



FRDC

FISHERIES RESEARCH &
DEVELOPMENT CORPORATION

FINAL

**An Impact Assessment of
FRDC Investment in 2009-303:
Australasian Aquaculture
2010 to 2014**

Agtrans Research

November 2017

FRDC Project No **2016-134**

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**An Impact Assessment of FRDC Investment in Australasian Aquaculture 2010 to 2014
Project 2016-134**

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Pheroze Jungalwalla– Former Chairperson, National Aquaculture Council

Abbreviations

CRRDC	Council of Research and Development Corporations
FRDC	Fisheries Research and Development Corporation
NAC	National Aquaculture Council
R&D	Research and Development
RD&E	Research, Development and Extension
WAS	World Aquaculture Society

Executive Summary

What the report is about

This report presents the results of an impact assessment of Fisheries Research and Development Corporation (FRDC) investment in a project to strengthen networks and showcase Australian Aquaculture. The project was funded by the FRDC over the six-year period July 2009 to October 2015.

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 valued. Benefits were estimated for a range of time frames up to 30 years from the year of last investment. Past and future cash flows were expressed in 2016/17 dollar terms and were discounted to the year 2016/17 using a discount rate of 5% to estimate the investment criteria.

Results/key findings

Several impacts of the investment were identified of which one was valued. It is expected that the primary beneficiaries of the investment will be the Australian aquaculture industry.

Investment Criteria

Total funding from all sources for the project was \$1.15 million (present value terms). The value of benefits was estimated at \$2.58 million (present value terms). This gave an estimated net present value of \$1.43 million, and a benefit-cost ratio of 2.24 to 1.

Conclusion

Overall, the project achieved its objective of hosting three international standard aquaculture conferences in Australia, providing extremely beneficial networking opportunities for all participants.

It is not possible to capture the value of the three conferences due to the general nature of the conferences covering the entire aquaculture industry. Knowledge transfer and improved networking were the main impacts of the project. However, it is difficult to ascertain the size of this impact. The assumptions made in the analysis trace the likely pathway to impact and use conservative assumptions. The impacts not valued along with these conservative assumptions, make it likely that the benefits valued are underestimated.

Keywords

Impact Assessment, Conference, Aquaculture

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 2009-303: *Australasian Aquaculture 2010 to 2014* 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

Aquaculture in Australia is a diverse industry covering diverse species including finfish, crustaceans and molluscs. As wild fisheries growth becomes static or declines, aquaculture is viewed as a viable alternative to meet the growing global demand for seafood. This places an emphasis on the importance of growth in the aquaculture industry to the future of sustained seafood production in Australia.

Previously biannual conferences for the Aquaculture industry have taken place in 2004, 2006 and 2008 with the National Aquaculture Council (NAC) and World Aquaculture Society (WAS) co-running the conferences. These conferences had largely been hailed as a success, with a recognition that further funding should be sought from FRDC to guarantee three future conferences. Previously FRDC had provided funding to these conferences on a conference by conference basis due to the uncertainty of the success of the events.

Rationale

It was recognised that conferences are one of the primary methods for networking and exchanging ideas between the different stakeholders in the aquaculture industry. With aquaculture constantly developing and changing, the exchanging of the ideas, showcasing the latest technological innovation, and creating new networks was identified as an important strategy to maintain industry growth.

With hosting three international events, including the world's biggest aquaculture event in 2014, was seen as allowing international guests and leaders in aquaculture to visit Australia, providing networking opportunities and information exchange with local aquaculturists so generating a wide range of benefits from these exchanges. It was seen as allowing local stakeholders to learn of aquaculture innovations in an international context.

Project Details

Summary

Project Code: 2009-303

Title: *Australasian Aquaculture 2010 – 2014*

Research Organisation: Fisheries Research and Development Organisation, Canberra

Principal Investigator: Neil Stump

Period of Funding: July 2009 – September 2014

Objectives

The objectives of the project were:

1. To provide an international forum for aquaculture stakeholders to identify pathways to sustainable aquaculture development.
2. To provide an international trade show of aquaculture equipment and services, fully integrated with the conference.
3. To promote Australian aquaculture to international interests.

Logical Framework

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

Table 1: Logical Framework for Project 2009-303

Activities and Outputs	<ul style="list-style-type: none">• Three Australasian Aquaculture conferences were held in 2010, 2012, and 2014. The 2014 conference doubled as the World Aquaculture Conference. The three conferences continued the NAC and WAS partnership in running conferences.• Each conference was themed to a specific industry topic at the time of the conference. The 2010 conference was themed “Keeping Pace with Change”, 2012 “The Next Ten Years”, and 2014 “Create/Nurture/Grow”.• Attendance numbers for the three conferences were 991, 914, and 2,042 respectively with international visitors making up between 18% and 38% of the attendees. This allowed for significant networking between Australian and international participants and improved exposure of Australian aquaculturists to the latest international aquaculture developments.• The conferences were attended by numerous industry types, including aquaculturists, researchers, government officials, other industry personnel including young industry leaders, and students.• There was networking of students/young industry leaders with experienced aquaculture professional’s due to mentoring/buddying up arrangements.• Industry trade shows were combined with each conference. The majority of trade booths were from Australia with up to 30 international companies also represented at each conference. This allowed the Australian industry to showcase products and innovations to the international aquaculture community.
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	<p>AQ1 Systems, Seafood Innovations, and Tassal that displayed some noteworthy innovations at the conferences.</p> <ul style="list-style-type: none"> • The conferences included a variety of information session presentations. For example, over 900 presentations were organised and delivered for the 2014 World Aquaculture Conference, allowing for a wide variety of information to be exchanged and extension of research findings to take place. • Each conference also had poster sessions showcasing researchers' work allowing wider exposure of findings to numerous aquaculture stakeholders. • From the conference feedback surveys, networking opportunities were rated as high by attendees at all three conferences. • International networks, ideas, and links were established between Australian and international aquaculturists in research, suppliers, and farmers; these interactions are not likely to have happened otherwise. • Several media releases were published from all three conferences in local and international media. • Numerous post conference programs were supported by the Australian aquaculture industry and post-Conference study tours arranged that were well attended.
Outcomes	<ul style="list-style-type: none"> • There have been no further Australasian Aquaculture conferences since 2014. The NAC decided to discontinue the conferences over concerns about profitability. Also, many individual aquaculture sectors decided that their interest would be better served holding individual conferences, as their individual industries had outgrown the existing NAC conference format. • The networking and other professional opportunities provided by the three conferences have led to an increase in communication within the Australian and International aquaculture industries. Also, improved networking was evident among aquaculturists, government, investors, equipment suppliers, and researchers. The exchanges and networking: <ul style="list-style-type: none"> ○ increased adoption of new technology and international best practices through easier communication with others in industry, especially international aquaculture personnel. ○ created a greater awareness of the Australian aquaculture industry and its progress around Australia and Internationally through international attendance and media coverage of the events. ○ produced better connected young industry leaders and students, increasing the likelihood of them staying in the aquaculture sector. • The conferences provided a forum for the extension of key research findings where researchers and industry personnel could discuss research outputs, their applications, and potential impacts. These extension opportunities have likely lead to a better understanding by industry of research outputs and also a higher level of adoption of some R&D outputs for those attendees that did not hear of the R&D before the conference. • The conferences provided a platform for technology transfer to take place between industry groups, and between researchers and industry, both domestic and international. • Side conferences and general meetings for industry were held, removing the need for extra travel. • There was an increased financial investment in the Australian aquaculture industry because of the increased understanding of the potential provided by the aquaculture industry. • There was increased use of Australian innovation to international markets as a result of being showcased at the conferences. • From the hosting of the three conferences, there was an increase in international visitors to Australia that would not have happened otherwise.

Impacts	<ul style="list-style-type: none"> • Increased Australian aquaculture industry capacity from networking as the three conferences provided links to other aquaculture industries, researchers, suppliers, and international aquaculturists that have assisted Australian industry growth. • Contribution to increased future investment sustainability, productivity, and growth for the Australian aquaculture industry through exposure to international best practice and outlook. • Potential increase in aquaculture industry profits through the adoption of new practices, showcasing Australian R&D to overseas and industry utilising R&D outputs. • Spillover impacts to regional communities where aquaculture based as well as industry outside of fisheries (e.g. the hospitality and tourism industry) in the form of additional income and profits. • Contribution to increase in both industry and research capacity.
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Project Investment

Nominal Investment

Table 2 shows the nominal annual investment made in Project 2009-303 by FRDC.

Table 2: Annual Investment in Project 2009-303 (nominal \$)

Year ended 30 June	FRDC (\$)	NAC (\$)	Other¹ (\$)	TOTAL (\$)
2010	60,000	40,000	100,000	200,000
2011	20,000	40,000	20,000	80,000
2012	60,000	40,000	120,000	220,000
2013	20,000	40,000	0	60,000
2014	60,000	40,000	120,000	220,000
2015	20,000	40,000	0	60,000
Totals	240,000	240,000	360,000	840,000

Program Management Costs

For FRDC investment, the cost of managing the FRDC funding was added to the FRDC contribution 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 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 (ABS, 2016). No additional costs of extension were included as there were no notable further extension activities after the conferences.

¹ Other includes salaries of conference committee members and cash contributions from the respective host state governments.

Impacts

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

Table 3: Triple Bottom Line Categories of Impacts from the Australasian Aquaculture Conferences

Economic	<ul style="list-style-type: none">• Increased in industry capacity and networking in Australian aquaculture• Potential increased adoption of industry and international best practice• Potential increased industry profits• Positive economic spillover benefits to hospitality and tourism sectors
Environmental	<ul style="list-style-type: none">• Potential increase in adoption of sustainable practices
Social	<ul style="list-style-type: none">• Contribution to increased research and industry capacity• Spillovers to the regional communities where aquaculture industries located

Public versus Private Impacts

The majority of the impacts are private in nature. There are also some potential public impacts via capacity building and spillover benefits to regional communities.

Distribution of Private Impacts

The private impacts will mainly be delivered to the Australian aquaculture industry, with other benefits going to the overseas aquaculture industry and to the hospitality and tourism sector.

Impacts on other Australian industries

There were some positive economic impacts to the hospitality and tourism sectors as they received income that would have otherwise been spent overseas if the conferences had not taken place.

Impacts Overseas

There may be some overseas benefits, as international guests visited the conference and enhanced their networking with the Australian aquaculture industry and potentially adopting Australian aquaculture innovations.

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 three aquaculture conferences contributed to Science and Research Priority 1 and Rural RD&E Priorities 1,2 and 4.

Table 4: Australian Government Research Priorities

Australian Government	
Rural RD&E Priorities (est. 2015)	Science and Research Priorities (est. 2015)
1. Advanced technology	1. Food
2. Biosecurity	2. Soil and Water
3. Soil, water and managing natural resources	3. Transport
4. Adoption of R&D	4. Cybersecurity
	5. Energy and Resources
	6. Manufacturing
	7. Environmental Change
	8. Health

Sources: DAWR (2015) and OCS (2015)

Valuation of Impacts

Impacts Valued

Analysis was undertaken for total benefits that included future expected benefits. A degree of conservatism was used when finalising assumptions, particularly when there is a large degree of uncertainty around the assumptions. Sensitivity analysis was undertaken for variables that have a high degree of uncertainty.

Only one impact was valued, the potential profits to industry associated with the conferences.

Impacts not Valued

Not all impacts identified in Table 3 could be valued in the assessment. The increased research and industry capacity are inherently difficult to measure due to a lack of data post conference (Pheroze Jungalwalla, pers. comm., May 2017) and limited time and resources for any analysis.

The potential sustainability impacts and regional spillover impacts have not been valued due to lack of available data and are time and resource constraints.

For the gains to hospitality and tourism, as the number of Australians who would not have travelled because of the conferences is unavailable, a reliable estimate of this impact cannot be reliably estimated.

Valuation of Impact 1: Increased Profits to Australian Aquaculture Industries

The impact valued is a small increase in productivity and profitability for some Australian aquaculture businesses and industries. This is assumed to be driven by increased exposure to research findings, innovation and international best practice, as well as networking between businesses and between industries.

It is assumed that 10% of the gross value of the Australian aquaculture industry consist of profits and that this percentage will be increased marginally due to each conference and that this increase will apply for a proportion of Australian aquaculture businesses. An associated assumption is that the increase lasts only for 4 years after each conference. Specific assumptions for the valuation are listed in Table 5.

Counterfactual

It is assumed that the impacts would not have occurred without the project.

Summary of Assumptions

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

Table 5: Summary of Assumptions

Variable	Assumption	Source
Benefit: Increased profit associated with conferences		
Gross value of Australian aquaculture		
Gross value of Aquaculture in Australia 17-18	\$1.308 billion	Agtrans Research ²
Gross value of Aquaculture in Australia 16-17 year	\$1.263 billion	
Gross value of Aquaculture in Australia 15-16	\$1.218 billion	
Gross value of Aquaculture in Australia 14-15	\$1.186 billion	ABARES, 2016
Gross value of Aquaculture in Australia 13-14	\$0.997 billion	
Gross value of Aquaculture in Australia 12-13	\$1.056 billion	
Gross value of Aquaculture in Australia 11-12	\$1.039 billion	
Gross value of Aquaculture in Australia 10-11	\$0.954 billion	
Estimated percentage of industry value to which benefit applies	50%	Agtrans Research
Existing estimated profit component	10% of gross value	
Increase in profit related to three conferences	1% of gross value	
Percentage increase in aquaculture profit per conference	0.333%	1% / 3
First year of impact	2011	Agtrans Research
Duration of impact	4 years after each conference	

² Gross value of Australian Aquaculture from 2015-2016 based on forecasts from historical gross value data.

Results

All benefits after 2016/17 were expressed in 2016/17 dollar 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. The base analysis used the best available estimates for each variable, notwithstanding a level of uncertainty for many of the estimates. The analysis ran for the length of the investment period plus 30 years from the last year of investment (2014/15).

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 attributable to the FRDC investment only, shown in Table 7, has been estimated by multiplying the total present value of benefits by the FRDC proportion of real investment (30.93%).

Table 6: Investment Criteria for Total Investment in the Project

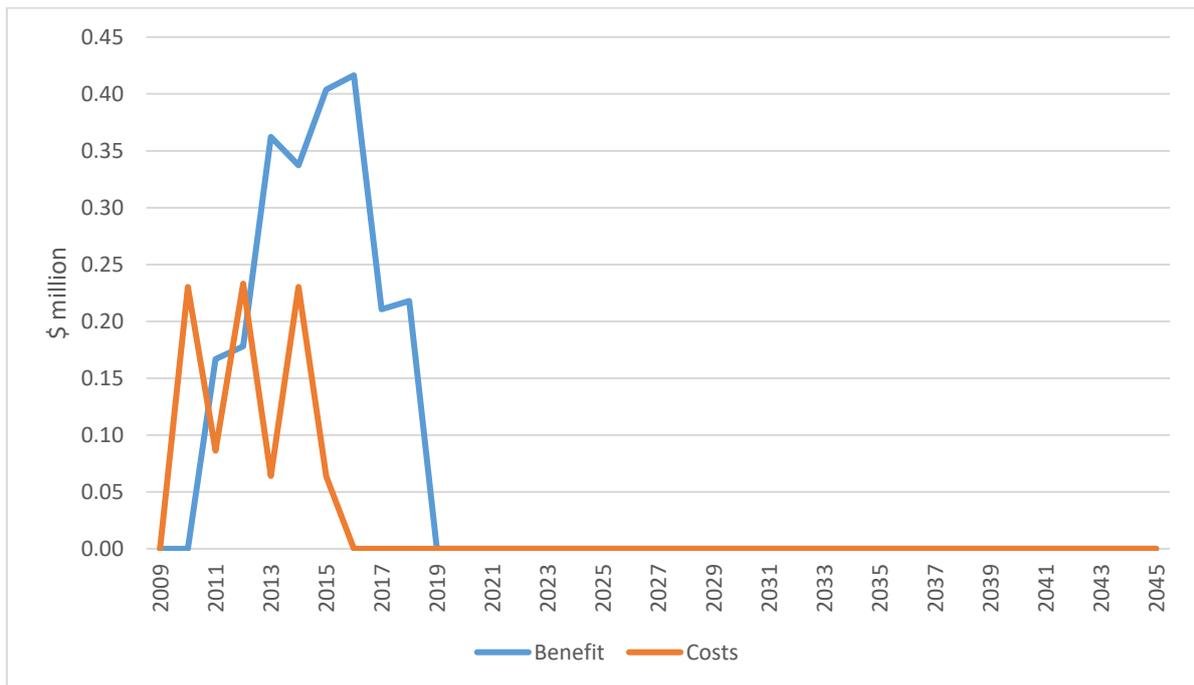
Investment criteria	Number of years from year of last investment						
	0	5	10	15	20	25	30
Present value of benefits (\$m)	1.73	2.58	2.58	2.58	2.58	2.58	2.58
Present value of costs (\$m)	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Net present value (\$m)	0.57	1.43	1.43	1.43	1.43	1.43	1.43
Benefit-cost ratio	1.50	2.24	2.24	2.24	2.24	2.24	2.24
Internal rate of return (%)	39.77	51.70	51.70	51.70	51.70	51.70	51.70
Modified IRR (%)	negative	74.94	27.15	18.13	14.32	12.23	10.90

Table 7: Investment Criteria for FRDC Investment in the Project

Investment criteria	Number of years from year of last investment						
	0	5	10	15	20	25	30
Present value of benefits (\$m)	0.53	0.80	0.80	0.80	0.80	0.80	0.80
Present value of costs (\$m)	0.36	0.36	0.36	0.36	0.36	0.36	0.36
Net present value (\$m)	0.18	0.44	0.44	0.44	0.44	0.44	0.44
Benefit-cost ratio	1.50	2.24	2.24	2.24	2.24	2.24	2.24
Internal rate of return (%)	39.59	51.43	51.43	51.43	51.43	51.43	51.43
Modified IRR (%)	negative	74.72	27.09	17.11	14.30	12.21	10.89

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)	2.29	2.58	2.92
Present value of costs (\$m)	0.91	1.15	1.45
Net present value (\$m)	1.39	1.43	1.46
Benefit-cost ratio	2.53	2.24	2.01

Pessimistic and Optimistic Scenarios

A sensitivity analysis was undertaken for pessimistic and optimistic levels of the variables with high levels of uncertainty: the percentage of industry impacted, the increase in profits attributed to the conferences, and the longevity of conference impacts. Results are reported in Table 9, 10, and 11. Even with pessimistic assumptions, the project still has a positive impact.

Table 9: Sensitivity to Assumptions for Percentage of Industry Impacted
(Total Investment, 30 years)

Investment Criteria	Percentage of industry impacted		
	40%	50%	60%
Present value of benefits (\$m)	2.07	2.58	3.10
Present value of costs (\$m)	1.15	1.15	1.15
Net present value (\$m)	0.91	1.43	1.95
Benefit-cost ratio	1.79	2.24	2.69

Table 10 Sensitivity to Profit Increase
(Total Investment, 30 years)

Investment Criteria	Level of profit increase		
	.75%	1%	1.25%
Present value of benefits (\$m)	1.94	2.58	3.23
Present value of costs (\$m)	1.15	1.15	1.15
Net present value (\$m)	0.78	1.43	2.08
Benefit-cost ratio	1.68	2.24	2.80

Table 11: Sensitivity to Longevity of Impacts
(Total Investment, 30 years)

Investment Criteria	Period of impact		
	3 years	4 years	5 years
Present value of benefits (\$m)	1.31	2.58	3.22
Present value of costs (\$m)	1.15	1.15	1.15
Net present value (\$m)	0.16	1.43	2.07
Benefit-cost ratio	1.13	2.24	2.80

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 12). 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 12: Confidence in Analysis of Project

Coverage of Benefits	Confidence in Assumptions
Medium	Low

The coverage of benefits was assessed as Medium due to the conferences targeting the entire aquaculture industry in Australia, and the benefits being highly generalised.

Confidence in the assumptions are rated as low, due to lack of evidence available for the increase in profits.

Conclusions

Overall, the project achieved its objective of hosting three international standard aquaculture conferences in Australia, providing extremely beneficial networking opportunities for all participants.

Total funding for the project over the six years totalled \$1.15 million (present value terms) and produced estimated total expected benefits of \$2.58 million (present value terms). This gave a net present value of \$1.43 million, a benefit-cost ratio of 2.24 to 1, an internal rate of return of 51.7% and a modified internal rate of return of 10.9%, discounted for 30 years.

It is not possible to capture the value of the three conferences due to the general nature of the conferences covering the entire aquaculture industry. Knowledge transfer and improved networking were the main impacts of the project. However, it is difficult to ascertain the size of this impact. The assumptions made in the analysis trace the likely pathway to impact and use conservative assumptions. The impacts not valued along with these conservative assumptions, make it likely that the benefits valued are underestimated.

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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