FINAL

An Impact Assessment of FRDC Investment in 2015-044: The development of a mobile application for the Aquatic animal diseases significant to Australia: Identification field guide

Agtrans Research

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An Impact Assessment of FRDC Investment in 2015-044: The development of a mobile application for the Aquatic animal diseases significant to Australia: Identification field guide

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

Contents

List of Tables

List of Figures

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Ben Diggles – Director, DigsFish

Abbreviations

ABS	Australian Bureau of Statistics
BCR	Benefit-Cost Ratio
CRRDC	Council of Rural Research and Development Corporations
DAWR	Department of Agriculture and Water Resources
DAFF	Department of Agriculture, Fisheries, and Forestry
FRDC	Fisheries Research and Development Corporation
GDP	Gross Domestic Product
MIRR	Modified Internal Rate of Return
OCS	Office of the Chief Scientist
P.A.	Per Annum
PDF	Portable Document Format
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 a Fisheries Research and Development Corporation (FRDC) investment in: *The development of a mobile application for the Aquatic animal diseases significant to Australia: Identification field guide*. The project was funded by FRDC over the period April 2016 to February 2017.

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 investment has likely contributed to greater use of the field guide due to easier accessibility. The increased accessibility of the field guide will improve disease detection in aquatic species in Australia, lowering the risk of significant disease outbreaks due to earlier action taken. Several economic, social and environmental impacts/potential impacts were identified. The most significant impact was the reduced economic loss of aquaculture from diseases due to the application identifying diseases in a timelier manner.

Investment Criteria

Total funding from all sources for the project was $0.05 million (present value terms) with FRDC investment in the project totalling $0.05 million. The investment produced estimated total expected benefits of $0.13 million (present value terms). This gave a net present value of $0.08 million, an estimated benefit-cost ratio (BCR) of 2.81 to 1, an internal rate of return of 16.7% and a modified internal rate of return (MIRR) of 8.8%.

Conclusions

While several economic, environmental, and social impacts identified were not valued, the impacts were considered indirect, uncertain and/or minor compared with the impact valued. Nevertheless, combined with conservative assumptions for the impact valued, investment criteria as provided by the valuation may be underestimates of the actual performance of the investment.

Keywords

Impact assessment, cost-benefit analysis, aquatic diseases, mobile applications, app, Aquatic disease identification field guide, fish disease.

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 2015-044: *The development of a mobile application for the Aquatic animal diseases significant to Australia: Identification field guide* 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

Pests and diseases have a significant impact on production costs in both the wild catch and aquaculture fishing industries. These costs are generally in the form of either prevention and treatment costs or lost production due to pest and disease impact. There are also some concerns that fishing activity (particularly aquaculture) may itself lead to pest and disease problems, through increased intensity of production or moving species outside of their natural habitat. Pests and diseases can also negatively impact on biodiversity and environmental and resource condition. In 2001, an Aquatic Animal Health Subprogram was established by FRDC that aimed to provide a cohesive and national approach to animal health research and development in Australia.

The latest edition of the Aquatic animal diseases significant to Australia: Identification field guide (DAFF, 2012) (hereafter referred to as the field guide) is a 292-page document helping fisheries agents, fishers, and the general public correctly identify fish diseases. The field guide covers 48 aquatic diseases including finfish, amphibians, crustaceans, and molluscs. The aim of the guide is to help people working with aquatic species to quickly identify aquatic diseases. The field guide primary users are fisheries and aquaculture managers, fisheries and aquaculture field staff, veterinary workers, and students of aquatic animal health, with secondary users of the guide being the seafood processing industry, recreational and commercial fishers, and the rest of the public (DAFF, 2012).

Rationale

The purpose of the project was to be able to take the physical copy of the field guide and develop a mobile application (hereafter app.) for rapid and efficient use of the guide in the field. As carrying a 292-page document was not always considered practical, having an app. would ensure access to the field guide in a multitude of locations, ensuring diseases can be checked quickly and effectively. The app. was designed and intended to be an information source, rather than be used to report disease.

Project Details

Summary

Project Code: 2015-044

Title: *The development of a mobile application for the Aquatic animal diseases significant to Australia: Identification field guide*

Research Organisation: DigsFish Services Pty Ltd

Principal Investigator: Ben Diggles

Period of Funding: April 2016 to February 2017

FRDC Program Allocation: Industry (100%)

Objectives

There was only one objective from the project:

1. To develop a mobile application for the 'Aquatic animal diseases significant to Australia: Identification field guide'.

Logical Framework

Table 1 provides a detailed description of the project in a logical framework.

Table 1: Logical Framework for Project 2015-044

Activities and Outputs	• A prototype of the field guide app. was developed. • The app. was further developed for use on Android, iOS and Microsoft operating systems. This was achieved to ensure the app. was able to be used on all possible devices. • The app. then was 'user tested' on an iPad air 2 10.1.1 device. • The prototype app. then was submitted to the Department of Agriculture and Water Resources (DAWR) for approval. • After approval by DAWR, the Aquatic Disease Field Guide app. was then finalised and made available for download on compatible devices through the Apple Store, Google Play, and Microsoft Store. • For Android devices, the app. has been downloaded over 50 times (Google Play, 2018). • The app. enables users to search and learn about aquatic animal diseases that affect finfish, molluscs, crustaceans and amphibians while fishing or in the field. • A promotional video was produced and uploaded to YouTube. The video can be viewed at https://www.youtube.com/watch?v=PxnYA2zqzEE • The app. was written about in Ocean Watch, Intrafish, and CIO (an information technology magazine) promoting the benefits of the app.
Outcomes	• Fishers and field agents now have mobile access to the convenient Aquatic Disease Field Guide app. instead of having to carry the full 292-page book/pdf field guide, allowing for rapid and efficient disease identification, improved reporting, and increased convenience. • The app has had 50 plus downloads on Android platforms, with one review on the Android store stating "*A useful app. Perhaps could be improved by including*

	non-reportable diseases, as well as treatment advice for the relevant disease. A great start though. Thanks guys." • Increased probability of correct action being taken after correctly identifying fish diseases. • The Assistant Minister for Agriculture and Water Resources, Senator the Hon. Anne Ruston, promoted the app. via a media release.
Impacts	• Increased efficiency for fisheries field agents in identifying diseases. • Lower probability of aquatic disease establishment within Australia. • Reduced loss of stock through identification of disease.

Project Investment

Nominal Investment

Table 2 shows the annual investment (cash and in-kind) in project 2015-044 by FRDC.

Table 2: Annual Investment in the Project 2015-044 (nominal $)

Year ended 30 June	FRDC ($)	TOTAL ($)
2016	27,216	27,216
2017	9,804	9,804
Totals	37,020	37,020

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, 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 (GDP) (ABS, 2018). There may be minor extension costs in promoting the app. as the cost of the YouTube video promoting the app. was not included in the budget.

Impacts

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

Table 3: Triple Bottom Line Categories of Principal Impacts from Project 2015-044

Economic	• Increased efficiency for fisheries field agents and other users in identifying diseases through using the app. • Reduced loss of stock through earlier and correct identification of disease.
Environmental	• Lower probability of aquatic disease establishment within Australian ecosystems due to earlier and correct identification.
Social	• Nil

Public versus Private Impacts

The impacts identified are both private and public impacts. While the majority of impacts are private, there is a significant public impact of a lower probability of aquatic diseases being established in wild aquatic species populations (both wild-catch species and recreational species).

Distribution of Private Impacts

The private impacts from the project will mainly be distributed to the aquaculture sector, the wild catch sector, recreational fishing sector and to fisheries staff who use the app. There will be an increase in probability that there will be a decrease in loss in profitability due to earlier identification of aquatic disease. There may also be an increase in efficiency for fishers, and fisheries field agents use of time due to faster disease identification.

Impacts on other Australian industries

There are not expected to be impacts on other Australian industries.

Impacts Overseas

No significant impacts to overseas parties are expected.

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 1, 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)**
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. 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.

The principal impact valued is the reduced loss of aquaculture stock through earlier disease identification.

Impacts Not Valued

Not all impacts identified in Table 3 could be valued in the assessment. The economic and environmental impacts not valued included:

- The decreased loss from disease in wild-catch and recreational species.

The above impact was not valued due to difficulty determining a probability of earlier treatment for wild-catch and recreational species and the associated probability of benefits occurring from such earlier treatment of wild aquatic diseases.

- Increased efficiency for fisheries field agents and other users in identifying diseases by using the app.
- The environmental impact is the lower probability of aquatic disease establishment affecting Australian natural ecosystems due to earlier and correct identification.

These economic and environmental impacts, while significant, could not be valued due to difficulty assigning a reasonable monetary value to non-market impacts, lack of usable data, and time and resource constraints.

Valued Impact: Reduced loss of aquaculture stock

The app. will help correctly identify diseases in aquaculture production earlier' than otherwise would have taken place with the hardcopy of the field guide. The app. will give confidence to the person/s who discovered the aquatic pest or disease that to be sure it is identified correctly due to being able to immediately at the scene check the suspect pest or disease against the app., and analysing the aquatic animals symptoms, leading to better reporting of the disease or pest.

The gross value of aquaculture in Australia was reported as $1,306.7 million for 2016 (ABARES, 2017). It was assumed profitability per year is 10% of the gross value per year. It is assumed that the hard copy field guide should reduce the risk of an outbreak by an absolute 0.5%. The expected value of the field guide is therefore estimated as 0.5% of the value of aquaculture profits or $653,350 per year.

The use of the app. is assumed to improve the effectiveness of the field guide by a further 5% due to the increased accessibility. The 5% benefit of the app. applied to the benefit from the field guide results in an expected annual benefit of $32,668.

There is a probability of impact assumed for the impact of the app. of 25%. This is applied as, in many situations on aquaculture farms the disease may have been identified as effectively with just the field guide and without the use of the app. With the probability of impact applied, the expected annual benefit of the app. is therefore $8,167 per year.

Specific assumptions for valuing the impact are provided in Table 5.

Counterfactual

Without the project, the Aquatic Identification guide would still be available, but only online, in a Portable Document Format (PDF) and in-print form. These formats mentioned would make it less accessible in a practical setting, increasing the risk of misidentification of a disease at the initial stage, and slowing down response times.

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
General		
Gross value of Australian Aquaculture per annum (p.a.)	$1,306.7 million p.a.	ABARES, 2017
Profitability as a percentage of gross value	10%	Agtrans Research
Profitability of the aquaculture sector	$130.67 m p.a.	10% * $1,306.7 m
Counterfactual		
Reduction of risk to profits because of the field guide	0.5%	Agtrans Research
Value of risk reduction due to field guide	$653,350 p.a.	$130.67m *0.5%
With the app.		
Added effectiveness of the field guide due to the app.	5%	Agtrans Research
Avoided loss per annum due to the app.	$32,668 p.a.	5% * $653,350 p.a.
Probability of impact	25%	Agtrans Research
Expected benefit per annum	$8,167 p.a.	$32,668 * 25%
FRDC Program Allocation		
Program - Industry	60%	FRDC
Program - Environment	40%	FRDC

Results

All past and future costs and benefits were expressed in 2017/18 dollar terms using the Implicit Price Deflator for GDP. 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 FRDC investment respectively. The present value of benefits (PVB) attributable to the FRDC investment only, as shown in Table 7 is the same as the total proportion of investment as FRDC was the only funder of the project.

Table 6: Investment Criteria for Total Investment in Project 2015-044

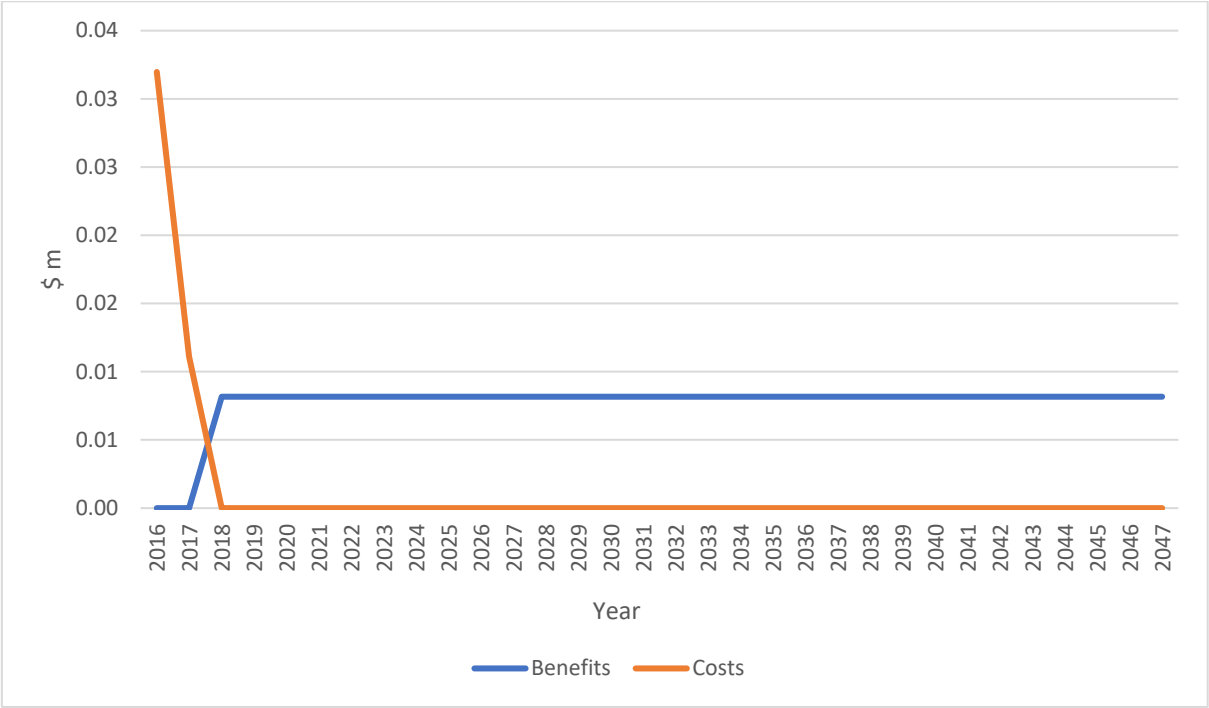
Investment Criteria	**Years after Last Year of Investment**						
	0	**5**	**10**	**15**	**20**	**25**	**30**
Present Value of Benefits ($m)	0.00	0.04	0.07	0.09	0.11	0.12	0.13
Present Value of Costs ($m)	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Net Present Value ($m)	-0.05	-0.01	0.02	0.04	0.06	0.07	0.08
Benefit-Cost Ratio	0.00	0.79	1.41	1.90	2.28	2.58	2.81
Internal Rate of Return (%)	negative	negative	11.7	15.0	16.1	16.5	16.7
MIRR (%)	negative	negative	9.1	9.9	9.7	9.2	8.8

Table 7: Investment Criteria for FRDC Investment in Project 2015-044

Investment Criteria	**Years after Last Year of Investment**						
	0	**5**	**10**	**15**	**20**	**25**	**30**
Present Value of Benefits ($m)	0.00	0.04	0.07	0.09	0.11	0.12	0.13
Present Value of Costs ($m)	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Net Present Value ($m)	-0.05	-0.01	0.02	0.04	0.06	0.07	0.08
Benefit-Cost Ratio	0.00	0.79	1.41	1.90	2.28	2.58	2.81
Internal Rate of Return (%)	negative	negative	11.7	15.0	16.1	16.5	16.7
MIRR (%)	negative	negative	9.1	9.9	9.7	9.2	8.8

The annual undiscounted benefit and cost cash flows for the total investment for the duration of the valued impacts from the FRDC project 2015-044 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 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 ($m)	0.25	0.13	0.08
Present value of costs ($m)	0.04	0.05	0.05
Net present value ($m)	0.20	0.08	0.03
Benefit-cost ratio	5.69	2.81	1.66

A sensitivity analysis was then undertaken for the assumption of the app. to the improved utilisation of the field guide. This is the main variable over which the project has a direct influence and is a key driver of the main benefit. Results of this sensitivity analysis are reported in Table 9.

Table 9: Sensitivity to Improvement because of the App.
(Total investment, 30 years)

Investment Criteria	**Improvement because of the App.**		
	2.5% (Pessimistic)	**5% (base)**	**7.5% (Optimistic)**
Present value of benefits ($m)	0.07	0.13	0.20
Present value of costs ($m)	0.05	0.05	0.05
Net present value ($m)	0.02	0.08	0.15
Benefit-cost ratio	1.41	2.81	4.22

The results from Table 9 indicate that the investment criteria are sensitive to the effect of the app. to the effectiveness of the field guide. The pessimistic scenario provides investment criteria just above the break-even point, while the optimistic scenario has a Benefit-Cost Ratio (BCR) of over four.

The percentage of profits potentially lost due to disease risk in aquaculture was estimated at 5% (Table 5).

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

The coverage of benefits was assessed as medium as the impact valued was potentially viewed as where the app may have the most value.

Confidence in the assumptions, used for valuation of the impact, was assessed as low. Despite the valuation being based on a logical sequence, there is was no strong evidence that the app. has reduced diseases becoming established or saving eradications or management costs in Australian aquaculture.

Conclusions

The investment in the Aquatic animal diseases significant to Australia: Identification field guide app. has produced a mobile app. of the field guide. The app. will allow greater use of the field guide due to easier accessibility. The greater accessibility of the field guide will improve disease detection in aquatic species in Australia, lowering the risk of disease outbreaks due to earlier action taken.

Funding for the project totalled $0.05 million (present value terms) and produced estimated total expected benefits of $0.13 million (present value terms). This gave a net present value of $0.08 million, an estimated BCR of 2.81 to 1, an internal rate of return of 16.7% and a MIRR of 8.8%.

While several economic, environmental, and social impacts identified were not valued, these impacts were considered indirect, uncertain and/or minor compared with the impact valued. Nevertheless, combined with conservative assumptions for the impact valued, investment criteria as provided by the valuation may be underestimates of the actual performance of the investment.

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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