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An Impact Assessment of FRDC Investment in 2008-327: FRDC Agribusiness Scholarship

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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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Jo-Anne Ruscoe, Project Manager, Fisheries Research and Development Corporation
Former FRDC Agribusiness Scholarship Holders

Abbreviations

CBA	Cost-Benefit Analysis
CRRDC	Council of Research and Development Corporations
FRDC	Fisheries Research and Development Corporation
IRR	Internal Rate of Return
MIRR	Modified Internal Rate of Return
PVB	Present Value of Benefits
RD&E	Research, Development and Extension

Executive Summary

What the report is about

This report presents the results of an impact assessment of the Fisheries Research and Development Corporation (FRDC) investment in a project to strengthen business management capacity in fish and fish product supply chains. The project was funded by the FRDC over the years ending June 2008 to June 2015.

Methodology

The investment in the project was analysed qualitatively within a logical framework that included activities/outputs, outcomes, and impacts. Identified impacts were then categorised into a triple bottom line framework. Principal impacts from those identified were then valued. Benefits were estimated for a range of time frames up to 30 years from the year of last investment in the project. Past and future cash flows in 2016/17 $ terms were discounted to the year 2016/17 using a discount rate of 5% to estimate the investment criteria.

Results/key findings

The major impact identified and valued was of a financial nature. However, some social impacts also were identified but not valued. It is expected that members of the Australian fish and fish product supply chains, including Australian consumers, will be the primary beneficiaries of the investment.

Investment Criteria

Total funding from all sources for the project was $0.18 million (present value terms). The value of benefits was estimated at $0.56 million (present value terms). This gave an estimated net present value of $0.38 million, and a benefit-cost ratio of 3.0 to 1.

Conclusions

The investment in this project has resulted in improvements in personal, business and industry capacity along the Australian seafood supply chains.

The analysis provided a good example of a small investment in training that has benefited the seafood industry in the short to medium term through decreased costs and increased demand. However, there is likely to be an additional longer-term economic and industry impact as part of the strengthened individual business capacity built may be translated into stronger industry networks and strengthened industry leadership capacity.

Keywords

Impact assessment, scholarship, Agribusiness

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 included 20 randomly selected FRDC investments worth a total of approximately $6.31 million (nominal FRDC investment). The investments were selected from an overall population of 136 FRDC investments worth an estimated $24.98 million (nominal FRDC investment) where a final deliverable had been submitted in the 2015/16 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 25% 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 2008-327: *Development Program: FRDC Agribusiness Scholarship* 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

It was recognised that the seafood industry needed to build improved business relationships along the fish and fish product supply chains including consumers, particularly by strengthening capacity in the areas of marketing, innovation, brand management, customer relationships, and general business growth and development.

A 2005 FRDC review of people development in the Australian Fishing Industry (Project 2005-309) stimulated the initial development of project 2008-327: FRDC Agribusiness Scholarship. Project 2008-327 was subsequently endorsed by the FRDC people development subprogram. Also, previous to project funding, a pilot scholarship was awarded in 2007 (Project 2007-317) and the subsequent report from that pilot project convinced FRDC to fund Project 2008-327.

Project Details

Summary

Project Code: 2008-327

Title: *People Development Program: FRDC Agribusiness Scholarship*

Research Organisation: Fisheries Research and Development Corporation

Principal Investigator: Jo-Anne Ruscoe

Period of Funding: July 2008 to June 2015

Objectives

The objectives of the project were:

1. To provide two annual scholarships to the Monash University food executive and/or meat executive program.
2. To support aspiring middle and senior industry players to gain insights into key consumer and retail trends, managing relationships between manufacturer and retailer, marketing and brand management and developing the business.
3. To provide opportunity for the seafood industry to learn from and form networks with other food industry sectors.

Logical Framework

Table 1 provides a description of the project in a logical framework developed for the evaluation.

Table 1: Logical Framework for Project 2008-327

Activities	• The scholarships were invited/advertised; applications for the scholarships received and then assessed by a selection panel. • Scholarships were provided to two successful scholarship recipients each year to attend the Monash University Agribusiness Executive Program (food/meat courses) or the Seafood Executive Program; support included registration costs and accommodation up to the value of $5,000. • The scholarship recipients underwent an intensive one-week residential course, focussing on the then current issues of different industry sectors. • Opportunities were provided to work together in a joint learning framework involving all components of the supply chain. Emphasis was on problem solving, discussions of industry issues and the development of strategies to address current and future trends. • Specific topics included: Analysing market trends, leadership and management of people, effective customer management, value chain management, managing commercial relationships, marketing and merchandising, innovation, and successful business growth. • There were 18 scholarships funded between 2008 and 2014. • A report was required by each scholarship holder on their participation and completion of their scholarship. • Each report was to demonstrate progress towards the achievement of increased skills, experience and capacity that had been developed. This

	included a description of the perceived impacts on the participant's business, to an industry sector, or to the broader industry in which they were involved. • During the Program, networks were developed with other individual professionals attending the program. • FRDC ended the scholarship support at the end of the Program as the concept had been sufficiently developed and could be supported by individual companies in future.
Outcomes	• As the recipients were already successful individuals, it is not an easy task to confidently define the difference the course would have made to their achievements thereafter. • Some tracking of scholarship holders in terms of where they are currently employed was undertaken in this evaluation. Given the period that has elapsed since the first scholarships were funded, it was not surprising that several had changed their employment; for example, two had moved into large corporations such as National Australia Bank and Woolworths. • Many other scholarship holders have been promoted in their positions in their respective organisations. • Based on some of the past reports tendered by participants at the end of their scholarship and current contact with a number of participants as part of this evaluation, some of the outcomes delivered have included (individual quotes): o Useful exposure to others in alternative activities along the supply chain and hence a better understanding of the industry as a whole, as well as improved networking o Better understanding of third party certification and brand protection o Improvement in commercial negotiation skills o Improvement in understanding of the seafood buyer's dilemma (positive health versus suspect sustainability) o Positive networking with other companies to discuss areas of common ground and addressing similar issue and obstacles o Improved performance associated with people management; in particular, how to deal with internal and external stakeholders • At least two of the scholarship holders have since been awarded Nuffield Scholarships. For example, Wayne Dredge (2014) travelled to 20 different countries to investigate international fishing methods and their impact on marine mammal interactions, international fisheries management, and barriers to technology and investment in fishing methods. Jonas Woolford (2017) is currently investigating cohesion between primary industry, community and government for the effective co-management of natural resources in the inherently complex seafood industry. • Based on the foregoing information, it is likely that the following generalised potential outcomes have been driven, at least in part, by the scholarship investments in the Agribusiness Executive Program or the Seafood Executive Program: *Individual Business* • New initiatives undertaken such as quality improvements, added value, business growth, staff management and product development processes. • New or existing market development activities undertaken by the business, sometimes driven by improved networking. • Market share increases for the business via promotion/advertising and improved customer management.

	• Increased innovation and efficiency in operational activities leading to cost reductions for the business. *Relevant Industry or Industries* • Improved capacity by the participant to undertake industry leadership roles including planning activities, and encouragement of improved networking across the industry. • Contribution to increased industry cohesion, purpose, and direction, including preparation of industry submissions. • Contribution to increased industry profitability and/or export development. *General Seafood Industry* • Contribution to interaction between networks across different seafood industries. • Contribution to an enhanced profile of the general seafood industry as viewed by the public/community. • Increased consumer satisfaction through product quality and safety
Potential Impacts	• Increased and more effective investment in innovation along the supply chain. • Increased confidence in the efficiency of the supply chain potentially leading to greater investment in the industry by responsible parties. • Increased demand for seafood from new market and product initiatives at individual firm and/or industry level. • Potential for demand expansion from improved and more consistent product quality reaching the consumer. • Cost reductions and reduced wastage along the supply chain due to increased efficiency. • Contribution to maintenance of social licence of fish industries through improved information reaching consumers.

Project Investment

Nominal Investment

Table 2 shows the annual investment made in Project 2008-327 by FRDC. There was no other funding organisation involved. However, each participant gave up at least one week of their time to attend the course. This is valued on an imputed wage per participant of $2,000 per week. Also, it is possible that the registration fees received by Monash University and others for conducting the course may not have covered all costs. No allowance for this possibility has been included.

Table 2: Annual Investment in Project 2008-327 (nominal $)

Year ended 30 June	FRDC ($)	OTHER[(a)] ($)	TOTAL ($)
2008	4,630	2,000	6,630
2009	5,100	4,000	9,100
2010	11,440	4,000	15,440
2011	13,000	4,000	17,000
2012	14,740	6,000	20,740
2013	25,667	8,000	33,667
2014	0	8,000	8,000
2015	14,480	0	14,480
Totals	**89,057**	**36,000**	**125,057**

(a) Imputed salary foregone

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 (1.115). This multiplier was estimated based on the share of 'employee benefits' and 'supplier' expenses in total FRDC expenditure reported in the FRDC's Cash Flow Statement (FRDC, 2016). This multiplier then was applied to the nominal investment by FRDC shown in Table 2.

Real Investment and Extension Costs

For purposes of the investment analysis, the investment costs of all parties were expressed in 2016/17 $ terms using the Implicit Price Deflator for Gross Domestic Product. No additional costs of extension were included as the project was training-focussed and involved industry personnel.

Impacts

Table 3 provides a summary of the principal types of impacts expanded from those listed in Table 1 and categorised into economic, environmental and social impacts.

Table 3: Triple Bottom Line Categories of Principal Impacts from the Supply Chain Training Scholarships

Economic	• Increased seafood business operational efficiency and effectiveness from innovation and product development and more efficient resource allocation resulting in reduced costs and increased profit.
	• Increased demand for seafood from
	  o improved and more consistent product quality reaching the consumer, and
	  o from improved promotion and communication of the sustainability of seafood industries.
	• Increased future capacity for industry networking and strengthened industry leadership.

Environmental	• Nil
Social	• Personal career development for scholarship holders. • Increased personal and business capacity to develop and negotiate solutions to issues faced in the future. • Spinoff to increased community well-being through the spill-over effects of increased supply chain efficiency, effectiveness and profitability.

Public versus Private Impacts

Most impacts identified in this evaluation are personal, business and industry related and therefore the benefits are considered largely private benefits. Some of the private benefits accruing to individuals and businesses will be transformed to specific industry and seafood industry impacts. Minor public benefits may have been delivered, including social benefits in the form of public health and regional community spill-overs.

Distribution of Private Impacts

Private benefits initially will be captured by the individual business where changes have been made. It can be assumed that the final distribution of some of the benefits from the investment will be distributed between participants along the commercial fish and fish product supply chains, including final consumers.

Impacts on other Australian industries

It is assumed that project impacts will be confined to the Australian fish and fish product supply chains.

Impacts Overseas

No significant benefits to overseas parties are expected, with the potential exception where new initiatives in exporting and export product development have been advanced.

Match with National Priorities

The Australian Government's Science and Research Priorities and Rural Research, Development and Extension (RD&E) priorities are reproduced in Table 4. The increased capacity and resulting supply chain impacts will contribute primarily to Rural RD&E Priorities 1 and 4 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)**
1. Advanced technology 2. Biosecurity 3. Soil, water and managing natural resources 4. Adoption of R&D	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. Due to the training nature of the investment, including the widespread roles and foci of the participants, generalised assumptions were required regarding the improvement to supply chains that potentially have been made.

Only one impact was valued, increased profitability to supply chain businesses. This single impact was assumed to be driven by two intermediate impacts: a cost reduction along the supply chains and an increased demand for seafood product affecting a small sector of the seafood market. Figure 1 presented earlier illustrates the pathway to the final impact.

Impacts not Valued

Not all impacts identified in Table 3 could be valued in the assessment. The future economic industry impact associated with increased networking capacity and prospective leadership potential, social impacts were difficult to value for various reasons including time and resources, the availability of baseline data, and the difficulty in quantifying the causal relationships and pathways between the agribusiness training and the specific social impact.

Valuation of Impact: Increased Profitability to Supply Chain Businesses

Total Value of the Supply Chain

The valuation of the increased profit for supply chain businesses commenced with estimating the total value of the supply chain. The margins between the boat /farm-gate price and final sale price for various wild catch fisheries as well as aquaculture industries can vary considerably depending on the added value along the various supply pathways. As a rough indication, the price multiplier between the boat price and final sale is about 3 times.

For example, an oyster supply chain price analysis in 2010 determined that the fishmonger sale price for Pacific Oyster was about 2x that for the farm gate price, but about 4x for a mid-tier restaurant. Also, an international study on wild catch tuna estimated that the final sales value was 2.73x the ex-vessel value.

For Australian aquaculture, ex-farm gate /ex-boat price is estimated at $1 2 billion per annum for aquaculture and $1.6 billion per annum for the wild catch sector (ABARES, 2016).
Using the 3x multiplier, the total supply chain gross costs (including profits) are therefore estimated at about $3.6 billion for aquaculture and $4.8 billion for wild catch, a total of $8.4 billion. If profit along the chain is assumed to be about 10%, total profit may be estimated at $840 million per annum.

Scholarship Holders Representation

Only a very small proportion of this estimated profit would have been relevant to the businesses represented by scholarship holders, even though some significant producers and supply chains were represented by the participants (e.g. Tassal, Raptis). It is assumed that 1.0% of the total profit applied to the businesses of the participants.

Increased Profits

If it is assumed that the average increase in profit per business due to the training investment was 2% per annum, then this would provide an annual increased profit of $168,000 per annum. This profit increase is assumed to commence in 2015 and lasts for five years after which it would decline to zero in the next five years as the impact of the training course wanes, the competitive edge reduces and some scholarship recipients move to other industries.

Counterfactual

Without the agribusiness scholarships being available, many of the participants may still have delivered some of the impacts assumed as they were recognised as having high potential due to their selection for the scholarships. It is assumed that 50% of the impacts may still have been delivered without the scholarship funding.

Summary of Assumptions

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

Table 5: Summary of Assumptions

Variable	Assumption	Source
Farm Gate Value of Aquaculture Sector	$1.2 billion p.a.	ABARES, 2016
Ex-boat Price of Wild Catch Fisheries	$1.6 billion p.a.	
Total ex-farm gate/ex-boat value	$2.8 billion p.a.	1.2 + 1.6
Multiplier to estimate total value of supply chain	3x	Based on: CDI Pinnacle Management (2010); Poseidon Aquatic Resource Management (2016)
Total value of supply chain costs including profits	$8.4 billion p.a.	3 x 2.8
Estimated profit share	10%	Agtrans Research
Estimated profit along supply chain	$840 million p.a.	
Representation of scholarship recipients relevant to these supply chain costs	1.0%	
Average profit increase assumed due to scholarship recipients	2.0%	
Counterfactual (proportion of profit increase that would have occurred without training due to inherent ability of scholarship recipients)	50%	
First year of impact	2015	
Duration of impact	5 years, thereafter declining linearly to zero after a further five years	

Results

All benefits after 2016/17 were expressed in 2016/17 $ terms. All costs and benefits were discounted to 2016/17 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 (2014/15) 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) attributable to the FRDC investment only, shown in Table 7, has been estimated by multiplying the total PVB by the FRDC proportion of real investment before discounting (73.4%).

Table 6: Investment Criteria for Total Investment in Project 2008-327

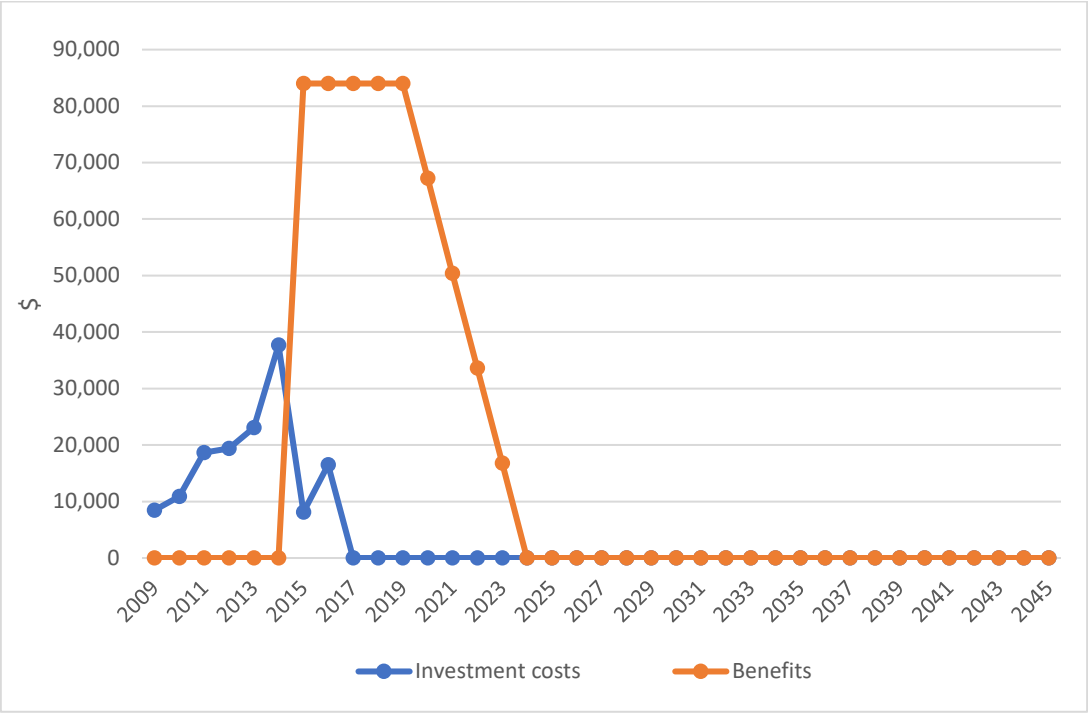
Investment criteria	**Number of years from year of last investment**						
	0	**5**	**10**	**15**	**20**	**25**	**30**
Present value of benefits ($m)	0.09	0.48	0.56	0.56	0.56	0.56	0.56
Present value of costs ($m)	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Net present value ($m)	-0.09	0.29	0.38	0.38	0.38	0.38	0.38
Benefit-cost ratio	0.50	2.60	3.04	3.04	3.04	3.04	3.04
Internal rate of return (%)	negative	24.15	25.68	25.68	25.68	25.68	25.68
Modified Internal Rate of Return (%)	56.83	47.56	21.71	14.99	12.12	10.53	9.53

Table 7: Investment Criteria for FRDC Investment in Project 2008-327

Investment criteria	**Number of years from year of last investment**						
	0	**5**	**10**	**15**	**20**	**25**	**30**
Present value of benefits ($m)	0.07	0.35	0.41	0.41	0.41	0.41	0.41
Present value of costs ($m)	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Net present value ($m)	-0.06	0.23	0.29	0.29	0.29	0.29	0.29
Benefit-cost ratio	0.54	2.80	3.27	3.27	3.27	3.27	3.27
Internal rate of return (%)	negative	27.58	29.10	29.10	29.10	29.10	29.10
Modified Internal Rate of Return (%)	60.72	49.02	22.19	15.27	12.32	10.69	9.65

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

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 moderately low sensitivity to the discount rate.

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

Investment Criteria	**Discount rate**		
	0%	**5% (base)**	**10%**
Present value of benefits ($m)	0.59	0.56	0.54
Present value of costs ($m)	0.14	0.18	0.24
Net present value ($m)	0.45	0.38	0.30
Benefit-cost ratio	4.12	3.04	2.27

Pessimistic and Optimistic Scenarios

A sensitivity analysis was undertaken for pessimistic and optimistic levels of the variables with the highest level of uncertainty: the level of representation of the scholarship holders and the increase in profit generated. Results are reported in Table 9. Results show that the investment criteria for the pessimistic scenario are negative.

Table 9: Sensitivity to Combined Assumptions for Percentage Representation and Profit Increase (Total Investment, 30 years)

Investment Criteria	**Sensitivity to Representation and Profit Increase Assumptions**		
	Pessimistic (0.50% and 1%)	**Most likely (1.0% and 2%)**	**Optimistic (2% and 4%)**
Present value of benefits ($m)	0.14	0.56	2.24
Present value of costs ($m)	0.18	0.18	0.18
Net present value ($m)	-0.04	0.38	2.05
Benefit-cost ratio	0.76	3.04	12.15

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 10). 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 10: Confidence in Analysis of Project

Coverage of Benefits	**Confidence in Assumptions**
Medium-Low	Low

The coverage of benefits was assessed as medium-low due to the aggregation of individual impacts identified to a profit assumption being required. Likewise, while many of the assumptions were supported in part by the reports and other inputs by scholarship holders, many still somewhat speculative and therefore confidence was considered to be low.

Conclusions

The investment in this project has resulted in improvements in personal, business and industry capacity along the Australian seafood supply chains.

Funding for the project over the eight years totalled $0.18 million (present value terms) and produced estimated total expected benefits of $0.56 million (present value terms). This gave a net present value of $0.38 million, a benefit-cost ratio of 3.04 to 1, an internal rate of return of 25.7% and a modified internal rate of return of 9.5%.

While several social impacts identified were not valued, their contributions were considered minor compared with the impact valued. Nevertheless, combined with conservative assumptions for the impact valued, investment criteria as provided by the valued benefit are likely to be underestimates of the investment performance.

The analysis provided a good example of a small investment in training that has benefited the seafood industry in the short to medium term through decreased costs and increased demand. However, there is likely to be an additional longer-term economic and industry impact as part of the strengthened individual business capacity built may be translated into stronger industry networks and strengthened industry leadership capacity.

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.

References

Australian Bureau of Agricultural and Resource Economics and Sciences. (2016). *Australian fisheries and aquaculture statistics 2015.* Canberra: Australian Bureau of Agricultural and Resouce Economics and Sciences.

Council of Rural Research and Development Corporations. (2014). *Impact Assessment Guidelines.* Canberra: Council of Rural Research and Development Corporations. Retrieved from http://www.ruralrdc.com.au/wp-content/uploads/2016/04/CRRDC-Impact-Assessment-Guidelines-V.1-070514.pdf

CDI Pinnacle Management. (2010). *Australian Oyster Industry Supply Chain Analysis.* Retrieved from http://oysterstasmania.org/wp-content/uploads/2013/09/Oyster-Benchmarking-Project-REPORT-DRAFT-June2010.pdf

Department of Agriculture and Water Resources. (2015). *Agricultural Competitiveness White Paper.* Canberra: Commonwealth of Australia. Retrieved from http://agwhitepaper.agriculture.gov.au/SiteCollectionDocuments/ag-competitiveness-white-paper.pdf

Fisheries Research and Development Corporation. (2016). *Annual Report 2015-16.* Canberra: Fisheries Research and Development Corporation. Retrieved from http://www.frdc.com.au/about_frdc/Documents/Annual_Report/FRDC_Annual_Report_2016.pdf

Office of the Chief Scientist. (2015). *Strategic Science and Research Priorities.* Canberra: Commonwealth of Australia. Retrieved from http://www.chiefscientist.gov.au/wp-content/uploads/STRATEGIC-SCIENCE-AND-RESEARCH-PRIORITIES_181214web.pdf

Poseidon Aquatic Resource Management Ltd. (2016). *Estimate of Global Sales Values From Tune Fisheries, Phase 2 Report.* Retrieved from http://www.pewtrusts.org/~/media/assets/2016/05/estimate-of-global-sales-values-from-tuna-fisheries--phase-2.pdf