FINAL

Evaluation of R&D projects completed in years ending June 2016 to June 2018

2016/17 FRDC Evaluations (Year 2)

Aggregate Summary Report

Agtrans Research

October 2018

FRDC Project No **2016-134**

Evaluation of R&D projects completed in years ending June 2016 to June 2018: 2016/17 FRDC Evaluations (Year 2) – Aggregate Summary Report
Project 2016-134

2018

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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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Acknowledgments

Agtrans Research would like to thank all the project and program personnel associated with the Fisheries Research and Development Corporation that were involved in the evaluation process for their cooperation and feedback throughout the project.

Abbreviations & Acronyms

ABS	Australian Bureau of Statistics
AFMA	Australian Fisheries Management Authority
BCR	Benefit-Cost Ratio
CRC	Cooperative Research Centre
CRRDC	Council of Rural Research and Development Corporations
ERA	Ecological Risk Assessment
ET	Ettingshausen (Andrew)
FRDC	Fisheries Research and Development Corporation
INFORMD	Inshore Network for Observation and Regional Management: Derwent-Huon
IRR	Internal Rate of Return
LIFE	Low Impact Fuel Efficient
MIRR	Modified Internal Rate of Return
NPV	Net Present Value
NR	Not Reported
NSW	New South Wales
POMS	Pacific Oyster Mortality Syndrome
PST	Paralytic Shellfish Toxins
PVB	Present Value of Benefits
PVC	Present Value of Costs
R&D	Research and Development
RAC WA	Research Advisory Committee Western Australia
RD&E	Research, Development and Extension
SRL IPA	Southern Rocklobster Ltd Industry Partnership Agreement
TSGA IPA	Tasmanian Salmonid Growers' Association Ltd Industry Partnership Agreement

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) to Australia, regardless of to whom they accrue.

Investment criteria - Measures of the economic worth of an investment such as Net Present Value, Benefit Cost Ratio, and Internal Rate of Return.

Present Value of Costs -The discounted value of R&D investment costs

Present Value of Benefits - The discounted value of benefits.

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.

Benefit-Cost Ratio - The ratio of the present value of investment benefits to the present value of investment costs.

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 is equal to present value of costs.

Modified Internal Rate of Return - The MIRR is a modified IRR estimated so that any cash inflows from an investment are assumed re-invested at the rate of the cost of capital (a designated re-investment rate).

Introduction

The following summary report presents an overview and aggregate results of the second year of an annual series of economic evaluations of research, development and extension (RD&E) investments carried out for the Fisheries Research and Development Corporation (FRDC).

Background

FRDC required a series of impact assessments to be carried out annually on a number of investments in the FRDC 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).

Agtrans Research was contracted to complete the assessments under FRDC project 2016-134: *Evaluation of R&D projects completed in years ending June 2016 to June 2018*.

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

Sample Selection

Brief Description of the Selection Process

The second series of impact assessments, carried out in calendar 2018, 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.

The 2016/17 Evaluation Sample

From the initial population of 96 projects the following 20 project investments were randomly selected for evaluation (Table 1).

Table 1: Stratified random sample of 20 projects for economic evaluation as part of the FRDC's annual evaluation program 2016/17 (by Project Code)

Project Code	Project Title	FRDC Program Allocation(s)	FRDC Investment (nominal $)
2011-042	TSGA IPA: clarifying the relationship between salmon farm nutrient loads and changes in macroalgal community structure/ distribution (Existing Student Support)	Environment (80%) Industry (10%) Communities (10%)	44,930

2011-070	TSGA IPA: Comparative susceptibility and host responses of endemic fishes and salmonids affected by amoebic gill disease in Tasmania	Industry (100%)	227,357
2012-015	RAC WA: Improving confidence in the management of the blue swimmer crab (*Portunus armatus*) in Shark Bay	Industry (60%) Environment (40%)	675,282
2012-024	INFORMD Stage 2: Risk-based tools supporting consultation, planning and adaptive management for aquaculture and other multiple-uses of the coastal waters of southern Tasmania	Environment (80%) Industry (20%)	750,000
2012-403	Development of the East Arnhem Fisheries Network Training Framework	People (80%) Communities (20%)	113,096
2013-051	TSGA IPA: The Australian Aquatic Animal Health and Vaccine Centre: First Phase to Establish Atlantic Salmon Biosecure Fish Facility Capabilities and Develop Strategy for an Australian Centre of Excellence	Industry (100%)	1,694,600
2013-056	Tactical Research Fund: revision of the Australian Shellfish Quality Assurance Program manual - in light of the FRDC funded PST review report	Environment (100%)	39,000
2014-001	Aquatic Animal Health Subprogram: Strategic approaches to identifying pathogens of quarantine concern associated with the importation of ornamental fish	Environment (100%)	249,836
2014-012	Tasmania's coastal reefs: deep reef habitats and significance for finfish production and biodiversity	Environment (100%)	227,904
2014-036	First implementation of an independent observer program for the Charter Boat Industry of NSW: data for industry-driven resource sustainability	Environment (100%)	209,300
2014-204	Implications of current spatial management measures on AFMA ERAs for habitats	Environment (100%)	191,289
2014-301	Social and economic evaluation of NSW coastal commercial wild-catch fisheries	Communities (100%)	436,368
2014-729	Seafood CRC: improving the taste, bioavailability and efficacy of orally administered praziquantel for yellowtail kingfish with lipid nanoparticles and hybrid lipid carrier systems	Industry (100%)	171,000
2015-044	The development of a mobile application for the 'Aquatic animal diseases significant to Australia: Identification field guide'	Industry (60%) Environment (40%)	37,020
2015-232	Oysters Australia IPA: Australian Seafood Industries Pacific Oyster Mortality Syndrome (POMS) investigation into the 2016 disease outbreak in Tasmania - ASI emergency response	Industry (100%)	49,700
2016-057	Workshop to identify research needs and a future project to reduce bycatch and improve fuel efficiency via Low Impact Fuel Efficient (LIFE) prawn trawls	Industry (70%) Environment (30%)	35,000
2016-228	SRL IPA: Traceability Systems for Wild Caught Lobster, via Sense-T and Pathways to Market	Industry (80%) Environment (20%)	135,000
2016-266	Prawn White Spot Disease Response Plan	Adoption (50%) Industry (50%)	70,388
2016-411	Create a matrix of skills and capability building priorities across FRDC partners and advisory groups	People (85%) Adoption (15%)	38,000
2016-501	Seafood with ET	Adoption (50%) Industry (50%)	220,000
Total			**5,615,070**

Tables 2 and 3 present some key descriptive statistics about the sample in relation to the sample selection criteria.

Table 2: Key sample statistics for first year of annual FRDC economic evaluations

Program Area	**No. of Projects in Sample**	**Total FRDC Investment (nominal $)**	**Proportion of Total Sample Investment**
Environment	7	1,712,259	30.5%
Industry	8	3,024,959	53.9%
Communities	1	436,368	7.8%
People	2	151,096	2.7%
Adoption	2	290,388	5.2%
Total	**20**	**5,615,069**	**100.0%**

Table 3: Number of projects in each project size category within the random stratified sample

Program	**Small (≤ $50,000)**	**Medium ($50,001 to $250,000)**	**Large (> $250,000)**	**Totals**
Environment	2	4	1	7
Industry	3	3	2	8
Communities	0	0	1	1
People	1	1	0	2
Adoption	0	2	0	2
Totals	**6**	**10**	**4**	**20**

General Evaluation Method

The economic 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.

Aggregate Results

Overview

The following section presents estimated investment criteria for each of the 20 FRDC RD&E investments evaluated, for all 20 investments in aggregate, and for the aggregate investment by Program.

For the purposes of the investment analyses, the investment costs of all parties were expressed in 2017/18 dollar terms using the Implicit Price Deflator for Gross Domestic Product (ABS, 2018). All benefits after 2017/18 also were expressed in 2017/18 dollar terms. All costs and benefits were discounted to 2017/18 using a discount rate of 5% and using a reinvestment rate of 5% for calculating the Modified Internal Rate of Return (MIRR). The base analyses used the best available estimates for each variable, notwithstanding a level of uncertainty for many of the estimates. All individual analyses ran for the length of the project investment period plus 30 years from the last year of investment.

Results presented include the Present Value of Costs (PVC), estimated Present Value of Benefits (PVB), Net Present Value (NPV), Benefit-Cost Ratio (BCR), Internal Rate of Return (IRR) and MIRR. Definitions for these terms may be found in the Glossary of Economic Terms at the beginning of this summary report.

For some projects, impacts identified were not able to be quantified. Detailed reasoning behind the decision not the value the impacts can be found in the individual project impact assessment reports submitted to FRDC. For projects where no impacts were valued, only the PVC was explicitly reported, all other investment criteria appear as NR (not reported). However, the benefit and cost cash flows for projects with no impacts valued were still taken into account for the calculation of the aggregate investment criteria for all 20 project investments.

Investment Criteria: Aggregate (all 20 projects)

Table 4 shows the estimated aggregate investment criteria for all 20 project investments evaluated as part of the 2016/17 FRDC sample.

Table 4: Aggregate Investment Criteria
(Total Investment, 5% discount rate)

Aggregate Investment Criteria	**Years after last year of investment in all 20 projects (2016/17)**						
	0	**5**	**10**	**15**	**20**	**25**	**30**
PVB ($m)	0.04	20.08	40.20	57.29	72.28	84.34	92.21
PVC ($m)	16.15	16.15	16.15	16.15	16.15	16.15	16.15
NPV ($m)	-16.11	3.93	24.05	41.14	56.13	68.19	76.07
BCR	0.00	1.24	2.49	3.55	4.48	5.22	5.71
IRR (%)	negative	9.2	18.4	20.6	21.4	21.6	21.7
MIRR (%)	negative	8.1	13.0	12.9	12.3	11.5	10.8

Investment Criteria: by Project

Table 5 shows the estimated investment criteria by individual project for the 2016/17 FRDC sample.

Table 5: Investment Criteria by Project
(Total Investment, 30 years, 5% discount rate)

Project Code	Project Title	PVB ($m)	PVC ($m)	NPV ($m)	BCR	IRR (%)	MIRR (%)
2011-042	TSGA IPA: clarifying the relationship between salmon farm nutrient loads and changes in macroalgal community structure/ distribution (Existing Student Support)	2.28	0.69	1.60	3.32	23.9	9.6
2011-070	TSGA IPA: Comparative susceptibility and host responses of endemic fishes and salmonids affected by amoebic gill disease in Tasmania	NR	0.66	NR	NR	NR	NR
2012-015	RAC WA: Improving confidence in the management of the blue swimmer crab (*Portunus armatus*) in Shark Bay	7.28	2.20	5.08	3.31	15.9	9.4
2012-024	INFORMD Stage 2: Risk-based tools supporting consultation, planning and adaptive management for aquaculture and other multiple-uses of the coastal waters of southern Tasmania	8.26	2.12	6.14	3.90	20.6	9.4
2012-403	Development of the East Arnhem Fisheries Network Training Framework	NR	0.15	NR	NR	NR	NR
2013-051	TSGA IPA: The Australian Aquatic Animal Health and Vaccine Centre: First Phase to Establish Atlantic Salmon Biosecure Fish Facility Capabilities and Develop Strategy for an Australian Centre of Excellence	67.13	4.45	62.68	15.09	32.1	14.6
2013-056	Tactical Research Fund: revision of the Australian Shellfish Quality Assurance Program manual - in light of the FRDC funded PST review report	0.28	0.05	0.23	5.59	16.7	11.0
2014-001	Aquatic Animal Health Subprogram: Strategic approaches to identifying pathogens of quarantine concern associated with the importation of ornamental fish	NR	1.44	NR	NR	NR	NR
2014-012	Tasmania's coastal reefs: deep reef habitats and significance for finfish production and biodiversity	NR	0.63	NR	NR	NR	NR
2014-036	First implementation of an independent observer program for the Charter Boat Industry of NSW: data for industry-driven resource sustainability	2.02	0.46	1.56	4.37	16.8	10.2
2014-204	Implications of current spatial management measures on AFMA ERAs for habitats	0.70	0.41	0.29	1.72	19.6	6.9
2014-301	Social and economic evaluation of NSW coastal commercial wild-catch fisheries	2.52	0.95	1.57	2.66	11.1	9.6
2014-729	Seafood CRC: improving the taste, bioavailability and efficacy of orally administered praziquantel for yellowtail	NR	0.37	NR	NR	NR	NR

	kingfish with lipid nanoparticles and hybrid lipid carrier systems						
2015-044	The development of a mobile application for the 'Aquatic animal diseases significant to Australia: Identification field guide'	0.13	0.05	0.08	2.81	16.7	8.8
2015-232	Oysters Australia IPA: Australian Seafood Industries Pacific Oyster Mortality Syndrome (POMS) investigation into the 2016 disease outbreak in Tasmania - ASI emergency response	0.60	0.06	0.53	9.27	115.4	13.1
2016-057	Workshop to identify research needs and a future project to reduce bycatch and improve fuel efficiency via Low Impact Fuel Efficient (LIFE) prawn trawls	0.13	0.08	0.05	1.60	13.0	6.7
2016-228	SRL IPA: Traceability Systems for Wild Caught Lobster, via Sense-T and Pathways to Market	NR	0.94	NR	NR	NR	NR
2016-266	Prawn White Spot Disease Response Plan	0.11	0.09	0.01	1.16	9.3	5.5
2016-411	Create a matrix of skills and capability building priorities across FRDC partners and advisory groups	0.16	0.05	0.11	3.30	8.8	7.2
2016-501	Seafood with ET	0.60	0.28	0.32	2.15	34.9	8.1
Aggregate Results		**92.21**	**16.15**	**76.07**	**5.71**	**21.7**	**10.8**

(a) NR: Not Reported

Investment Criteria: by Program

Table 6 shows the estimated investment criteria by FRDC Program area for the 2016/17 FRDC sample.

Table 6: Investment Criteria by FRDC Program
(Total Investment, 30 years)

Program	**PVB ($m)**	**PVC ($m)**	**NPV ($m)**	**BCR**	**IRR (%)**	**MIRR (%)**
Environment	14.45	6.35	8.09	2.27	13.6	7.8
Industry	74.50	8.39	66.11	8.88	26.1	12.1
Communities	2.75	1.05	1.70	2.62	11.5	8.2
People	0.14	0.16	-0.03	0.84	4.3	4.7
Adoption	0.38	0.20	0.19	1.95	26.2	7.9
Aggregate Total	**92.21**	**16.15**	**76.07**	**5.71**	**21.7**	**10.8**

Discussion

At the individual project level, six of the 20 project investments subjected to impact assessment were not valued in monetary terms. The total investment across all 20 RD&E projects ranged from $0.05 million to $4.45 million (present value terms), while estimated benefits ranged from zero to $67.13 million. The weighted average BCR for all 20 projects was approximately 5.7 to 1 and the simple average BCR was approximately 4.3 to 1. The BCR for only the 14 projects valued was estimated at 7.7 to 1.

At the Program level, four of the five FRDC Program areas reported a positive BCR (greater than, or equal to, 1 to 1). Based on the investment criteria presented, the Industry Program reported the best performance with an estimated BCR of 8.9 to 1. This positive result was influenced strongly by the high BCR estimated for project 2013-051 (The Australian Aquatic Animal Health and Vaccine Centre). On the other hand, based on the results estimated and the FRDC program allocations, the People Program reported the lowest performance with a BCR of 0.8 to 1. In part, this was because, of the two projects partially allocated to the People Program (2012-403 and 2016-411), only 2016-411 was valued in monetary terms and the non-valued project (2012-403) had relatively higher investment costs. It is anticipated that, as further project investments from the People Program are evaluated as part of the ongoing, annual FRDC evaluation process, future aggregate results reported over time may lead to positive results for the People Program. However, it should be noted that, in general, proportionally less impacts for the Communities, People and Adoptions Programs are able to be valued in monetary terms, and this likely will affect the Program level investment criteria over time.

Conclusion

Total funding from all sources across all 20 RD&E project investments totalled $16.15 million (present value terms) and produced estimated total expected benefits of $92.21 million (present value terms). This gave an aggregate NPV of $76.07 million, a weighted average BCR of approximately 5.7 to 1, an IRR of 21.7% and an MIRR of 10.8%.

The overall result should be viewed positively by FRDC, the various fisheries and aquaculture industries, and policy personnel responsible for allocation of public funds.

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