations*
4. 2018-148: *A Stock Assessment Toolbox for Australian Fisheries*
5. 2018-164: *Commercial production trial with high POMS tolerant triploid Pacific Oysters in approved NSW estuaries*
6. 2018-205: *Informing strategies, policies and options supporting owner-operated fishing businesses in fisheries experiencing corporatisation*

This report presents the assessment process and findings for Project 2016-261: *Investigating the use of trace element profiles to substantiate provenance for the Australian prawn industry.*

Evaluation Framework

The annual impact assessments of FRDC RD&E investments followed 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 includes both qualitative and quantitative assessment components that are in accord with the current [guidelines for impact assessment](#) published by the CRRDC (CRRDC, 2018).

The evaluation process utilised an input to impact continuum RD&E project inputs (costs), objectives, activities, and outputs were briefly described and documented. Actual and expected outcomes, and any actual and/or potential future impacts (positive and/or negative) associated with project outcomes then were identified and described. The principal economic, environmental, and social impacts were then summarised in a triple bottom line framework and validated through consultation with expert personnel and review of published literature.

Once impacts were identified and validated, an assessment then was made about whether to quantify/value any of the impacts in monetary terms as part of the project-level analysis. The decision to value an impact identified was based on:

- Data availability and information necessary to form credible valuation assumptions,
- The complexity of the relevant valuation methods applicable given project resources,
- The likely magnitude of the impact and/or the expected relative value of the impact compared to other impacts identified, and
- The strength of the linkages between the RD&E investment and the impact identified.

Where one or more of the identified impacts were selected for valuation, the impact assessment used cost-benefit analysis (CBA) as a principal tool. The impacts valued therefore were deemed to represent the principal benefits delivered by the project investment. However, as not all impacts were valued (based on the selection criteria), the investment criteria estimated for the project investment evaluated are likely to represent an underestimate of the true performance of the FRDC project.

The qualitative and quantitative analysis processes, data sources, assumptions, specific valuation frameworks (where applicable), and evaluation results were clearly documented and then integrated into a written report.

Project Background

Background

In 2015 industry stakeholders from the Australian Council of Prawn Fishers (ACPF) and the Australian Prawn Farmers Association (APFA) identified the potential for the "Love Australian Prawns" campaign to be undermined by the practice of unscrupulous operators substituting Australian prawns with lower value product.

Rationale for Project 2016-261

Therefore, it was proposed that, to support the national marketing strategy, a rapid and robust scientific method should be developed to verify geographical provenance.

The trace metal authentication methods used by other primary production industries represented a possible opportunity to prove provenance. Should the technology prove suitable, a detailed and effective communication strategy (aligned with the "Love Australian Prawns" distribution channels) was considered mandatory to ensure whole of chain knowledge of the capability as well as demonstrate how the knowledge could be applied to manage product integrity issues.

A project to investigate this technology, funded as FRDC 2016-261 (Investigating the Use of Trace Element Profiles to Substantiate Provenance for the Australian Prawn Industry) was subsequently supported.

Project Details

Summary

Project Code: 2016-261

Title: *Investigating the Use of Trace Element Profiles to Substantiate Provenance for the Australian Prawn Industry*

Research Organisation: Curtin University of Technology

Principal Investigator: Dr Janet Howieson

Period of Funding: September 2019 to January 2021

FRDC Program Allocation: Communities 25%, Industry 75%

Objectives

The specific objectives of project 2016-261 were to:

1. Investigate and pilot a cost-effective, legally enforceable method to establish the provenance of prawns and ensure robust identification of source harvest areas for the Australian prawn industry.
2. Investigate and confirm with stakeholders how the method can be used as a basis for preventing / discouraging the substitution currently impacting the "Love Australian Prawns" national strategy and other accreditation/branding initiatives (e.g., MSC Certification).
3. Communicate the outcomes of project results to supply chain partners and regulators and evaluate such that it can be shown that they are aware that such a method exists and how it can be used to manage product integrity.

Logical Framework

Table 1: Logical Framework for FRDC Project 2016-261

Activities	Stage 1: Proof of concept:
	• A steering committee was formed that included FRDC, ACPF and APFA.
	• The steering committee sought legal advice to underpin the project including definitions around different types of food substitution/misrepresentation, the regulatory implications of food substitution in each Australian jurisdiction, frameworks needed for enforcement, and the standard of evidence required to support the scientific method.
	• Face-to-face consultation was completed with industry, distributors, retailers, and enforcement agencies to determine the level of support for the proposed approach and support was secured from these stakeholders.
	• A prawn sampling program was trialled based on a "chain of custody" protocol and aligned documentation was developed by a forensic laboratory.
	• In 2016/17, 120 prawn samples were collected, collated, and stored under the protocol.
	• An expression of interest process was executed in 2018 to select a suitable laboratory for Stage 2 analytical work and Source Certain International was selected.
	• The final report for Stage 1 of the project was reviewed by the ACPF and APFA Boards who subsequently agreed to take the project to Stage 2.
	Stage 2: Database construction and extension:
	• An assessment of ACPF and APFA production areas resulted in the delineation of 35 wild harvest sources and 19 farmed prawn sources for the project.

	• Between 2016 and 2019, 273 wild harvest and 136 farmed prawn samples were collected and forwarded to Source Certain International for analysis and inclusion in the project database. • Prawn sample analysis resulted in a statistically robust ability to separate prawns by fishery and by farm. • The ability of the test protocol and prawn sample database to establish provenance was established via an in-market exercise in mid-2019. • Project partners have subsequently worked together on commercialisation and extension of the tools. • Commercial wild-catch and farmed prawn businesses, retailers, and third-party certification bodies have expressed interest in accessing the technology and the database. Final decisions on commercialisation and extension will be guided by the project's overarching goal of protecting the provenance of Australian prawns. • Throughout the project, information on progress and ultimate project success was communicated via industry fora and media channels. This communication activity culminated with the announcement of proven capacity to establish Australian prawn provenance by the Federal Assistant Minister for Forestry and Fisheries, Jonathon Durham at an event attended by more than 80 prawn industry stakeholders in Melbourne in October 2019.
Outputs	• A scientifically robust, legislatively supported method of establishing the provenance of Australian prawns. This method has been widely communicated to industry and potential unscrupulous operators who may otherwise be tempted to substitute low-cost alternatives for Australian prawns. Project researchers won a national seafood R&D award for this project.
Outcomes	• Protection of the reputation and associated price premium for Australian prawns.
Impacts (potential)	• Protection of the price premium realised by Australian prawn fishers and farmers for their product (i.e., marketing advantage, consumer confidence, and avoided income loss). • Increased researcher capacity in relation to trace element profiling and its application to food provenance. • Improved regional community wellbeing through spillover benefits from more productive and profitable prawn fishing and farming businesses. • Potential increase in consumer trust in Australian prawn products.

Source: FRDC project documentation

Nominal Investment

Table 2 shows the total annual investment made in project 2016-261 by FRDC and other contributors.

Table 2: Total Investment in FRDC Project 2016-261
(nominal dollar terms)

Year ended 30 June	FRDC ($)	Others ($)	Total ($)
2017	55,000	4,800	59,800
2018	171,800	20,000	191,800
2019	43,451	0	43,451
Totals	**270,251**	**24,800**	**295,051**

Source: FRDC project 2016-261 documentation

Management and Administration Costs

For the FRDC investment, the cost of managing the FRDC funding was added to the FRDC contribution for the project via a management cost multiplier (x1.179). This multiplier was estimated based on a five-year average of the ratio of total FRDC cash expenditure to project expenditure reported in the FRDC's Cash Flow Statement (FRDC Annual Reports, 2018-2022). This multiplier then was applied to the nominal investment by FRDC shown in Table 2. A multiplier of 1.00 was used for administration and management costs for other contributors.

Real Investment and Extension Costs

For the purposes of the impact analysis, the investment costs of all parties were expressed in 2022/23-dollar terms using the Implicit Price Deflator for Gross Domestic Product (ABS, 2023).

The cost of extension to maintain stakeholder awareness of the tool along with ongoing update of the provenance database is required to secure potential project impacts over the long term.

Impacts

Table 3 provides a summary of the principal types of potential impacts from project 2016-261. Impacts have been taken from those listed in Table 1 and categorised using a triple bottom line framework into economic, environmental, and social impact types.

Table 3: Principal Potential Impact Types from Investment in FRDC Project 2016-261

Economic	• Protection of the price premium realised by Australian prawn fishers and farmers for their product (i.e., marketing advantage, consumer confidence, and avoided income loss).
Environmental	• Nil
Social	• Increased researcher capacity in relation to trace element profiling and its application to food provenance. • Improved regional community wellbeing through spillover benefits from more productive and profitable prawn fishing and farming businesses. • Potential increase in consumer trust for Australian prawn products.

Public versus Private Impacts

Both public and private potential impacts were identified for the project. Private impacts may be delivered through protection of the price premium received by Australian prawn fishers and farmers. Public impacts are likely to be delivered through increased researcher capacity and spillover benefits from more profitable fishing and farming businesses.

Distribution of Private Impacts

Private impacts from the investment in project 2016-261 will accrue to prawn fishers, prawn farmers and their associated supply chains. Supply chain beneficiaries will include fish cooperatives, wholesalers, processors, exporters, retailers, and consumers. The share of benefit retained by each member of the supply chain will depend on both short- and long-term supply and demand elasticities.

Impacts on Other Australian Industries

No direct impacts to other Australian industries beyond prawn fishing, prawn farming and their associated supply chains were identified. However, it is possible that capacity developed as part of the project may be used to develop systems to establish provenance in other Australian primary industries. There is also potential for increased overall trust in Australian seafood product provenance.

Impacts Overseas

Implementation of a system that proves the provenance of Australian prawns will provide overseas consumers with confidence in the quality of the product they are buying and consuming.

Match with National Priorities

Australian Agriculture, Science, and Research Priorities

The Australian Government's National Science and Research Priorities and Agricultural Innovation Priorities are reproduced in Table 4. Project 2016-261 contributed to National Science and Research Priority 1. The project also contributed to Agricultural Innovation Priorities 1 and 3.

Table 4: Australian R&D Priorities

Australian Government	
National Science and Research Priorities[1]	National Agricultural Innovation Priorities[2]
1. **Food** – optimising food and fibre production and processing; agricultural productivity and supply chains within Australia and global markets. 2. **Soil and Water** – improving the use of soils and water resources, both terrestrial and marine. 3. **Transport** – boosting Australian transportation: securing capability and capacity to move essential commodities; alternative fuels; lowering emissions. 4. **Cybersecurity** – improving cybersecurity for individuals, businesses, government, and national infrastructure. 5. **Energy and Resources** – supporting the development of reliable, low cost, sustainable energy supplies and enhancing the long-term viability of Australia's resources industries. 6. **Manufacturing** – supporting the development of high value and innovative manufacturing industries in Australia. 7. **Environmental Change** – mitigating, managing, or adapting to changes in the environment. 8. **Health** – improving the health outcomes for all Australians.	On 11 October 2021, the National Agricultural Innovation Policy Statement was released. It highlights four long-term priorities for Australia's agricultural innovation system to address by 2030. These priorities replace the Australian Government's Rural Research, Development and Extension Priorities which were published in the 2015 Agricultural Competitiveness White Paper. 1. Australia is a trusted exporter of premium food and agricultural products by 2030. 2. Australia will champion climate resilience to increase the productivity, profitability, and sustainability of the agricultural sector by 2030. 3. Australia is a world leader in preventing and rapidly responding to significant incursions of pests and diseases through futureproofing our biosecurity system by 2030. 4. Australia is a mature adopter, developer, and exporter of digital agriculture by 2030.

FRDC National RD&E Priorities

Through extensive consultation, the FRDC 2020-2025 RD&E Plan identified five key outcome areas. The five outcome areas were:

1. Growth for enduring prosperity.
2. Best practices and production systems.
3. A culture that is inclusive and forward thinking.
4. Fair and secure access to aquatic resources.
5. Community trust, respect, and value.

Project 2016-261 addressed outcome areas 1, 2, 3 and 5.

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[1] Source: 2015 Australian Government *Science and Research Priorities*. https://www.industry.gov.au/data-and-publications/science-and-research-priorities.

[2] Source: 2021 National Agriculture Innovation Policy Statement. https://www.awe.gov.au/agriculture-land/farm-food-drought/innovation/research_and_development_corporations_and_companies#government-priorities-for-investment.

Valuation of Impacts

The decision to value an impact identified in Table 3 was based on:

- Data availability and information necessary to form credible valuation assumptions,
- The complexity of the relevant valuation methods applicable given project resources,
- The likely magnitude of the impact and/or the expected relative value of the impact compared to other impacts identified, and
- The strength of the linkages between the RD&E investment and the impact identified.

Impacts Valued

A single potential impact of investment in project 2016-261 was valued – protection of Australian prawn price premiums with proven provenance.

Valuation of Impact 1: Protection of Australian prawn price premium

Project research has delivered a scientifically robust, legislatively supported method of establishing the provenance of Australian prawns. With this technology in place, prawn fishers and farmers have access to a tool that will deter substitution and protect the premium Australian product enjoys in both domestic and export markets.

Specific assumptions used to value this impact are reported in Table 5.

Impacts Not Valued

The impacts not valued included:

- Increased researcher capacity in relation to trace element profiling and its application to food provenance. Detailed study of changes in researcher knowledge and their application would be needed to make an estimate this benefit.
- Improved regional community wellbeing through spillover benefits from more productive and profitable prawn fishing and farming businesses. Estimation requires Input-Output modelling that was not part of this impact assessment.

Summary of Assumptions

Table 5 describes the specific assumptions used in the valuation of impacts.

Table 5: Summary of Assumptions for the Valuation of Impact 1

Impact 1: Protection of Australian prawn price premium		
Variable	**Assumption**	**Source**
Australian wild-catch and farmed prawn value.	$506 million/year.	ABARES 2021.
Price premium available to prawn fishers and farmers for Australian provenance.	10%.	Analyst assumption including premiums available in export markets.
Risk in price premium loss with substitution of low-cost product for Australian prawns pre-project.	10% (A)	Analyst assumption.
Risk of price premium loss post-project.	5% (B)	Analyst assumption.
Reduction in risk attributable to the project.	5%	(A) minus (B).
First year of impact.	2023/24.	Commercial partners and active testing program in place 5 years after project completion.
Period of impact.	15 years (2037/38 is last year of impact).	Analyst assumption – trace element testing to substantiate provenance replaced with new technology after this time.
Attribution of impact to this project.	50%.	Analyst assumption – a previous study (a MSc completed by Charlene Tan, Uni WA, 2013) had already determined prawn trace element profiling was feasible.
Risk Factors		
Probability of output.	100%	Project has delivered a testing regime and supporting database.
Probability of outcome.	60%	Commercialisation of technology not yet in place.
Probability of impact.	60%	Other factors may erode price premium e.g., Australian prawn contamination incident.
Counterfactual		
It is assumed that the benefits estimated and attributable to the investment in FRDC Project 2016-261 would not have occurred without the investment.		

Results

All past costs and benefits were expressed in 2022/23-dollar terms. All costs and benefits were discounted to 2022/23 using a discount rate of 5%. A reinvestment rate of 5% was used for estimating the modified internal rate of return (MIRR). The base analysis used the best available estimates for each variable, notwithstanding a level of uncertainty for many of the estimates. All analyses ran for the length of the investment period plus 30 years from the last year of investment (2018/19) to the final year of benefits assumed.

Investment Criteria

Tables 6 and 7 show the investment criteria estimated for different periods of benefits for the total investment and FRDC investment respectively. The present value of benefits (PVB) for the FRDC investment was estimated by multiplying the total PVB cash flow by the proportion of FRDC investment in real, undiscounted dollar terms (92.7%).

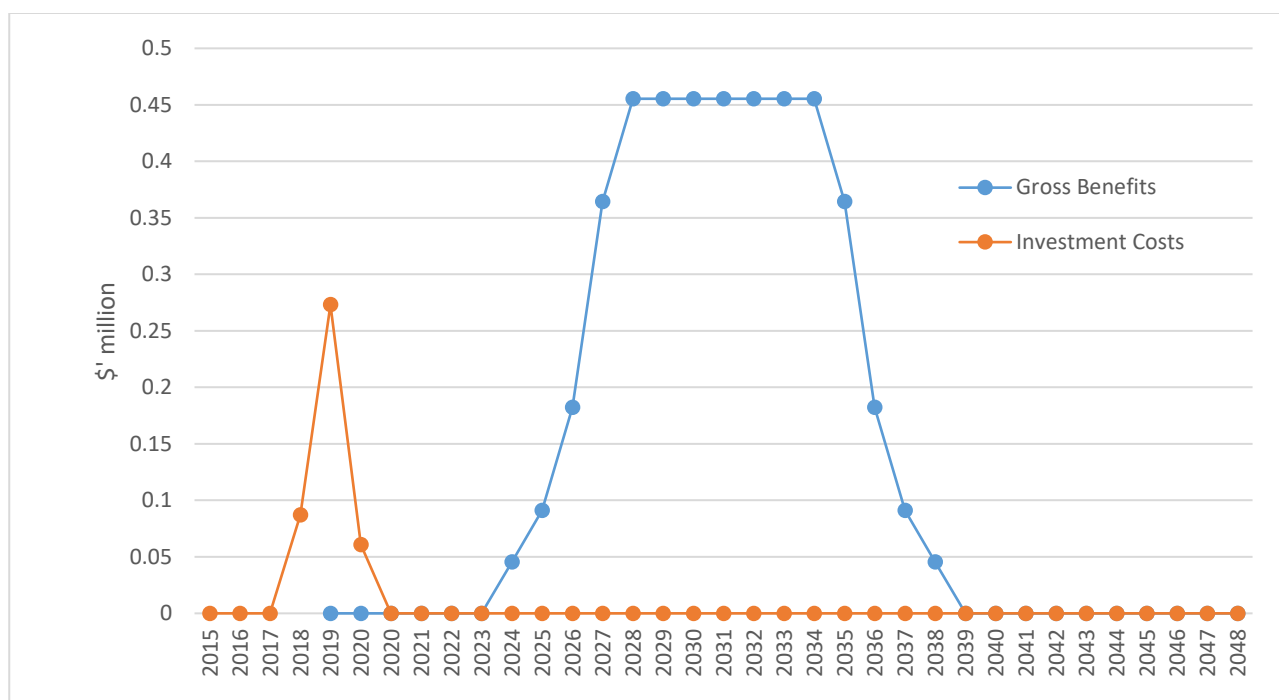Table 6: Investment Criteria for Total Investment in Project 2016-261

Investment criteria	Number of years from year of last investment						
	0	**5**	**10**	**15**	**20**	**25**	**30**
Present value of benefits ($m)	0.00	0.04	1.28	2.75	3.12	3.12	3.12
Present value of costs ($m)	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Net present value ($m)	-0.54	-0.50	0.74	2.21	2.58	2.58	2.58
Benefit-cost ratio	0.00	0.08	2.37	5.10	5.78	5.78	5.78
Internal rate of return (%)	negative	negative	22.4	31.3	31.9	31.9	31.9
MIRR (%)	negative	negative	18.0	19.8	16.1	13.5	11.8

Table 7: Investment Criteria for FRDC Investment in Project 2016-261

Investment criteria	Number of years from year of last investment						
	0	**5**	**10**	**15**	**20**	**25**	**30**
Present value of benefits ($m)	0.00	0.04	1.19	2.55	2.89	2.89	2.89
Present value of costs ($m)	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Net present value ($m)	-0.50	-0.46	0.69	2.05	2.39	2.39	2.39
Benefit-cost ratio	0.00	0.08	2.37	5.10	5.78	5.78	5.78
Internal rate of return (%)	negative	negative	22.4	31.3	31.9	31.9	31.9
MIRR (%)	negative	negative	18.0	19.8	16.1	13.5	11.8

The annual undiscounted benefit and cost cash flows for the total investment for the duration of investment period plus 30 years from the last year of investment are shown in Figure 1.

Figure 1: Annual Cash Flow of Undiscounted Total Benefits and Total Costs

Sensitivity Analyses

Sensitivity analyses were performed for variables that were considered (a) key drivers of the investment criteria, and/or (b) uncertain. Each sensitivity analysis was performed for the total investment and with benefits taken over the life of the investment plus 30 years from the last year of investment. All other parameters were held at their base values.

A sensitivity analysis was carried out on the discount rate. The results, shown in Table 8, showed moderate sensitivity to the discount rate. This was largely due to the benefit cash flows occurring well into the future and therefore being subject to relatively more severe discounting. At all three discount rates the investment criteria show a favourable return on investment.

Table 8: Sensitivity to Discount Rate
(Total investment, 30 years)

Investment Criteria	Discount rate		
	0%	5% (base)	10%
Present value of benefits ($m)	4.55	3.12	2.22
Present value of costs ($m)	0.42	0.54	0.68
Net present value ($m)	4.13	2.58	1.54
Benefit-cost ratio	10.82	5.78	3.25

A sensitivity analysis then was carried out on the assumed price premium available to prawn fishers and farmers for Australian provenance. Table 9 shows the results. The premium on Australian prawns would have to be less than 2% (base case 10%) before project costs equal project benefits.

Table 9: Sensitivity to Price Premium Available to Prawn Fishers/Farmers for Australian Provenance
(Total investment, 5% discount rate, 30 years)

Investment Criteria	Price Premium for Australian Prawns		
	1.75%	5%	10% (base)
Present value of benefits ($m)	0.55	1.56	3.12
Present value of costs ($m)	0.54	0.54	0.54
Net present value ($m)	0.01	1.02	2.58
Benefit-cost ratio	1.01	2.89	5.78

Reduction in risk of premium loss attributable to the project

A final sensitivity analysis was undertaken on the reduction in risk of premium loss attributable to the project. The results, presented in Table 10, show that even if risk of premium loss for Australian prawns was reduced by only 1% as a result of the project, project benefits would continue to exceed project costs.

Table 10: Sensitivity to Reduction in Risk of Premium loss Attributable to the Project
(Total investment, 5% discount rate, 30 years)

Investment Criteria	Reduction in Risk of Premium loss Attributable to the Project		
	1%	5% (base)	10%
Present value of benefits ($m)	0.62	3.12	6.24
Present value of costs ($m)	0.54	0.54	0.54
Net present value ($m)	0.08	2.58	5.70
Benefit-cost ratio	1.16	5.78	11.57

Confidence Rating and Other Findings

The results produced are highly dependent on the assumptions made, some of which are uncertain. There are two factors that warrant recognition. The first factor is the coverage of benefits. Where there are multiple types of benefits it is often not possible to quantify all the benefits that may be linked to the investment. The second factor involves uncertainty regarding the assumptions made, including the linkage between the research and the assumed outcomes.

A confidence rating based on these two factors has been given to the results of the investment analysis (Table 11). The rating categories used are High, Medium, and Low, where:

High: denotes a good coverage of benefits or reasonable confidence in the assumptions made

Medium: denotes only a reasonable coverage of benefits or some uncertainties in assumptions made

Low: denotes a poor coverage of benefits or many uncertainties in assumptions made

Table 11: Confidence in Analysis of Investment

Coverage of Benefits	Confidence in Assumptions
High	Medium

The coverage of benefits was assessed as High. The impact valued was deemed to be the most important from the investment.

Confidence in assumptions was rated as Medium. Many of the valuation assumptions were underpinned by credible data (e.g., ABARES estimates of wild catch and farmed prawn industry value). However, because the investment was only recently completed, there was limited evidence of actual outcomes and impacts. This meant that a number of the assumptions used in the valuation were uncertain.

Conclusions

Project 2016-261 research has delivered a scientifically robust, legislatively supported method of establishing the provenance of Australian prawns. With this technology in place, prawn fishers and farmers will have access to a tool to deter substitution and protect the price premium Australian product enjoys in both domestic and export markets.

The investment has led to a range of potential economic and social impacts. Importantly, Project 2016-261 contributed to:

- Protection of the price premium realised by Australian prawn fishers and farmers for their product (i.e., avoided income loss).
- Increased researcher capacity in relation to trace element profiling and its application to food provenance.
- Improved regional community wellbeing through spillover benefits from more productive and profitable prawn fishing and farming businesses.
- Potential increase in consumer trust for Australian prawn products.

Total funding for the Project was $0.54 million (present value terms) and produced total expected net benefits of $3.12 million (present value terms). This produced an estimated net present value of $2.58 million, a benefit-cost ratio of 5.8 to 1, an internal rate of return (IRR) of 31.9%, and a modified IRR of 11.8% (over 30 years, using a 5% discount rate and 5% finance rate).

Given the conservative assumptions made and the fact that a number of impacts were not valued in monetary terms, the investment criteria reported are likely to be an underestimate of the true performance of the investment in Project 2016-261. The positive results should be viewed favourable by FRDC, the Australian Government, industry, and other RD&E stakeholders.

Glossary of Economics Terms

Cost-benefit analysis:	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.
Benefit-cost ratio:	The ratio of the present value of investment benefits to the present value of investment costs.
Discounting:	The process of relating the costs and benefits of an investment to a base year using a stated discount rate.
Internal rate of return:	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.
Investment criteria:	Measures of the economic worth of an investment such as Net Present Value, Benefit-Cost Ratio, and Internal Rate of Return.
Modified internal rate of return:	The internal rate of return of an investment that is modified so that the cash inflows from an investment are re-invested at the rate of the cost of capital (the re-investment rate).
Net present value:	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.
Present value of benefits:	The discounted value of benefits.
Present value of costs:	The discounted value of investment costs.

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