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FISHERIES RESEARCH &
DEVELOPMENT CORPORATION

FINAL

**An Impact Assessment of FRDC
Investment in 2013-056:
Revision of the Australian
Shellfish Quality Assurance
Program Manual – in light of the
FRDC funded PST review**

Agtrans Research

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Project 2016-134**

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Wayne Hutchinson, Research Portfolio Manager, Fisheries Research and Development Corporation

Abbreviations

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ABS	Australian Bureau of Statistics
ASQAAC	Australian Shellfish Quality Assurance Advisory Committee
ASQAP	Australian Shellfish Quality Assurance Program
CRRDC	Council of Rural Research and Development Corporations
DAWR	Department of Agriculture and Water Resources (Commonwealth)
FRDC	Fisheries Research and Development Corporation
FSANZ	Food Safety Australia New Zealand
GVP	Gross Value of Production
MIRR	Modified Internal Rate of Return
OCS	Office of the Chief Scientist
PST	Paralytic Shellfish Toxin
RD&E	Research, Development and Extension
SC	Steering Committee
US	United States (of America)

Executive Summary

What the report is about

This report presents the results of an impact assessment of a Fisheries Research and Development Corporation (FRDC) investment in the *revision of the Australian Shellfish Quality Assurance Program – in light of the FRDC funded PST review*. The project was funded by FRDC over the period May 2014 to July 2016.

Methodology

The investment was analysed qualitatively within a logical framework that included activities and outputs, outcomes and impacts. Impacts were categorised into a triple bottom line framework. Principal impacts identified were then considered for valuation. Past and future cash flows were expressed in 2017/18 dollar terms and were discounted to the year 2017/18 using a discount rate of 5% to estimate the investment criteria.

Results/key findings

The major potential impact identified was of a financial nature and involved reduced expected economic losses for the Australian shellfish sector through a decreased risk of future food safety incidents associated with Australian shellfish.

Investment Criteria

Funding for the project totalled \$50,915 (present value terms) and produced estimated total expected benefits of \$0.28 million (present value terms). This gave a net present value of \$0.23 million, an estimated benefit-cost ratio of 5.6 to 1, an internal rate of return of 16.7% and a modified internal rate of return of 11.0%.

Conclusions

The investment in the revision of the Australian Shellfish Quality Assurance Program Operations Manual has provided Australian shellfish managers and producers with a national framework that will assure that shellfish grown in Australian waters continue to be produced in a safe manner, following internationally respected risk assessment principles and a scientifically sound management framework.

While several potential social impacts identified were not valued, the linkages between the project and these impacts were weak and the impacts were considered uncertain and minor compared with the impacts valued. Nevertheless, combined with conservative assumptions for the impacts valued, investment criteria as provided by the valued impacts may be underestimates of the investment performance.

Keywords

Impact assessment, cost-benefit analysis, Australian Shellfish Quality Assurance Program, ASQAP Operations Manual, food safety, edible shellfish

Introduction

The Fisheries Research and Development Corporation (FRDC) required a series of impact assessments to be carried out annually on a number of investments in the FRDC research, development and extension (RD&E) portfolio. The assessments were required to meet the following FRDC evaluation reporting requirements:

- Reporting against the FRDC 2015-2020 RD&E Plan and the Evaluation Framework associated with FRDC's Statutory Funding Agreement with the Commonwealth Government.
- Annual Reporting to FRDC stakeholders.
- Reporting to the Council of Rural Research and Development Corporations (CRRDC).

The first series of impact assessments, that included 20 randomly selected FRDC investments, was completed in August of 2017. The published reports for the first series of evaluations can be found at: <http://frdc.com.au/Research/Benefits-of-research/2017-Portfolio-Assessment>

The second series of impact assessments also included 20 randomly selected FRDC investments. The investments were worth a total of approximately \$5.62 million (nominal FRDC investment) and were selected from an overall population of 96 FRDC investments worth an estimated \$21.32 million (nominal FRDC investment) where a final deliverable had been submitted in the 2016/17 financial year.

The 20 investments were selected through a stratified, random sampling process such that investments chosen spanned all five FRDC Programs (Environment, Industry, Communities, People and Adoption), represented approximately 26% of the total FRDC RD&E investment in the overall population (in nominal terms) and included a selection of small, medium and large FRDC investments.

Project 2013-056: *Revision of the Australian Shellfish Quality Assurance Program Manual – in light of the FRDC funded PST review* was selected as one of the 20 investments and was analysed in this report.

General Method

The impact assessments 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 descriptions that are in accord with the impact assessment guidelines of the CRRDC (CRRDC, 2014).

The evaluation process involved identifying and briefly describing project objectives, activities and outputs, outcomes, and impacts. The principal economic, environmental and social impacts were then summarised in a triple bottom line framework.

Some, but not all, of the impacts identified were then valued in monetary terms. Where impact valuation was exercised, the impact assessment uses cost-benefit analysis as its principal tool. The decision not to value certain impacts was due either to a shortage of necessary evidence/data, a high degree of uncertainty surrounding the potential impact, or the likely low relative significance of the impact compared to those that were valued. The impacts valued are therefore deemed to represent the principal benefits delivered by the project. However, as not all impacts were valued, the investment criteria reported for individual investments potentially represent an underestimate of the performance of that investment.

Background and Rationale

Background

Australian Shellfish

Shellfish, as a seafood classification for the purpose of this report, includes all edible species of bivalve molluscs such as oysters, clams, scallops, pipis, and mussels, either shucked or in the shell, fresh or frozen, whole or in part or processed, and harvested for human consumption (ASQAAC, 2017).

In 2015/16 the gross value of production (GVP) of molluscs (wild-caught and farmed) was approximately \$391.1 million (wild-caught¹: \$176.3 million at 12,392 tonnes; farmed²: \$214.8 million at 15,728 tonnes) (ABARES, 2017).

The Australian Shellfish Quality Assurance Program

The Australian Shellfish Quality Assurance Program (ASQAP) is a government-industry cooperative program designed to assure the food safety of shellfish managed in accordance with its operational guidelines (DAWR, 2017).

The ASQAP is a food safety program adopted by each shellfish producing state and territory of Australia and is overseen by the Australian Shellfish Quality Assurance Advisory Committee (ASQAAC) that consists of representatives from Food Safety Australia New Zealand (FSANZ), the Department of Agriculture and Water Resources (DAWR), State Government Departments responsible for shellfish safety, and industry representatives from each participant state/territory.

The ASQAP is modelled on the internationally accepted United States (US) National Shellfish Sanitation Program³. The premise of the ASQAP is that harvesting should only occur from growing areas that are shown to be free from harmful contaminants and pathogenic micro-organisms. Each growing area must undergo a full and comprehensive sanitary survey, with appropriate classifications and management strategies determined before harvesting is permitted (Biosecurity Tasmania, 2017).

The ASQAP Manual

The ASQAP Operations Manual (the Manual) comprises the procedures and administrative practices that, if adhered to, enable food safety programs to comply with the FSANZ Food Standards Code and Export Orders as they relate to bivalve molluscs. The Manual is noted in the Food Standards Code as 'the National guideline for managing risks in the harvesting, relaying, depuration and wet storage of shellfish'. The implementation of pre- and post-harvest Manual standards is the responsibility of the appropriate state and territory government agencies and industry (ASQAAC, 2017).

¹ Includes squid.

² Includes pearl oysters.

³ For further information see:

<https://www.fda.gov/Food/GuidanceRegulation/FederalStateFoodPrograms/ucm2006754.htm>

Rationale

In October 2012, a shipment of mussels derived from the east coast of Tasmania was rejected by Japanese import authorities due to the presence of unacceptable levels of paralytic shellfish toxins (PSTs). Following the initial discovery, additional seawater and bivalve samples revealed the presence of PSTs in bivalves at several sites between Eddystone Point and Marion Bay (Tasmania). The presence of PSTs at high levels in mussels represented a major breakdown in the Tasmanian component of the Shellfish Quality Program.

In 2013, FRDC funded project 2012-060: *Review of the 2012 paralytic shellfish toxin non-compliance incident in Tasmania* to determine the key factors that led to the non-compliance event, and to learn from the event to assist in the development of future strategies to reduce the probability of future events occurring (FRDC project documentation, Project 2012-060).

In light of the FRDC funded PST review, the ASQAAC noted the urgent need to update the ASQAP Operations Manual. Project 2013-056 was funded to update the ASQAP Manual to ensure that guidance on shellfish management is up to date, sufficient to allow consistency of interpretation and risk assessment, and is in line with international best practice.

Project Details

Summary

Project Code: 2013-056
Title: <i>Revision of the Australian Shellfish Quality Assurance Program Manual – in light of the FRDC funded PST review</i>
Research Organisation: Department of Primary Industries and Regions, South Australia
Principal Investigator: Clinton Wilkinson
Period of Funding: May 2014 to July 2016
FRDC Program Allocation: Environment (100%)

Objectives

The project's objectives were:

1. An updated ASQAP manual will be produced in consultation with all members of ASQAAC.
2. The updated manual will be internationally peer reviewed.
3. The updated manual will be endorsed by the ASQAAC for agreement by International Scientific Committee.

Logical Framework

Project 2013-056 aimed to produce an updated ASQAP Manual that was outcome focused, provided clear guidance that was internationally robust, and that would provide a framework to the relevant state agencies for running their state shellfish safety programs. Table 1 provides a more detailed description of the project in a logical framework.

Table 1: Logical Framework for Project 2013-056

Activities and Outputs	<ul style="list-style-type: none">• An ASQAAC Steering Committee (SC) was formed to address the issues that had been identified from the FRDC Tasmania PST report (project 2012-060) and assess other issues from the past and future concerns.• An expert on marine biotoxins with knowledge on international best practice was contracted to write the new ASQAP Operations Manual in conjunction with the SC.• The SC held regular meetings in person and by teleconference throughout the project.• The Manual was completely re-written, adding world's best practice. The re-write took the Manual from a US based model to a more Australia-specific model that takes into account both US and European models (Clinton Wilkinson, pers. comm., 2018).• Wording within the Manual was adapted to be more outcome focused, clearly stating the aims of each policy. Other major changes included (Clinton Wilkinson, pers. comm., 2018):<ul style="list-style-type: none">○ The ability to classify based on meat testing,○ An increased requirement for biotoxin risk assessment and monitoring, and○ The addition of bacteriophage as a tool for managing shellfish waste.• A full and final draft of the Manual was reviewed by the ASQAAC SC and accepted.
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	<ul style="list-style-type: none"> Stakeholders (e.g. FSANZ) were notified of the new Manual and the final document was published on the SafeFish website: http://safefish.com.au/Reports/Manuals-and-Technical-Guidelines The project recommended that additional/supplementary guidance documents be produced on: <ul style="list-style-type: none"> the management of sewage incidents in proximity to shellfish leases, and the implementation of biotoxin management, including the use of biotoxin rapid test technologies.
Outcomes	<ul style="list-style-type: none"> The revision of the Manual has made it easier for shellfish control authorities to use the Manual (Clinton Wilkinson, pers. comm., 2018). The ASQAAC agreed that the Manual, as a national reference, will help to assure that shellfish grown in Australian waters continue to be produced in a safe manner, following internationally respected risk assessment principles and a scientifically sound management framework. All relevant Australian States and Territories (with the exception of Queensland) have now adopted the revised Manual and State program managers now have an up to date Manual to assist them in running their individual, state-based programs. The shellfish industry now has a risk based, national framework to operate under that may lead to fewer shellfish safety incidents and continued access to current international markets. Development of a biotoxin risk template remains on the ASQAAC agenda and will be discussed at the next ASQAAC meeting in August 2018. A document describing a draft guideline for marine biotoxin risk characterisations was distributed to relevant stakeholders. The goal is that all states and territories produce risk assessments that meet the guideline's key criteria and are updated regularly (Clinton Wilkinson, pers. comm., 2018).
Impacts	<ul style="list-style-type: none"> Maintenance of the reputation of Australian shellfish as food safe and sustainable. Potentially, reduced expected productivity losses for Australian shellfish industries through the Manual's contribution to a reduced risk of shellfish food safety incidents and maintained access to international markets. Potentially, maintained regional community well-being through the spill-over effects of maintained profitability for Australian shellfish industries. Potentially, maintained health and well-being outcomes for Australian and overseas consumers of Australian shellfish.

Project Investment

Nominal Investment

Table 2 shows the annual investment (cash and in-kind) in project 2013-056 by FRDC. The project was 100% funded by FRDC.

Table 2: Annual Investment in the Project 2013-056 (nominal \$)

Year ended 30 June	FRDC (\$)	OTHER (\$)	TOTAL (\$)
2014	11,700	0	11,700
2015	11,700	0	11,700
2016	0	0	0
2017	15,600	0	15,600
Totals	39,000	0	39,000

Program Management 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 (1.122). This multiplier was estimated based on the share of 'employee benefits' and 'supplier' expenses' in total FRDC expenditure (5-year average) reported in the FRDC's Cash Flow Statement (FRDC Annual Reports, 2013-2017). This multiplier then was applied to the nominal investment by FRDC shown in Table 2.

Real Investment and Extension Costs

For the purposes of the investment analysis, the investment costs of all parties were expressed in 2017/18 dollar terms using the Implicit Price Deflator for Gross Domestic Product (ABS, 2018). No additional costs of extension were included as the project included a high level of consultation with key stakeholders, including the ASQAAC, and extension through published project findings and presentations to industry representatives and State Program Managers.

Impacts

Table 3 provides a summary of the principal types of impacts emanating from the updated ASQAP Manual investment. Impacts have been categorised into economic, environmental and social impacts.

Table 3: Triple Bottom Line Categories of Principal Impacts from Project 2013-056

Economic	<ul style="list-style-type: none"> • Potentially, reduced expected productivity losses for Australian shellfish industries through the Manual’s contribution to a reduced risk of shellfish food safety incidents and maintained access to international markets.
Environmental	<ul style="list-style-type: none"> • Nil
Social	<ul style="list-style-type: none"> • Maintenance of the reputation of Australian shellfish as food safe and sustainable. • Potentially, maintained regional community well-being through the spill-over effects of maintained profitability for Australian shellfish industries. • Potentially, maintained health and well-being outcomes for Australian and overseas consumers of Australian shellfish.

Public versus Private Impacts

Both private and public impacts were identified for project 2013-056. Private impacts potentially will occur through reduced expected production losses for Australian shellfish producers because of a reduced risk of food safety incidents and maintained access to international markets. On the other hand, public impacts are likely to be delivered through community well-being spill-over effects from maintenance of industry incomes and through maintained reputation and health and well-being outcomes.

Distribution of Private Impacts

Private impacts would primarily be experienced by individual commercial shellfish producers operating in Australia. Impacts would be distributed according to associated supply and demand elasticities along the shellfish supply chains.

Impacts on other Australian industries

It was assumed that any private impacts from the investment in project 2013-056 will be confined to Australian shellfish producers and their associated supply chains including shellfish consumers (both Australian and overseas) .

Impacts Overseas

No significant impacts to overseas parties are expected. However, some minor impact may be delivered through maintained health and well-being outcomes for overseas consumers of Australian shellfish.

Match with National Priorities

The Australian Government’s Science and Research Priorities and Rural RD&E priorities are reproduced in Table 4. The project findings and related impacts will contribute primarily to Rural RD&E Priorities 2 and 3, and to Science and Research Priority 1.

Table 4: Australian Government Research Priorities

Australian Government	
Rural RD&E Priorities (est. 2015)	Science and Research Priorities (est. 2015)
<ol style="list-style-type: none"> 1. Advanced technology 2. Biosecurity 3. Soil, water and managing natural resources 4. Adoption of R&D 	<ol style="list-style-type: none"> 1. Food 2. Soil and Water 3. Transport 4. Cybersecurity 5. Energy and Resources 6. Manufacturing 7. Environmental Change 8. Health

Sources: (DAWR, 2015) and (OCS, 2015)

Valuation of Impacts

Impacts Valued

Analyses were undertaken for total benefits that included future expected benefits. A degree of conservatism was used when finalising assumptions, particularly when some uncertainty was involved. Sensitivity analyses were undertaken for those variables where there was greatest uncertainty or for those that were identified as key drivers of the investment criteria.

One key impact of the project was valued. This was the economic impact of reduced expected production losses for Australian shellfish producers because of a reduced risk of shellfish food safety incidents occurring. This impact was considered the primary and most significant impact stemming from the project 2013-056 investment.

Impacts Not Valued

Not all impacts identified in Table 3 could be valued in the assessment. Social impacts were hard to value because of a lack of evidence/data, difficulty in quantifying the causal relationships and pathways between the project investment and the impacts, and the complexity of assigning monetary values to the associated impacts.

The social impacts identified but not valued included:

- Maintenance of the reputation of Australian shellfish as food safe and sustainable.
- Potentially, maintained regional community well-being through the spill-over effects of maintained profitability for Australian shellfish industries.
- Potentially, maintained health and wellbeing outcomes for Australian and overseas consumers of Australian shellfish.

Valuation of Impact 1: Maintained Profitability for Australian Shellfish Producers

In Australia, seafood was implicated in 211 foodborne illness outbreaks involving 2,305 notified cases and one death between January 2001 and June 2014. Also, between January 2006 and August 2016 there were 27 recorded recalls of fish or fish products that involved domestic seafood production (Pahl, Malhi, & Turnbull, 2016).

The 2013-056 project investment produced an up to date ASQAP Operations Manual that provides a risk based, internationally recognised, national framework for shellfish producers to operate under that may contribute to fewer food safety incidents (reduced risk), and in turn contribute to reduced expected losses from such incidents.

The gross value of edible shellfish production in Australia was approximately \$294.3 million in 2015/16 (derived using statistics from ABARES (2017)) and it was conservatively assumed that 5% of the Australian edible shellfish sector is at risk of economic loss because of a food safety incident each year (e.g. as a result of non-compliance and/or deviation from the Manual). Further, it was assumed that profit represents 10% of the shellfish GVP.

Also, based on the direct economic costs of the Tasmanian PST incident (\$6.3 million) (Campbell, Hudson, McLeod, Nicholls, & Pointon, 2013) as a proportion of Tasmanian shellfish GVP in for 2012/13 (\$119.5 million) (ABARES, 2016), it was assumed that potential economic losses related to a food safety incident are approximately 5% of gross value.

The investment in project 2013-056 was assumed to have reduced the risk of food safety incidents for the Australian shellfish sector, resulting in a lower expected annual GVP loss.

Specific assumptions for valuing Impact 1 are provided in Table 5.

Counterfactual

Without the investment to revise the ASQAP Manual, it was assumed that the risk of a food safety incident related to Australian shellfish production was approximately 7.0% per year (based on the 211 foodborne illness outbreaks over 13.5 years) and that, if project 2013-056 had not been funded, the benefits estimated in this analysis would not be realised.

Summary of Assumptions

A summary of key assumptions made for valuation of the impacts is shown in Table 5.

Table 5: Summary of Assumptions

Variable	Assumption	Source
Impact 1: Reduced expected production losses from the reduced risk of future food safety incidents for the Australian shellfish sector		
GVP of Australian shellfish sector	\$294.3 million p.a.	Based on data from ABARES, 2017
Proportion of the Australian shellfish sector exposed to the risk of a significant food safety incident (e.g. through non-compliance/deviation from the Manual)	5% each year	Agrans Research, conservative assumption (see sensitivity analysis: Table 9)
Profit as a proportion of GVP	10%	
Estimated economic loss as a result of a significant food safety incident	5%	Agrans Research, based on the direct economic costs of Tasmanian PST as a proportion of Tasmanian shellfish GVP in 2012/13 (\$6.3/\$119.5 ~ 5%)
WITHOUT the investment		
Probability of a significant food safety incident linked to Australian shellfish	7.0% each year	Based on approximately 15 food safety incidents per year, and 1 in every 15 incidents leading to significant economic loss (211 foodborne illness outbreaks in the 14-year period 2001 to 2014 (Pahl, Malhi, & Turnbull, 2016))
WITH investment		
Probability of a significant food safety incident linked to Australian shellfish	5.0% each year	Agrans Research
First year of potential impact	2017/18	Based on publication year of revised ASQAP Operations Manual

Results

All past and future costs and benefits were expressed in 2017/18 dollar terms. All costs and benefits were discounted to 2017/18 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 project investment period plus 30 years from the last year of investment (2016/17) as per the CRRDC Impact Assessment Guidelines (CRRDC, 2014).

Investment Criteria

Tables 6 and 7 show the investment criteria estimated for different periods of benefits for the total investment and the FRDC investment respectively. The investment criteria for the FRDC investment only, shown in Table 7, are the same as for the total investment because FRDC contributed 100% of project funding.

Table 6: Investment Criteria for Total Investment in Project 2013-056

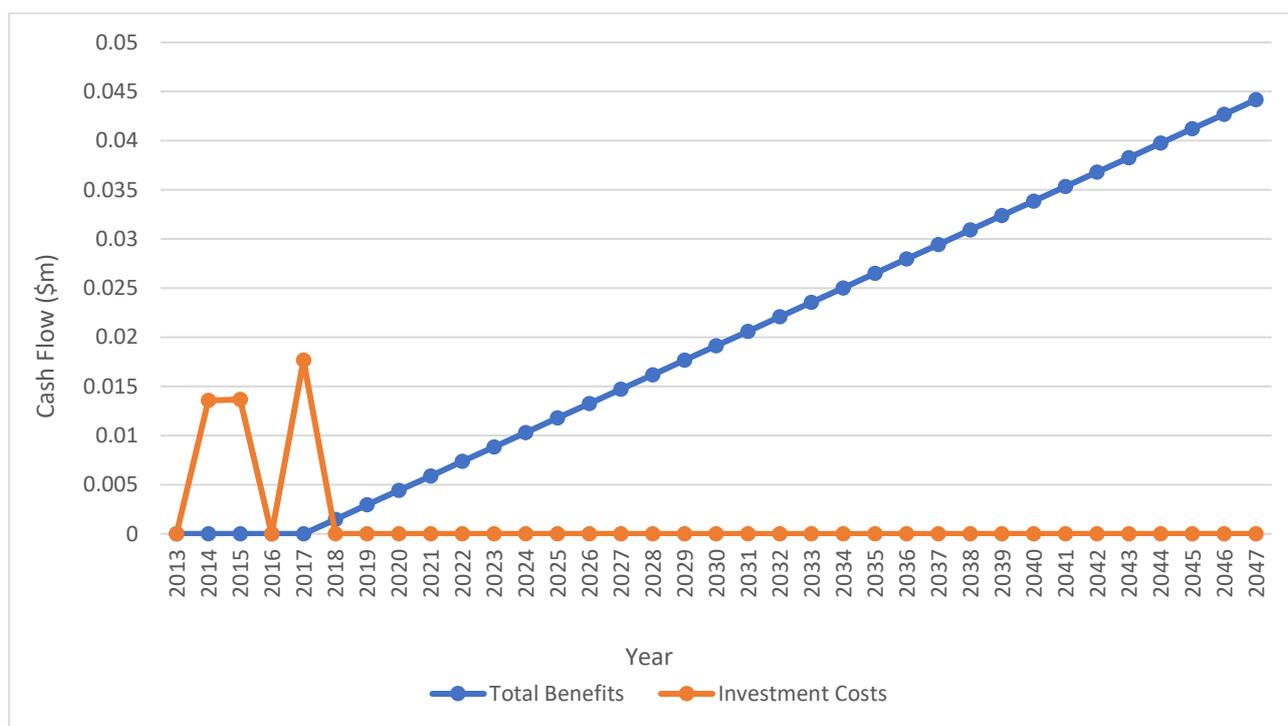
Investment Criteria	Years after Last Year of Investment						
	0	5	10	15	20	25	30
Present Value of Benefits (\$m)	0.00	0.02	0.06	0.11	0.17	0.23	0.28
Present Value of Costs (\$m)	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Net Present Value (\$m)	-0.05	-0.03	0.01	0.06	0.12	0.18	0.23
Benefit-Cost Ratio	0.00	0.38	1.20	2.24	3.37	4.50	5.59
Internal Rate of Return (%)	negative	negative	7.3	13.0	15.3	16.3	16.7
MIRR (%)	negative	negative	3.0	9.2	10.9	11.1	11.0

Table 7: Investment Criteria for FRDC Investment in Project 2013-056

Investment Criteria	Years after Last Year of Investment						
	0	5	10	15	20	25	30
Present Value of Benefits (\$m)	0.00	0.02	0.06	0.11	0.17	0.23	0.28
Present Value of Costs (\$m)	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Net Present Value (\$m)	-0.05	-0.03	0.01	0.06	0.12	0.18	0.23
Benefit-Cost Ratio	0.00	0.38	1.20	2.24	3.37	4.50	5.59
Internal Rate of Return (%)	negative	negative	7.3	13.0	15.3	16.3	16.7
MIRR (%)	negative	negative	3.0	9.2	10.9	11.1	11.0

The annual undiscounted benefit and cost cash flows for the total investment for the duration of the project 2013-056 investment 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 Investment Costs



Sensitivity Analyses

A sensitivity analysis was carried out on the discount rate. The 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. Table 8 presents the results. The results showed a moderate to high sensitivity to the discount rate. This was because the benefits of the investment occur well into the future and therefore are subject to heavy discounting.

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

Investment Criteria	Discount rate		
	0%	5% (base)	10%
Present value of benefits (\$m)	0.68	0.28	0.14
Present value of costs (\$m)	0.04	0.05	0.06
Net present value (\$m)	0.64	0.23	0.08
Benefit-cost ratio	15.23	5.58	2.43

A sensitivity analysis was undertaken for the assumption of the proportion of the edible shellfish industry at risk from a food safety incident each year as this was a key driver of the results and was a variable with some uncertainty. The results, reported in Table 9, show that the investment criteria remain positive even when the proportion of industry at risk falls to 1.0%.

Table 9: Sensitivity to the Proportion of the Edible Seafood Industry at Risk of a Food Safety Incident
(Total investment, 30 years)

Investment Criteria	Proportion of Edible Shellfish Industry at Risk		
	1%	5% (base)	20%
Present value of benefits (\$m)	0.06	0.28	1.14
Present value of costs (\$m)	0.05	0.05	0.05
Net present value (\$m)	0.01	0.23	1.09
Benefit-cost ratio	1.12	5.58	22.34

Finally, a sensitivity analysis was undertaken for the assumption of the change in risk associated with the investment in project 2013-056, given the risk of an incident without the project was estimated at 7.0%. The results, see Table 10, show that the investment criteria had a high sensitivity to the assumed change in risk. However, investment criteria remain positive even when the change in risk is as low as 0.5% (7.0% less 6.5%).

Table 10: Sensitivity to the Change in Risk Associated with Investment in Project 2013-056
(Total investment, 30 years)

Investment Criteria	Risk of Food Safety Incident WITH Project 2013-056		
	2.0%	5.0% (base)	6.5%
Present value of benefits (\$m)	0.71	0.28	0.07
Present value of costs (\$m)	0.05	0.05	0.05
Net present value (\$m)	0.66	0.23	0.02
Benefit-cost ratio	13.96	5.58	1.40

Confidence Ratings 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 Project

Coverage of Benefits	Confidence in Assumptions
Medium-High	Low

The coverage of benefits was assessed as medium to high as the impact valued represented the most direct and significant impact of the investment (reduced risk of economic loss associated with food safety incidents for the Australian edible shellfish sector). On the other hand, while the assumptions were partially supported by the project findings, consultation with the Principal Investigator and various public reports, the levels assumed for the proportion of industry at risk and changes to that risk are somewhat uncertain and therefore confidence was considered to be low.

Conclusions

The investment in the revision of the ASQAP Operations Manual has provided Australian shellfish managers and producers with a national framework that will assure that shellfish grown in Australian waters continue to be produced in a safe manner, following internationally respected risk assessment principles and a scientifically sound management framework. It is likely that the investment in project 2013-056 has contributed to a reduced risk of future food safety incidents associated with Australian shellfish that, in turn, will allow continued access to domestic and international markets.

Funding for the project totalled \$50,915 (present value terms) and produced estimated total expected benefits of \$0.28 million (present value terms). This gave a net present value of \$0.23 million, an estimated benefit-cost ratio of 5.6 to 1, an internal rate of return of 16.7% and a modified internal rate of return of 11.0%.

While several potential social impacts identified were not valued, the linkages between the project and these impacts were weak and their impacts were considered uncertain and minor compared with the impacts valued. Nevertheless, combined with conservative assumptions for the impacts valued, investment criteria as provided by the valued impacts may be underestimates of the investment performance.

Glossary of Economic 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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