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Analysis of ACIAR's returns on investment: appropriateness, efficiency and effectiveness

ACIAR IMPACT ASSESSMENT SERIES

63

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Analysis of ACIAR's returns on investment: appropriateness, efficiency and effectiveness

Matthew Harding, Tingsong Jiang and David Pearce
Centre for International Economics



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Research that works for developing countries and Australia

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The Australian Centre for International Agricultural Research (ACIAR) was established in June 1982 by an Act of the Australian Parliament. ACIAR operates as part of Australia's international development cooperation program, with a mission to achieve more productive and sustainable agricultural systems, for the benefit of developing countries and Australia. It commissions collaborative research between Australian and developing-country researchers in areas where Australia has special research competence. It also administers Australia's contribution to the International Agricultural Research Centres.

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GPO Box 1571, Canberra ACT 2601, Australia
Telephone: 61 2 6217 0500
aciarc@aciarc.gov.au

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Foreword

The Australian Centre for International Agricultural Research (ACIAR) has a long history of assessing the impact of its research and development (R&D) investments. These assessments have provided valuable lessons for improving the selection, design and delivery of R&D projects. They have also been useful for demonstrating the value of ACIAR as part of Australia's international development assistance program. The credibility of the ACIAR impact assessments has been enhanced by several meta-evaluations, the use of independent consultants to undertake the studies, and the development and implementation of guidelines for assessing the impacts of ACIAR's research activities. ACIAR has also commissioned the development of the ACIAR Database for Impact Assessments (ADIA) as a repository for evidence of impact and to facilitate systematic analysis and compilation of the results across the range of completed impact assessments.

The primary purpose of this report is to provide an update of previous analyses of the returns on ACIAR's investments in R&D. This quantitative component of the report draws heavily on ADIA, and provides summary information for a range of investment portfolio-based uses.

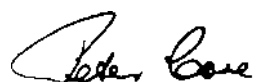
Based on an analysis of the quantitative information obtained from 37 ACIAR impact assessment studies, the total cost of the investment in these projects is estimated to be around A\$234 million in net present value terms (in 2008 dollar equivalents). Of these costs, A\$128 million are direct ACIAR costs. The projects generated an estimated total benefit of A\$12.6 billion, with the benefits attributable to ACIAR being A\$6.8 billion. Hence, the benefit:cost ratio for all the projects evaluated is around 54:1. These results indicate highly successful research. Indeed, the returns on the relatively small sample of projects (worth around 6% of total expenditure since ACIAR's inception in 1982) easily pay for the total cost of ACIAR, which is A\$2.1 billion in present value

terms (2008 dollars). This is consistent with previous meta-evaluation studies.

The distribution of the benefits of ACIAR research (i.e. the A\$12.6 billion) is also analysed by country and program area. The major beneficiary countries include China (A\$3.6 billion), Vietnam (A\$2.8 billion), India (A\$1.8 billion) and Australia (A\$1.2 billion). Indonesia, Thailand and Papua New Guinea are other significant beneficiaries.

With regard to distribution of benefits between program areas, crops (accounting for around 28.3% of total benefits), animals (25.5%) and forestry (15.4%) have been the major source of assessed benefits. This is not surprising given the importance of the commodities covered by these programs in many of ACIAR's partner countries.

In addition to estimating quantitative benefits, the study also contains a significant qualitative element that involves drawing evidence on the appropriateness, effectiveness and efficiency of ACIAR's activities. This is presented within the broad context of Australia's aid delivery system, with a particular emphasis on whole-of-government and public-good issues. The main finding is that ACIAR is an effective and efficient funding agency and that, despite its relatively small size in the international aid and research-for-development arena, the Centre performs well in terms of ensuring that the research it invests in meets the needs of its stakeholders, makes a difference to the livelihoods of the poor and aligns within the broader Australian aid program.



Peter Core
Chief Executive Officer
ACIAR

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Summary

The Australian Centre for International Agricultural Research (ACIAR) has, for over 20 years, been undertaking formal, independent, impact assessment studies, using benefit–cost analysis. It recently had a database developed for systematically storing these quantitative impact assessments. The database facilitates systematic analysis of the results of the impact assessments and provides summary information for a range of uses.

This study analyses the results of 37 quantitative impact assessments undertaken on ACIAR projects.

The total benefits to ACIAR research calculated in these impact assessments are estimated at A\$12.6 billion, for a total investment of approximately A\$234 million in 2008 dollar present-value terms. Of the total benefits, A\$11.4 billion accrue to developing countries and A\$1.2 billion to Australia. The average benefit:cost ratio across all projects assessed is 54.

The benefits directly attributable to ACIAR funding are estimated at A\$6.8 billion, for an investment of A\$128 million across projects. Total ACIAR expenditure since its inception is estimated at A\$2.1 billion, meaning that the returns from the research assessed pay for total expenditure more than three times over.

The major partner country beneficiaries of ACIAR research evaluated to date are China and Vietnam, which together account for just over half the total benefits. India is the next largest beneficiary, accounting for 15% of total benefits.

In regional terms, the major beneficiary of ACIAR research assessed to date has been South-East Asia (34% of total), followed by North Asia (29%), South Asia (15%), Australia (9%), and Papua New Guinea and the Pacific (3%).

In terms of research areas, the majority of benefits assessed are in crops and animals (54% of total benefits), followed by forestry (15%), fisheries (16%) and natural resources management (14%).

There is evidence to suggest that, on average, the returns on ACIAR research have been increasing over time. Other things being equal, this indicates that ACIAR's research is becoming more effective over time.

Average returns also vary depending on the partner country involved. Countries that show higher benefits in absolute terms (China, Vietnam and India) also have higher average returns. This reflects a range of factors, including the social, political and economic environments in these countries, and the research and extension capacity relative to other partner countries.

Overall, ACIAR's impact assessment program demonstrates the appropriateness, effectiveness and efficiency of the Centre's research over a long period. However, there are inevitably trade-offs associated with the undertaking of agricultural research in developing countries that affect its performance in different countries.

ACIAR's funding model is designed to align partner-country priorities with areas of Australian research capacity, to ensure appropriate research is undertaken. While the collaborative nature of ACIAR's funding model means that some country priorities are not funded because they do not align with Australian research capacity, it does ensure that ACIAR does not fund research in areas outside the partner-country priorities.

Another issue is the research and extension capacity of partner countries. ACIAR's research tends to be more successful in countries with strong capacity in these areas.

1 Introduction

The Australian Centre for International Agricultural Research (ACIAR) has, for over 20 years, been undertaking formal, independent, impact assessment studies based on benefit–cost analysis. During the past 4 years, it has commissioned several reviews of these studies (Raitzer and Lindner 2005; Pearce et al. 2006; ACIAR 2006). ACIAR has since commissioned a significant number of further assessment studies.

Recently, ACIAR had a database developed for systematically storing the results of its quantitative impact assessments. The ACIAR Database for Impact Assessments (ADIA) facilitates systematic analysis of the results of the impact assessments and provides summary information for a range of uses (CIE 2009).

This report has two purposes. First, using the recently developed database, it will provide an update of previous studies of returns on ACIAR research, in particular those of Raitzer and Lindner (2005) and Pearce et al. (2006). This exercise is aimed at both providing an updated picture of returns on ACIAR investments and at critically analysing the capacity of ADIA to facilitate this type of analysis. It will also examine and, where appropriate, provide feedback to ACIAR's guidelines for impact assessment studies (Davis et al. 2008).

The second aspect of this study is to provide analysis and discussion around a number of issues including:

- the appropriateness of ACIAR's activities with respect to how ACIAR research fills a research and development (R&D) gap left by the market, especially in terms of ACIAR's public-good R&D and its possible redistributive contribution
- ACIAR's effectiveness in meeting its objectives and achieving value for money for taxpayer funds

- ACIAR's efficiency in achieving its objectives, particularly by complementing the effectiveness of other government activities
- ACIAR's effectiveness in integrating its operations with other government agencies: for example, how well ACIAR develops complementary, whole-of-government activities and provides measures of the effects of these.

Report outline

This report is structured as follows. Chapter 2 presents a brief discussion of the two previous meta-analyses that ACIAR has commissioned, followed by an overview of ACIAR's impact studies facilitated by the database. This chapter will also identify any additions or modifications made to the database in the process.

Chapter 3 presents a discussion of the appropriateness, effectiveness and efficiency of ACIAR's activities, including whole-of-government issues. The discussion uses information gathered from the database analysis.

2 Overview of ACIAR's impact assessments

This chapter gives an overview of the results of ACIAR's completed impact assessments using the recently developed database. This is, in effect, an update of two previous studies that examined the returns on ACIAR research based on completed impact assessment studies. It is also aimed at providing a breakdown of the benefits to ACIAR research across a number of dimensions, including country and program area.

The study by Raitzer and Lindner (2005) aimed to calculate 'credible minimum aggregate benefit:cost ratios for total investment in ACIAR's bilateral research support activities'. It took the approach of identifying from completed impact assessments three levels of benefits. At the top level, all reported benefits were used to explore the potential level of benefits. The second level of benefits excluded those contingent on hypothesised future benefits and included only those 'based on documented evidence of adoption'. A third level restricted benefits to those from 'a very restricted pool of studies that clearly illustrate rigorous calculation of research investment returns'.

Pearce et al. (2006) examined the benefits to Australia from ACIAR-funded research. This study built on the analysis in Raitzer and Lindner (2005) with the addition of five case studies of ACIAR-funded projects not previously assessed.

Updating ACIAR's impact assessment database

The first step to updating ACIAR's impact assessment database is to ensure that the information is correct in terms of the completed Impact Assessment Series (IAS) studies already in the database and that all relevant studies are included in the database. A list of ACIAR's IAS reports is given in the appendix.

Since the completion of the impact assessment database (ADIA) there have been 22 assessments published in ACIAR's IAS. Of these, 17 are largely quantitative and the remainder qualitative. The assessments in IAS 39 and IAS 41 (Pearce et al. 2006; ACIAR 2006) are two of the earlier meta-analyses that this study is building on.

As well as not covering the qualitative assessments, this study does not include IAS 40, as it is a poverty analysis of research previously evaluated for ACIAR. IAS 44 is an assessment of capacity-building impacts which includes two case studies. These are not included, as they build on previous impact assessment studies that are already in the database.

The approach taken in updating the database is consistent with the original methodology. The information available on a range of qualitative factors such as outputs, type of impacts and related projects has been included in each entry, in addition to the annual stream of benefits and costs.

Total benefits of ACIAR-funded projects

The impact assessment database contains quantitative information on 37 ACIAR impact assessments (including the most recent update described above). The following results are generated using the ADIA interface, which allows specification of the base currency year, base discounting year and discount rate. For this analysis, 2008 is the base year. The discount rate used is 5%.

Table 1 summarises the results. In all, the total cost of the investment across the projects covered in ADIA is around A\$234 million in net present value terms (in 2008 dollar equivalents). Of these costs, A\$128 million are direct ACIAR costs, while the remaining A\$106 million are collaborator contributions (in-kind and otherwise). These projects have generated estimated total benefits of A\$12.6 billion, with benefits of A\$6.8 million attributable to ACIAR. The total benefit:cost ratio (BCR) across all projects evaluated is estimated at around 54.

Table 1. Summary of the benefits and costs of 37 ACIAR impact assessments for which there is quantitative information in the ACIAR Database for Impact Assessments (ADIA)

Total benefits (A\$m)	12,632
Benefits attributable to ACIAR (A\$m)	6,811
Total costs (A\$m)	234
ACIAR costs (A\$m)	128
Benefit:cost ratio	54

Note: Benefits and costs expressed in 2008 dollar equivalents, base year for discounting 2008, real annual discount rate of 5%.

Source: ADIA

These results indicate highly successful research. The magnitude of the benefits attributable to ACIAR estimated across the sample projects easily pays for the total expenditure of ACIAR since its inception. This is estimated at around A\$2.1 billion in present-value terms (2008 dollars). This is consistent with previous meta-analysis studies. In total, ACIAR's impact assessment program has covered projects worth around 6% of total expenditure since ACIAR's inception.

Figure 1 shows aggregate annual discounted benefits.

Although all the impact assessments included in this analysis are ex-post (after-the-fact) assessments, many of the benefits are expected to accrue in the future, as Figure 1 shows. Relatively few benefits accrue before 1990, while peak annual benefits occur in 2008. A number of individual future years show high benefits because some impact assessments calculate annuity values in the final year of the term over which the assessment is made.¹

Figure 2 shows the aggregated undiscounted stream of net benefits across the assessments.

Across the projects that have been evaluated, there is a range of BCRs, as illustrated in Figure 3.

A significant majority (71%) of projects have BCRs of less than 50. Only four projects have a BCR less than 1, while 16% of the projects assessed have a BCR greater than 100. Those projects with large BCRs skew the results somewhat: 73% of individual projects have a BCR lower than the average across all projects, while the median BCR across all projects is 20.6, significantly lower than the average of 50.

Distribution of total benefits

The ADIA provides a consistent framework for looking at the distribution of benefits generated by ACIAR projects that have been subjected to an impact assessment. The two key ways the distribution can be analysed are by country and by program area. The following analysis uses total benefits to ACIAR projects.

Distribution by country and region

Assuming that most past projects that have generated significant benefits have been subjected to an impact assessment, looking at the distribution of these benefits shows the degree of effectiveness of ACIAR research in different partner countries and Australia. Traditionally,

¹ ACIAR's guidelines for assessing the impacts of its research activities (Davis et al. 2008) include a recommendation that annuity values should be used in the final year of the impact assessment period. Annuity values reflect the ongoing value of the research beyond the impact assessment period.

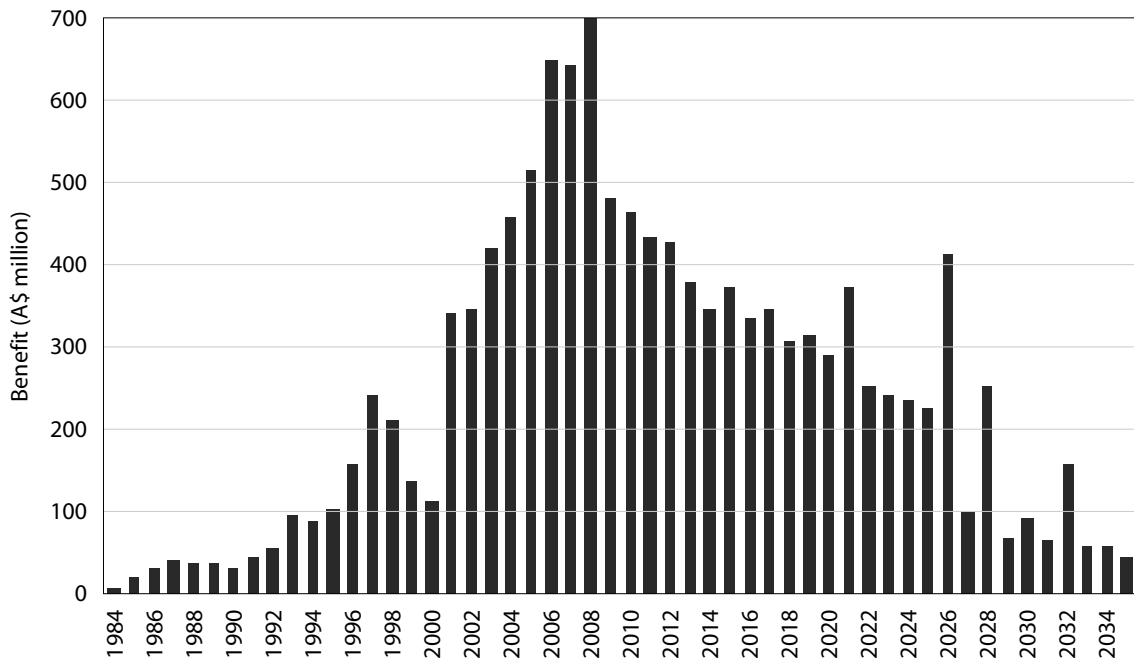


Figure 1. Aggregate annual discounted benefits (in 2008 Australian dollars) for 37 ACIAR impact assessments for which there is quantitative information in the ACIAR Database for Impact Assessments (ADIA).
Data sources: ADIA; Centre for International Economics calculations

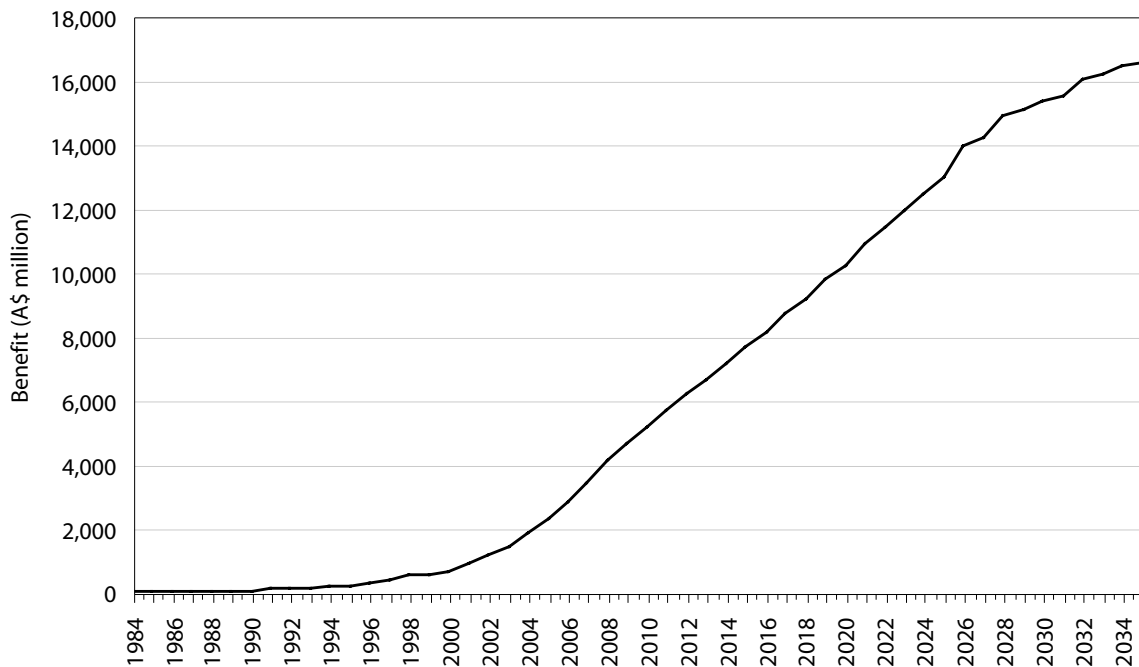


Figure 2. Cumulative undiscounted net benefits for 37 ACIAR impact assessments for which there is quantitative information in the ACIAR Database for Impact Assessments (ADIA). Data sources: ADIA; Centre for International Economics calculations

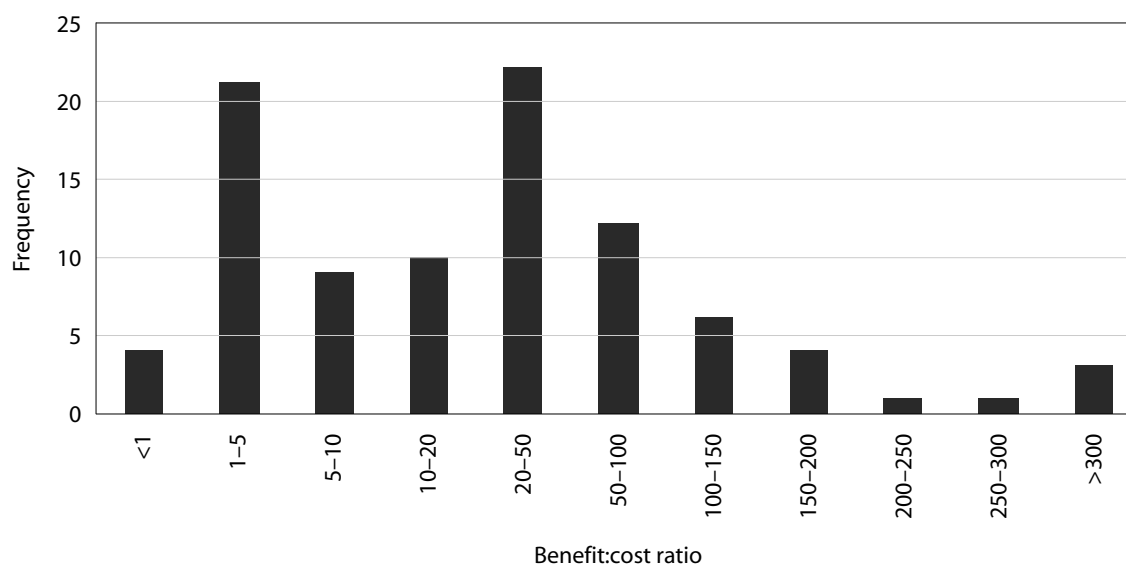


Figure 3. Distribution of benefit:cost ratios across 37 ACIAR impact assessments for which there is quantitative information in the ACIAR Database for Impact Assessments (ADIA). Data sources: ADIA; Centre for International Economics calculations

ACIAR has undertaken impact assessments on projects for which there has been some evidence of adoption of project outputs. This strategy derives largely from the need to demonstrate returns on ACIAR's investment in agricultural R&D.

Although care should be taken in drawing too strong conclusions from the results, comparing returns to partner countries with average budgets or expenditure can highlight partner countries where ACIAR has been relatively more, or less, effective.

The other way to analyse the distribution of benefits to partner countries is by region. ACIAR's annual funding targets are allocated on this basis, across the following regions:

- Papua New Guinea (PNG) and the Pacific islands
- South-East Asia
- South Asia
- North Asia
- Southern Africa.

Table 2 shows total discounted benefits for the major beneficiary countries, along with the number of projects contributing to those benefits, while Figure 4 illustrates the distribution of total benefits (across all impact assessments in ADIA) by country and by region.

Table 2. Total benefits from ACIAR research projects, by country

Country	Benefits (A\$m) ^a	No. of projects
China	3,614.8	19
Vietnam	2,825.6	17
India	1,837.8	11
Australia	1,176.9	47
Indonesia	670.3	11
Thailand	402.3	17
Papua New Guinea	371.2	2
Africa	330.8	1
Philippines	271.5	8
Others	1,130.8	0
Total	12,632.0	90 ^b

^a Discounted total benefits in 2008 dollars.

^b Some projects were implemented in more than one country.

Source: ACIAR Database for Impact Assessments; Centre for International Economics calculations

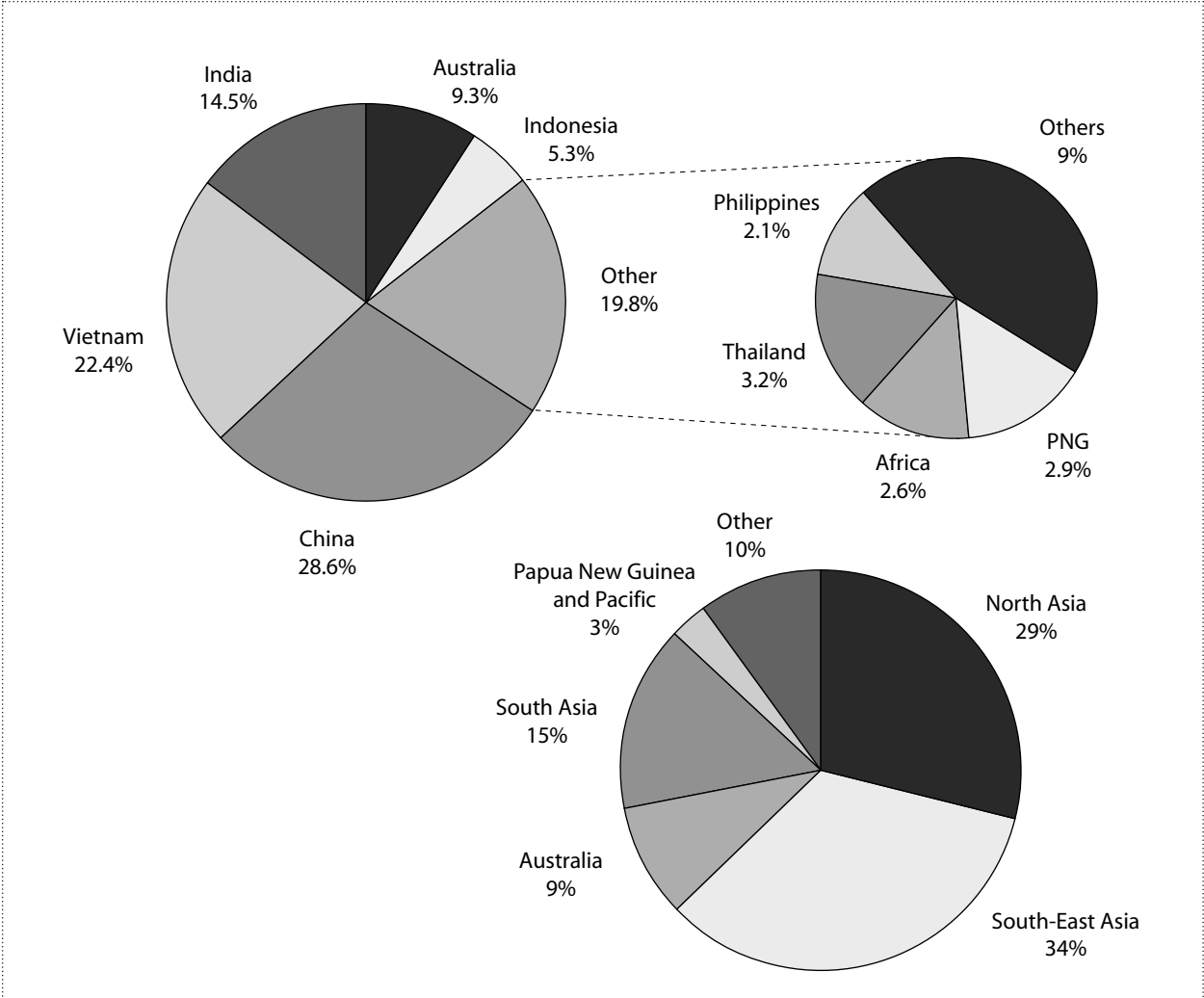


Figure 4. Distribution of total benefits from ACIAR research projects, by country and region.
 Data source: ACIAR Database for Impact Assessments; Centre for International Economics calculations

In terms of partner countries, China and Vietnam together account for over half of the calculated benefits of ACIAR research. India is the next largest beneficiary, accounting for around 15% of total benefits. Australia, which captures about 9% of total benefits, is also a significant beneficiary. Indonesia accounts for 5% of total benefits, with Thailand, PNG, Africa and the Philippines being the other major beneficiaries.

It is interesting to note the number of projects generating benefits for each country. On average, payoffs for China are slightly higher than those for Vietnam and India in terms of average per project assessed. Australia's benefits are derived from a significant number of projects, most likely due to the small indirect benefits that accumulate as a result of research targeted largely at partner countries. Average benefits per project

assessed for Thailand, Indonesia and the Philippines are significantly lower than for China, Vietnam and India. Assessed benefits to PNG have come from just two successful projects. This suggests that relatively few projects in PNG have had a significant impact. The implications of this are discussed further in the next section.

In regional terms, the largest benefits accrue to South-East Asia, with around one-third of the total benefits calculated. Under ACIAR's latest operational plan, South-East Asian countries represent the greatest budget allocation, with a funding target of at least 45%. The second largest beneficiary region is North Asia (in effect China), with 29% of total benefits. Other partner regions that have benefited from ACIAR research are South Asia (15%) and PNG and the Pacific (3%).

As noted earlier, these results represent the benefits of ACIAR research projects that have been subjected to a formal impact assessment. The benefits presented here are therefore likely to underestimate the total benefits across the ACIAR portfolio. It is likely that other completed but, as yet, not assessed projects have generated benefits, just as current and prospective projects are likely to do in the future. However, ACIAR's strategy for undertaking impact assessments has traditionally been to assess projects for which there was evidence that the results of the research were being taken up. This strategy has been used partly to satisfy demands for accountability but it also acknowledges that undertaking full impact assessments is both costly and time consuming. So it seems reasonable to assume that, while the total benefits are likely to be higher than those presented here, most projects generating significant benefits would have undergone an impact assessment.

Benefits by country relative to expenditure

At the overall level, the analysis presented earlier shows that demonstrated benefits to ACIAR-supported research more than pay for total expenditure since ACIAR's inception. In a similar way, it is possible to examine returns on ACIAR research in relation to total expenditure at the country level.

The country focus of ACIAR research evolves over time as circumstances change. Countries such as Vietnam and China have experienced significant economic

development since ACIAR's inception. Both the type and quantity of research required in these countries has changed significantly. It is difficult to get consistent, accurate data on ACIAR's expenditure by country over time. From the ACIAR website it is possible to obtain a breakdown of expenditure back to 2000–01, while further data from ACIAR have provided a breakdown back to 1997–98.

It is possible to compare total country expenditure from 1997–98 with assessed benefits (from ADIA) over this period. However, this comparison is complicated by the long period over which projects generate benefits: some benefits accruing well into the future are generated from early projects. Similarly, there is generally a lag between the completion of a project and the time at which it begins to generate benefits.

The approach taken in the following analysis is to limit benefits to projects with benefits accruing after 1997–98: any projects with benefits occurring before then are excluded. Expenditure by country is included for the period 1997–98 to 2006–07, recognising that much of the expenditure in years following 2006–07 is unlikely to be generating benefits as yet. It is emphasised that this analysis is illustrative, given the uncertainty about the magnitude of benefits occurring over the period in question.

Table 3 shows the results of this analysis for ACIAR's major partner countries.

Table 3. Returns on ACIAR research projects in partner countries since 1997–98

	Total benefits	Total expenditure	Indicative benefit:cost ratio	No. of projects assessed
	A\$m	A\$m		
China	1,236.3	54.8	22.56	9
India	589.3	41.9	14.06	3
Vietnam	521.3	39.9	13.05	14
Indonesia	255.5	65.3	3.91	10
Philippines	43.4	35.7	1.22	5
Thailand	34.6	13.3	2.60	3
Papua New Guinea	4.0	57.4	0.07	1
Pacific	0.0	33.4	0.00	0

Note: All values are presented in net present-value terms in 2007 dollars.

Source: ACIAR Database for Impact Assessments; ACIAR; Centre for International Economics calculations

China shows significant returns, with an overall BCR over the period of around 22. India and Vietnam also demonstrate strong returns, with BCRs of 14 and 13, respectively. These results largely mirror the total benefits by country presented earlier (Table 2). ACIAR research in Indonesia over the period analysed has generated returns at a BCR of almost 4:1. For Thailand, the BCR is around 2.5, while research in the Philippines has generated benefits roughly equivalent to costs. Returns on research in PNG have been extremely low relative to costs, while for the Pacific no projects were assessed over this period.

PNG is a unique case, with only two projects assessed. One of them has accounted for almost 99% of the total benefits to the country and, since it falls outside the period being analysed, estimated total returns are relatively low. Of the countries presented in Table 3, Indonesia and PNG have been the largest recipients of ACIAR funding. Returns on research in Indonesia over this period are more than four times the expenditure, but for PNG the expenditure has far outweighed demonstrated returns. This raises interesting questions

about the effectiveness of ACIAR research in some countries relative to other partner countries. They are discussed in the next chapter.

Distribution by program area

ADIA identifies the program area for each project. In all, 30 program areas are identified, many of them no longer current. Of the 30 program areas, 14 are represented in the sample of impact assessments analysed. They are listed in Table 4.

The approach taken in this analysis is to classify the program into the following groups: animals, crops, natural resource management (NRM), fisheries, forestry and policy. Figure 5 shows the distribution of benefits assessed across these groups.

Crop programs have been the major source of benefits assessed, accounting for around 28% of the total. This is not a surprising result given the importance of crops in many of ACIAR’s partner countries. Animals and forestry are the next largest, together accounting for around 41% of total benefits. Again, given the importance of forestry

Table 4. Program areas in the ACIAR Database for Impact Assessments (ADIA) represented in the analysis of returns on investment

Program	Program ID	Group
Animal Health	AH	Animal
Agricultural & Natural Resource Economics 1	ANRE1	Natural Resources Management (NRM)
Animal Sciences 1	AS1	Animal
Animal Sciences 2	AS2	Animal
Crop Protection	CP	Crops
Crop Sciences 1	CS1	Crops
Crop Sciences 2	CS2	Crops
Fisheries	FIS	Fisheries
Forestry	FST	Forestry
Land & Water Resources 1	LWR1	NRM
Land & Water Resources 1	LWR2	NRM
Postharvest Technology	PHT	Crops
Plant Nutrition	PN	Crops
Agricultural Development Policy	ADP	Policy

Source: ADIA

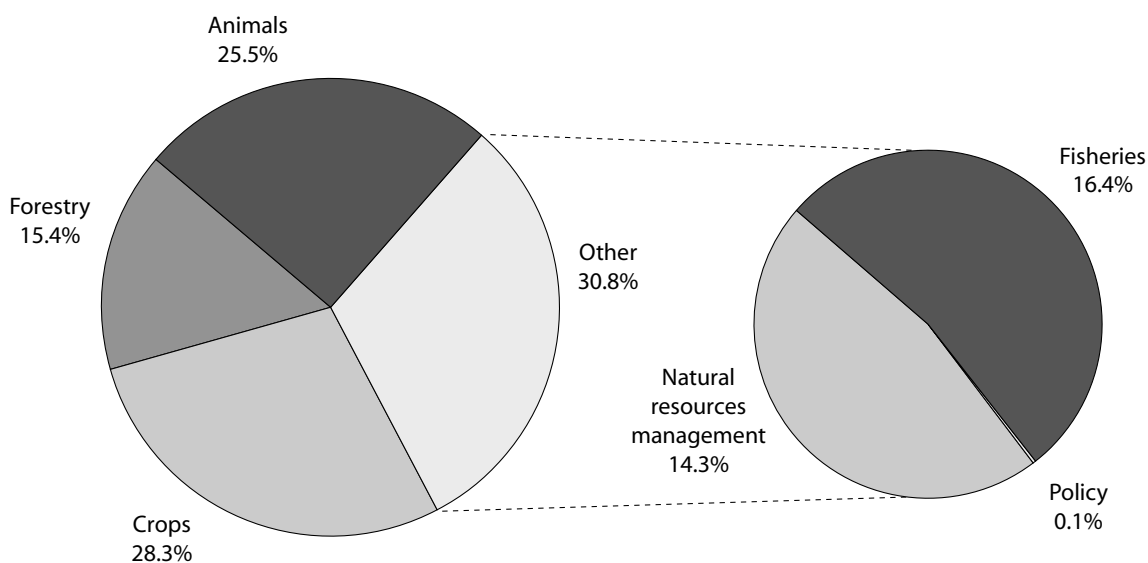


Figure 5. Distribution of the benefits of ACIAR research by program area (discounted total benefits in 2008 Australian dollars). Data sources: ACIAR Database for Impact Assessments; Centre for International Economics calculations

and livestock to the livelihoods of the rural poor in many developing countries, this is not unexpected. Of the others, only fisheries (16%) and NRM (14%) have generated significant benefits. It is generally difficult to undertake impact assessments of policy-oriented research. Although few benefits have been assessed in this area, it could be that this reflects this difficulty, rather than a lack of impact of this research. Comparing the benefits by program areas with expenditure across these areas would provide an interesting point of discussion, but there are no data to enable this analysis.

Analysis of project performance

The previous section outlined how the total benefits of ACIAR's impact assessment program are distributed across time, countries and program area. Another way to examine the data is to look at average returns (indicated by BCRs) across projects, to detect any systematic relationships that might illustrate how the performance of ACIAR's projects varies across a number of dimensions.

The database allows a comparison of project returns by project budget. This shows any trend between performance and budget. Figure 6 is a scatter plot of BCRs and total budget by project.

As Figure 6 shows, there is no correlation between project budget and BCRs. The correlation coefficient for the two data series plotted is -0.006 .

Another aspect of ACIAR's performance that is of interest is how average returns have changed over time. Figure 7 plots the distribution of project BCRs over time. The time period used is the first year each project was assessed as generating a benefit. It is difficult to see a clear pattern of BCRs, although a slight positive relationship is observed, with the correlation coefficient for the datasets plotted in Figure 7 being around 0.2.

Figure 8 presents these data in a slightly different way, giving BCRs by project for 5-year intervals. It also shows means and standard deviations for each period. The mean used is a 'trimmed-mean', which excludes a proportion of observations at either end of the distribution. Based on this, the mean BCR declined between 1985–90 and 1990–95 and again between 1990–95 and 1995–2000. However, it has increased since 2000. The standard deviations are relatively high in each period, due to the wide range and relatively few observations.

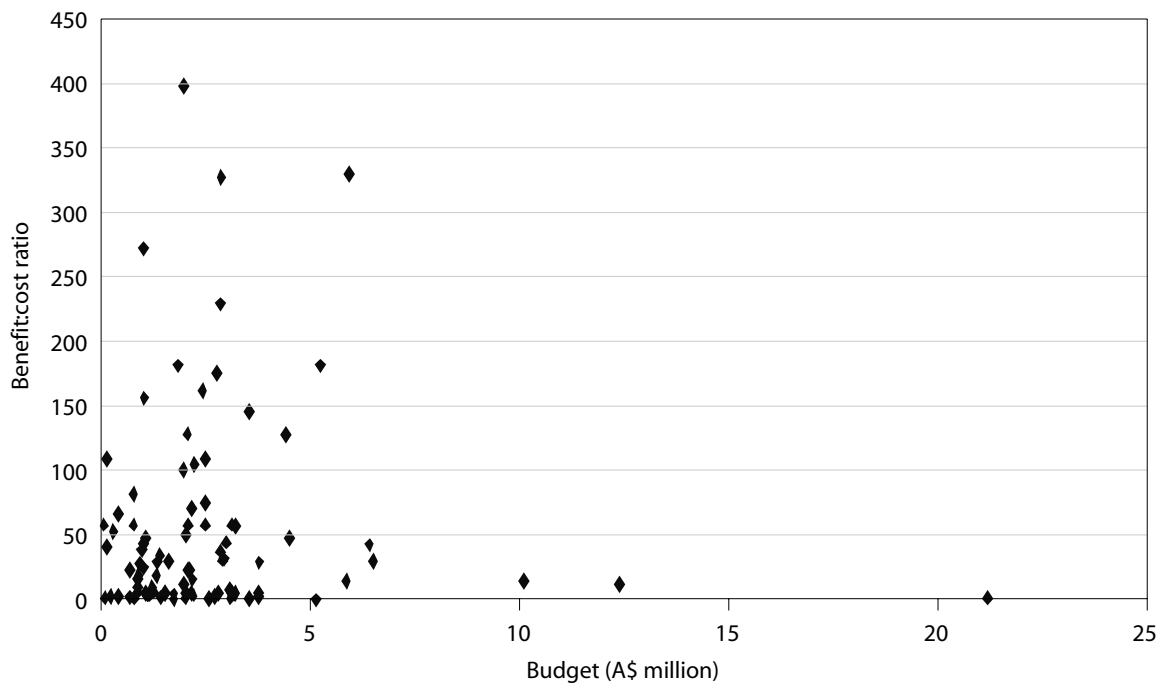


Figure 6. ACIAR project benefit:cost ratios versus project budget. Data sources: ACIAR Database for Impact Assessments; Centre for International Economics calculations

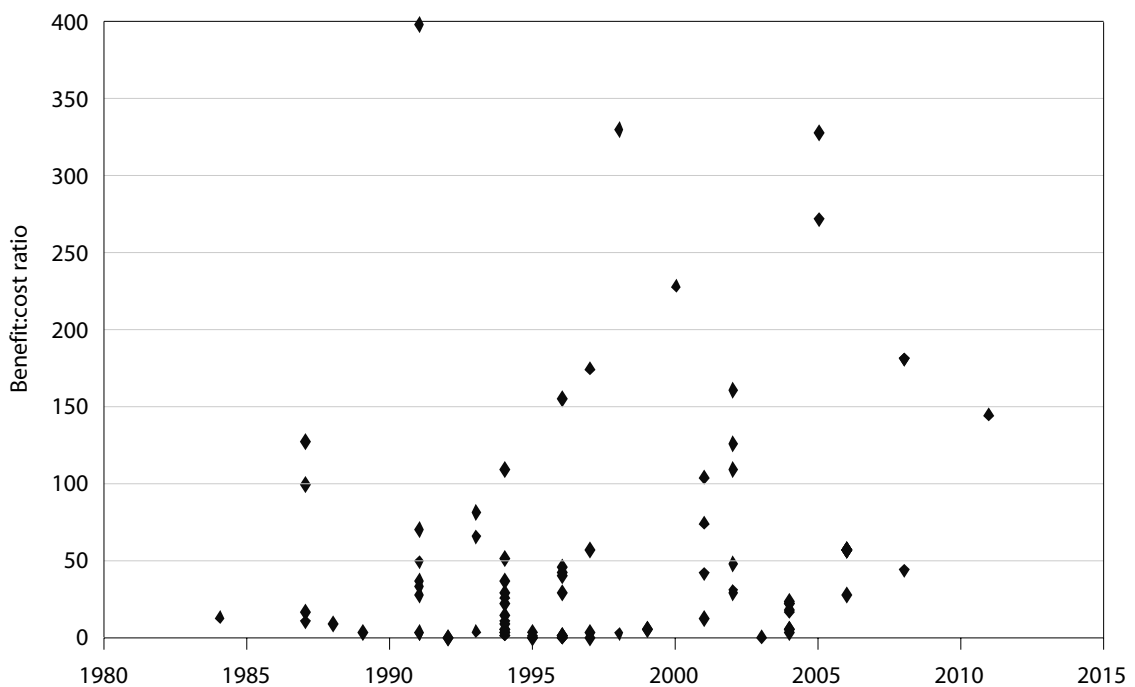


Figure 7. Distribution of benefit:cost ratios of ACIAR projects over time. Data sources: ACIAR Database for Impact Assessments; Centre for International Economics calculations

While visual representation can effectively illustrate relationships, a more systematic way to analyse relationships between variables is regression analysis. This involves examining the relationship between a dependent variable and one or more independent variables. In this case, the dependent variable is the project performance (BCR). A number of possible independent variables could be included: the following analysis uses country, program area, time, Australian benefits and budget.

Using a simple regression analysis, the performance across projects was found to not vary in a statistically significant way across program areas, whether or not the project generated benefits to Australia or budget. However, time and country were found to have a statistically significant impact on project performance. The regression analysis found that project performance has increased over time and that this increase is statistically significant. This confirms the view presented in Figures 6 and 7.

Because the partner country is a qualitative variable, a dummy variable needs to be used to represent it in the regression analysis. Therefore, the sign and scale of the coefficient that is generated will depend on how the dummy variable is constructed. Based on the analysis, it appears that the BCRs across the projects are higher for countries with higher overall benefits (China, Vietnam and India). This confirms not only that these countries account for a high proportion of total benefits but also that, on average, the assessed projects in these countries have performed better than the average across all assessed projects.

Figure 9 shows a plot of the Lorenz curve for the distribution of benefits and costs across partner countries. This illustrates the unequal distribution of benefits across partner countries. If benefits and costs were equally distributed (i.e. no difference in average BCRs across countries) then the line would be perfectly diagonal (as indicated on the figure).

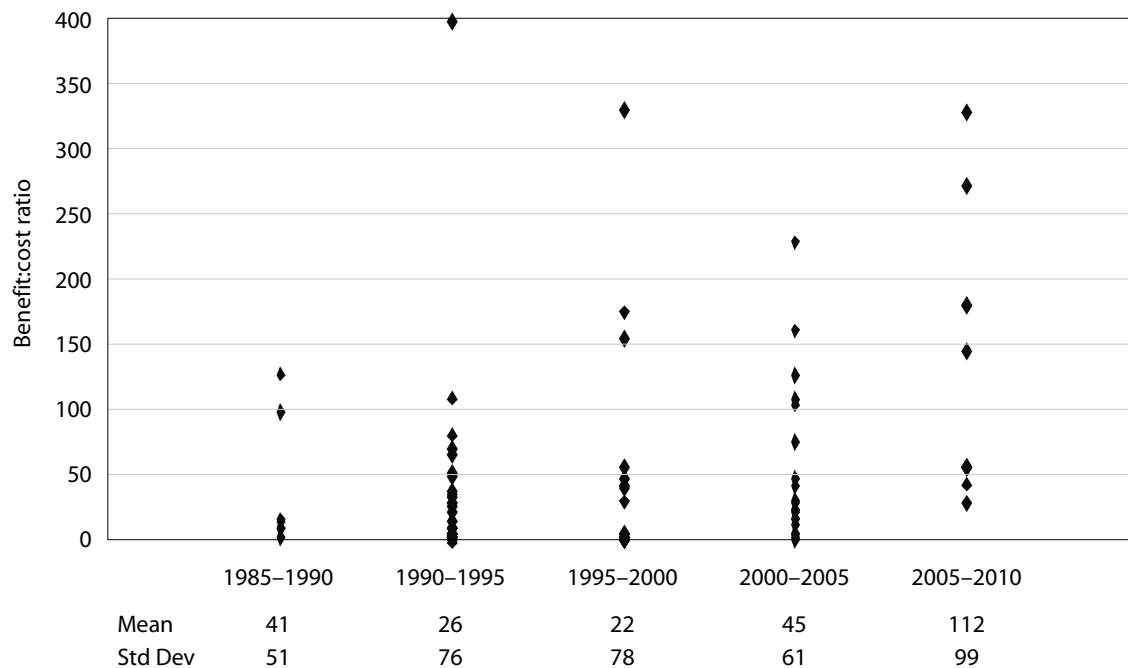


Figure 8. Distribution of benefit:cost ratios of ACIAR projects at 5-year intervals. Data sources: ACIAR Database for Impact Assessments; Centre for International Economics calculations

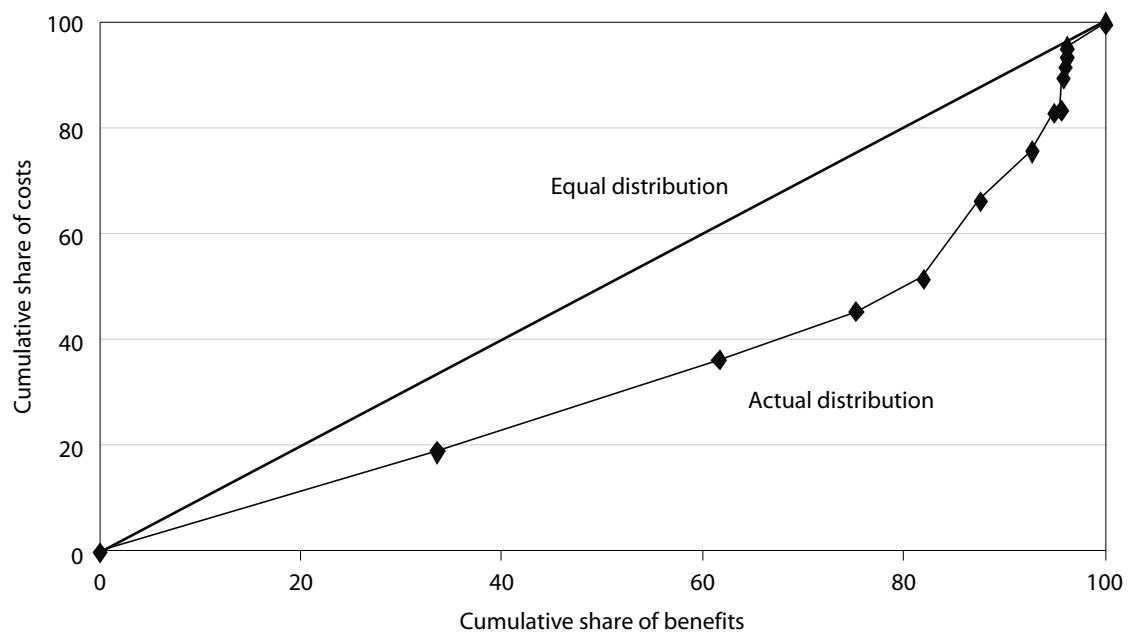


Figure 9. Distribution of the benefits and costs of ACIAR projects across countries. Data sources: ACIAR Database for Impact Assessments; Centre for International Economics calculations

3 Examining ACIAR's appropriateness, effectiveness and efficiency

A White Paper on the Australian Government's overseas aid program was released in 2006 (AusAID 2006). It was instigated in March 2005 by the Minister for Foreign Affairs and was aimed at providing a 'strategic framework to guide the direction and delivery of Australia's overseas aid program'. Following the release of the paper, the Office of Development Effectiveness (ODE) was established to improve the effectiveness of the Australian Government's aid program. Its roles and responsibilities include the following (ODE 2009):

- Prepare the Annual Review of Development Effectiveness. The review draws on the breadth of ODE's work and performance information generated by new reporting processes, and other independent assessments.
- Help to oversee the roll out of the new Performance Assessment and Evaluation Policy of Australia's aid program. The policy describes expectations for measuring the performance of Australian aid and includes principles that apply to all types of reporting.
- Undertake a number of high level thematic and country strategy evaluations and improve evaluation practice across the aid program.
- Support the development of country strategies.
- Assist in the Government's efforts to engage the Australian community on development and the aid program.
- Engage on the international effectiveness agenda, particularly the Accra High Level Forum in September 2008 and building links with international partners.

The establishment of the ODE, along with associated measures, reflects an increasing focus on effectiveness in the aid community. The Paris Declaration on Aid Effectiveness was endorsed in March 2005, with Australia one of 60 signatories. It aims to increase efforts in harmonising, aligning and managing aid for results.

ACIAR has a strong tradition of undertaking impact analysis on its activities. Chapter 2 presented the results of the assessments that have been undertaken to date. This chapter presents a broader discussion of ACIAR's role in Australia's aid-delivery system, including its appropriateness, effectiveness and efficiency, with a particular emphasis on whole-of-government and public-good issues.

ACIAR in the context of Australia's aid system

ACIAR holds a unique position in Australia's aid system. Its focus is on research into improving sustainable agricultural production in developing countries. It does this through a collaborative research approach that tackles problems of mutual interest and benefit to developing countries and Australia. Like providing physical infrastructure or delivering education, research is a form of aid that has the potential to continue to deliver benefits well after the funding has ceased. ACIAR directly funds activities in five regions: PNG and the Pacific islands; South-East Asia; North Asia; South Asia; and Southern Africa. Research is also allocated across regions through funding to the International Agricultural Research Centres.

ACIAR was established in 1982 in recognition of the unique position Australia holds among developed countries in terms of the range of its climates (temperate, tropical and subtropical) variously matching those found in developing countries. In addition to this, Australia's agricultural research capacity is highly regarded. Given this combination, Australia is well suited to engaging in agricultural research for developing countries.

The Australian benefits study of Pearce et al. (2006) highlighted schematically (Figure 10) where ACIAR sits in the aid and innovation system.

In the international aid context, the area of most relevance in Figure 10 is quadrant II. Through its research, ACIAR aims to deliver positive outcomes to developing-country agriculture. The analysis presented in Chapter 2 indicates that the estimated total benefits to developing countries as a result of a selected set of ACIAR projects amount to over A\$11.4 billion, for a total ACIAR investment of around A\$2.1 billion (present value terms in 2008 dollars). Of these benefits, around A\$5.8 billion are directly attributable to ACIAR funding.

The second area of benefits arising from ACIAR research is those to Australia. This interaction is represented in quadrant III of Figure 10. Pearce et al. (2006) examined these benefits in detail. They found that total benefits to Australia resulting from ACIAR research amounted to around A\$605 million in present-value terms (2004 dollars). The analysis presented in Chapter 2 here, suggests that updating for the most recent impact assessments published by ACIAR, gives total benefits to Australia as a result of ACIAR research of around A\$1.2 billion in 2008 dollar present-value terms.

Pearce et al. (2006) identify and discuss a number of ways that ACIAR research can deliver benefits to Australian agriculture:

- new production technology
- protection from pests and diseases
- increased trade
- increases in the stock of knowledge of Australian researchers.

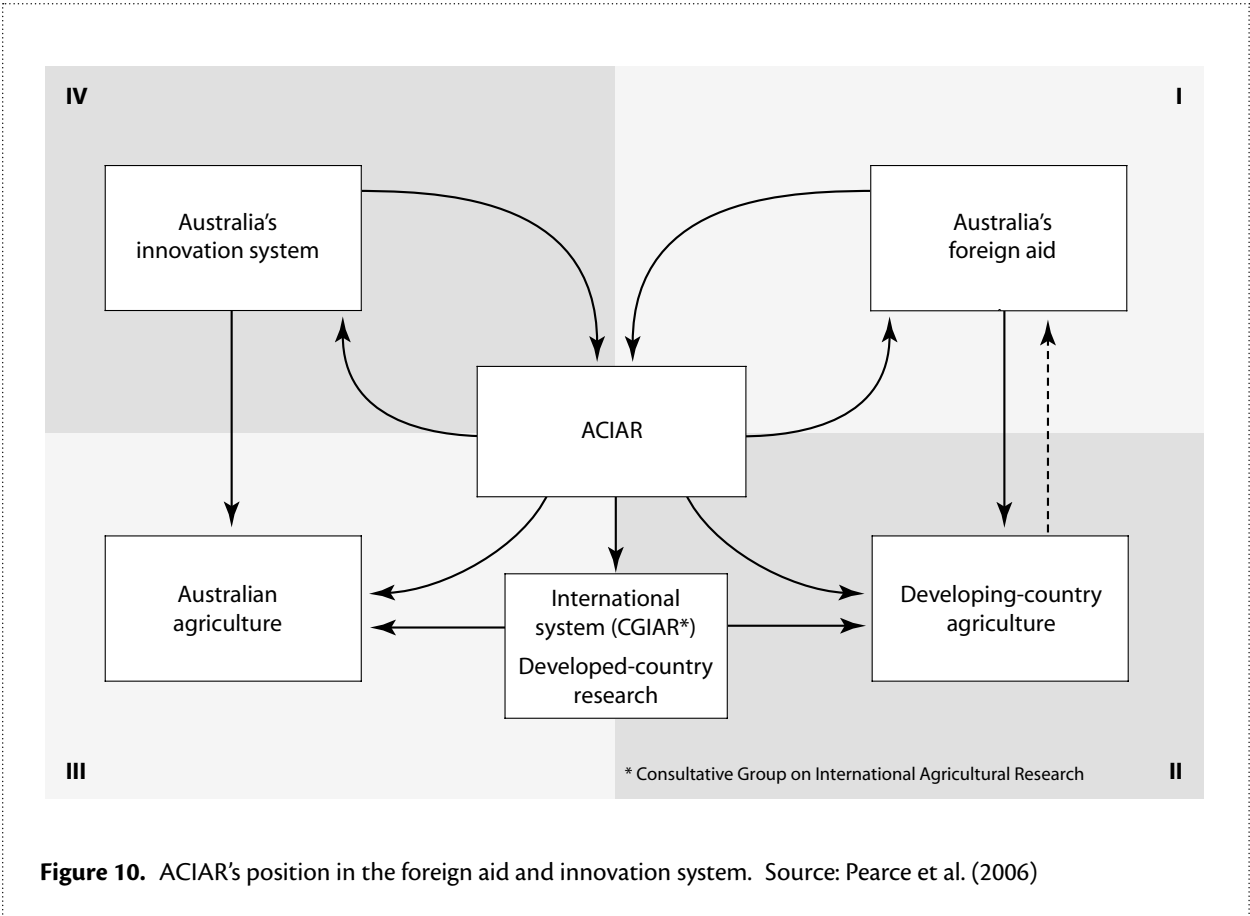


Figure 10. ACIAR's position in the foreign aid and innovation system. Source: Pearce et al. (2006)

The benefits to Australia calculated in the present report are mostly of the first three types listed. It is difficult to estimate the value of the increase in stock of knowledge and research capacity in Australia as a result of ACIAR research. Nevertheless, such benefits are widely recognised as being extremely important. ACIAR tends to fund research in areas where other research is already taking place. In that context, a contribution of ACIAR's research may be to increase the probability of success of, or lower the costs of, other research.

A discussion of the appropriateness, effectiveness and efficiency of ACIAR's research

The delivery of aid can be evaluated in a number of ways. The traditional benefit–cost approach examines a project or program in terms of its objectives, outputs, outcomes and impact. This approach is used regularly by ACIAR in its impact assessment studies. Other approaches take a wider view, looking at aid in the context of how it contributes to achieving broad development goals, including how each component fits and contributes to aid delivery in a whole-of-government context. The previous section outlined ACIAR's position within Australia's aid delivery system. This section examines ACIAR's activities in terms of three criteria commonly used to evaluate aid: appropriateness, effectiveness and efficiency.

Appropriateness

Agricultural research has the potential to increase agricultural productivity, both in developed and developing countries. Furthermore, increasing agricultural productivity is widely recognised as an effective means of reducing poverty in developing countries. Hence, there is a causal link between investing in agricultural research and poverty reduction. However, to increase the likelihood that investment in agricultural research will make a difference to the livelihoods of people in developing countries, it is important to consider the appropriateness of the research in terms of the environment within which it will be undertaken. As the term suggests, appropriateness in an aid context is broadly concerned with whether the research undertaken is focused on delivering outcomes that match the needs and

requirements of the poor in the targeted developing countries, taking account of the social and political environments operating there.

ACIAR's funding and research model

Two of the key aid-effectiveness principles outlined in the Paris Declaration (OECD 2005) are ownership and alignment. The ownership principle states that partner countries should 'exercise effective leadership over their development policies and strategies and co-ordinate development actions', while the alignment principle states that donors should 'base their overall support on partner countries' national development strategies, institutions and procedures'.

Broadly speaking, ACIAR's collaborative research model is designed to align ACIAR-funded research with the priorities of developing-country partners. ACIAR undertakes consultations with partner countries to help establish the main priority areas that correspond with those areas where Australian scientists have a strong expertise. These priorities are published, and Australian researchers are invited to submit proposals that address the priority research areas in each country. Assuming that partner-country priorities, as articulated through partner-country collaborating researchers, are aligned with the areas where research is proposed, this model helps ensure appropriateness in a broad sense.

ACIAR's research model also promotes partner-country ownership of research by ensuring that an in-country collaborator is engaged within each research project. The type of engagement varies across projects and countries, but the process is designed to enhance the sense of ownership of research in partner countries and improve the implementation and extension of research outputs.

Any research model inevitably involves trade-offs. One challenge with ACIAR's research model is in balancing demand- and supply-side elements. This is particularly true in those cases where a partner country's priorities do not directly align with Australia's areas of research expertise. ACIAR's funding model has tended to rely almost solely on Australian researchers as project leaders. Where a particular research priority in a partner country does not align well with Australia's research expertise, ACIAR would tend not to fund research in this area. It should be noted, however, that a significant component of ACIAR's research is aimed

at building capacity in collaborating countries. Given this, it makes sense to target research at areas where Australia has scientific expertise. In addition, ACIAR has progressively introduced more flexibility into its funding approach, such as engaging researchers as fee-for-service consultants. This approach differs from the standard ACIAR collaborative approach in that it does not necessarily include a contribution (in-kind or otherwise) from an Australian research institution.

Another challenge for some ACIAR research is to engage sufficiently with in-country collaborators. This is not necessarily an issue with ACIAR's funding model, which emphasises collaboration, but can be a problem depending on the Australian researcher involved. This is not a simple matter, with in-country research and extension capacity a major issue with many ACIAR partner countries. As shown in Chapter 2, on-the-ground impact is generally higher where partner-country research and extension capacity is high, such as it is in China, India and Vietnam. Other countries, such as PNG, Indonesia, Laos and Cambodia, have significant research and extension capacity issues. As a result, evidence to date suggests that uptake of the results of ACIAR's research in these countries is lower than in China, India and Vietnam.

While alignment with developing country goals is important, it is also important that these high-level goals reflect the real needs at the farmer level. To this end, ACIAR's network of in-country collaborators is highly effective in determining where gaps and opportunities exist for research that will benefit smallholders. Although ACIAR's in-country collaborators are often central government agencies, other agencies such as agricultural research bodies (the National Agricultural Research Institute in PNG, for example), non-government organisations and universities are often engaged. These agencies often work close to farmers and can have different perspectives on what the needs are on the ground. They also have the potential to facilitate better extension because they are close to and have the trust of farmers. The flexibility ACIAR has to engage with a variety of in-country stakeholders is important to ensuring the appropriateness and effectiveness of their research.

Addressing public good issues and market failures

In the context of taxpayer-funded research for development, one of the key questions is the extent to which the funds address 'market failures'; that is, whether the funds fill a gap that otherwise would not be. Although not all outputs of agricultural R&D meet the 'public good' test in the strictest sense (they can be 'excludable' and so amenable to commercial provision), in small, developing markets with little capacity to pay for R&D outputs, there is limited incentive for private funding of R&D. The size of the potential market for R&D in developing countries is often small, and the ability of smallholder farmers to pay for technology is extremely limited.

Smallholder farming systems in poor countries are generally low-input, multi-product systems with a range of subsistence and cash-generating activities. Within this system, there is often little capacity to invest in technology targeted at any one activity. Smallholder farmers often face a range of risks to specialising or investing in agricultural production, including but not limited to insecure land tenure, weak infrastructure, limited access to finance, and weak and often corrupt public institutions. A more detailed discussion of these factors can be found in a number of previous ACIAR reviews including those of Harding et al. (2007) and Quirke et al. (2007).

These constraints mean that the most effective research for agriculture in developing countries is directed at producing low-cost interventions that boost productivity. Attracting private, commercial funding for research into low-cost technology is difficult, however. Higher cost technology is often poorly suited to the smallholder system in developing countries, in addition to the fact that relatively poor farmers do not have the capacity to pay for such technology. These factors combined suggest a market failure with respect to agricultural R&D in developing countries and support the case for public funding of research.

Effectiveness

Given that ACIAR funding comes largely from Australian taxpayers, it is important that the Centre can demonstrate that these funds are being used effectively. As described in Chapter 2, demonstrating

aid effectiveness is becoming more important, with an increasing focus in the aid community on methods for doing this.

Ultimately, ACIAR's effectiveness ought to be judged on how successfully it achieves its objectives. At the broadest level, ACIAR's objective, like that of other aid agencies, is to reduce poverty in developing-country partners. However, its collaborative research model aims more specifically to achieve more productive and sustainable agricultural systems for the benefit of developing countries and Australia. ACIAR is fortunate to have a significant body of impact assessments to draw upon in demonstrating its effectiveness. Indeed, ACIAR's impact assessment program is an excellent example of project evaluation generally.

In terms of effectiveness, Chapter 2 outlined the results of an analysis of the benefits estimated to have come from those ACIAR projects that have been quantitatively evaluated. It showed that, across all its independent impact assessments, ACIAR research has generated total benefits of A\$12.6 billion, with benefits directly attributable to ACIAR of 6.8 billion. Of the total benefits, around A\$11.4 billion accrue to developing countries and A\$1.2 billion to Australia. The average BCR across all projects that have been assessed is estimated at 54:1. This indicates that many of these projects have been highly successful.

Another indication of ACIAR's effectiveness is the value of assessed benefits relative to total ACIAR costs. This gives an indication of whether returns on ACIAR research have 'paid for' total expenditure by ACIAR since its inception. Compared with total estimated benefits (attributable to ACIAR) of A\$6.8 billion, ACIAR's total expenditure since its inception is estimated at A\$2.1 billion. So, based on impact assessments to date, benefits resulting from ACIAR research have paid for total expenditure several times over. Additionally, as noted earlier, the benefits presented in this report can be seen as an underestimate as they include only projects that have been subjected to a formal impact assessment.

Chapter 2 also indicated that the effectiveness of ACIAR research varies according to the country it is undertaken in. This is different from simply saying that more benefits have been estimated for particular countries. It indicates that, across the sample of projects that have been subjected to formal impact

assessments, the effectiveness (measured by BCRs) has varied across partner countries. Relatively speaking, ACIAR projects have been more effective in the countries that have accounted for the largest proportion of total benefits. This makes sense intuitively, given ACIAR's overall approach to its impact assessment program. Given that projects are selected for impact assessment in a large part on the basis of whether or not there has been evidence of uptake of the research outputs, it stands to reason that countries that have relatively more 'successful' projects would also have, on average, stronger returns across the projects that have been assessed.

This raises interesting questions for the structure of ACIAR's research. There are no systematic relationships between project performance and program area or budget. The only statistically significant relationships were between performance and country, along with time. The fact that the average assessed returns on ACIAR's research are increasing over time—indicating increasing effectiveness—is undoubtedly a positive. But the results also indicate that effectiveness could potentially be further increased if more research were focused on countries that generate higher returns on average. There are, however, other considerations within Australia's whole-of-government objectives for its aid program. They are discussed in the next section.

Efficiency

While efficiency is an important consideration in the delivery of services paid for by taxpayer funds, it is notoriously difficult to measure. Economists generally describe efficiency as achieving a given set of outcomes at the lowest possible cost. For ACIAR, this would mean asking whether it could achieve current outcomes at a lower cost, or if it could achieve greater outcomes given current costs. As this study has shown, ACIAR has generated returns far in excess of total costs, but it is difficult to say whether these benefits could have been generated at lower cost.

Other, more specific measures of efficiency include administrative efficiency, which looks at an organisation's administration and overhead costs in comparison to its overall budget. However, this is a measure that can be misleading when applied to the delivery of aid, as different methods of aid delivery can

have vastly different administration costs. Moreover, those with the lowest administrative costs are not necessarily the most effective.

Efficiency in the context of returns on ACIAR research

Examining efficiency within the context of ACIAR's activities is not without difficulty. Results presented earlier in the report suggest that ACIAR has been more effective in some partner countries than in others. This largely reflects a range of preconditions in partner countries, rather than factors within ACIAR's control. Agricultural R&D in developing countries is notoriously difficult. There are many factors that make R&D in some developing countries more difficult than in others. In general, the difficulty is reduced in countries where there is:

- a more stable political environment
- better governance
- greater capacity in research and extension
- greater scale in agriculture
- less reliance on subsistence farming.

ACIAR has recognised that the economic, policy and institutional environments within partner countries play a major role in the success or otherwise of R&D projects. In 2004, ACIAR's Board of Management approved a strategy whereby the Centre would make greater use of studies to assess policy and institutional issues that might have important effects on the outcomes of its major technical research investments. The aim of this is to ensure that the technical research takes the possible impacts of the policy and institutional environment into account and perhaps identifies work that ACIAR could commission to support efforts to improve the environment for the conduct and uptake of research.

Given that ACIAR's research to date has been demonstrably more effective in some countries than in others, from an efficiency perspective the question needs to be asked: should more resources be directed to these countries? Looking at efficiency purely from a value-for-money perspective, it is likely that greater returns could be gained from directing more resources into some countries at the expense of others.

However, this approach neglects key, whole-of-government objectives and ACIAR's responsibility to contribute towards achieving these. One of the key whole-of-government objectives is support for neighbouring countries, particularly PNG and the Pacific islands. Australia is internationally recognised as playing a leading role in the Pacific. Returns on assessed ACIAR projects in this region are relatively low relative to investment. There are several reasons for this, including a difficult policy and institutional environment, the latter reflected in particularly weak capacity within key institutions and extension agencies. ACIAR has recognised this and currently has a project underway reviewing past investments in PNG and the effect that the economic, policy and institutional environment has had on past projects. ACIAR's commitment to investing in PNG and the Pacific islands reflects whole-of-government objectives, not necessarily where the expected returns on R&D are the greatest.

Another consideration in relation to efficiency and returns on ACIAR's R&D is the public-good nature of ACIAR's research. In a sense, the countries and regions that provide the most difficult environment for agricultural research are the ones least likely to attract private providers of research services. Given a highly uncertain environment (including policy and institutional uncertainty), the returns on research are likely to be low relative to other countries with an environment more conducive to R&D and the uptake of research outputs. As countries develop and the associated legal frameworks and public institutions become more functional, returns on R&D become more certain. In this type of environment, commercial incentives to undertake private R&D and extension are much stronger, and the case for public funding of R&D by organisations such as ACIAR becomes weaker.

Chapter 2 also analyses ACIAR's returns to see if any systematic relationships exist to give an indication of ways to further improve efficiency. Based on this analysis, there is no linkage between returns and project budget or program area within the sample data. However, in addition to an effect by country, the analysis also found that average returns across assessed projects have been increasing. This provides an indicator that efficiency has been increasing over time.

Other dimensions to efficiency

As noted earlier, ACIAR holds a unique position within Australia's aid-delivery system. Another indication of efficiency, particularly within a whole-of-government context, is how well ACIAR coordinates with other relevant agencies. The most obvious connection for ACIAR is with the Australian Agency for International Development (AusAID), the Australian Government's principal aid agency. ACIAR's activities are highly complementary to AusAID functions. AusAID does not directly undertake agricultural R&D, but it does have a range of rural development programs in many of the countries ACIAR operates in. Given that ACIAR is largely focused on R&D, these programs provide the ideal vehicle for implementation and extension of ACIAR's research outputs. While this point was noted in a previous ACIAR review (Nairn et al. 1998), it is reasonable to repeat it here and suggest that more could be done in this area.

ACIAR's collaborative research model implicitly (and sometimes explicitly) relies on partner-country extension and implementation services. As discussed earlier, this can be a risky strategy in some countries where the institutions responsible for supplying these services have significant capacity constraints. Recognising this, ACIAR has increasingly looked to coordinate with other donors (particularly AusAID). As noted in its latest corporate plan (ACIAR 2008):

ACIAR will coordinate with and support investments by international agencies such as the World Bank, Asian Development Bank, Food and Agriculture Organization, and bilateral donors that are formally linked to national partner initiatives or development programs... In particular, ACIAR will encourage projects to complement the broader AusAID agenda in countries where AusAID is active in rural development.

Other studies (Harding et al. 2007; Quirke et al. 2007) have recommended closer coordination with broader development programs within other aid agencies, including AusAID. There are several projects that are examples of the success of this approach. Research into pig breeding and feeding in Vietnam aimed at enhancing the productivity of pig meat production in Vietnam was undertaken in project AS2/1994/023. Two impact assessments (Tisdell and Wilson 2001; Fisher and Gordon 2008) examined the impacts of this research. These studies found that the research had generated significant benefits. AusAID funded a follow-up project for five artificial insemination centres in Vietnam that facilitated the spread of the superior genes resulting from the ACIAR project. AusAID also directly funds a proportion of ACIAR research in PNG. This is recognition not only of the Australian Government's commitment to development in PNG, but also the potential for ACIAR, through the agricultural research it commissions, to contribute positively to this.

Closer collaboration and coordination have the potential to further increase ACIAR's effectiveness and efficiency by increasing the probability that project outputs are adopted. It is particularly important in countries where rural extension services are poor, which includes many of ACIAR key partner countries. However, given that ACIAR is a relatively small player within the aid community, this is not always easy. The best approach is likely to be to continue to focus on closer collaboration and coordination with AusAID where possible. The obvious linkage between AusAID and ACIAR within the Australian aid system should facilitate coordination.

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- Tisdell C. and Wilson C. 2001. Breeding and feeding pigs in Australia and Vietnam. Impact Assessment Series Report No. 17. ACIAR: Canberra.

Appendix List of ACIAR Impact Assessment Series reports

No.	Title	Author(s) and year of publication	ACIAR project numbers
1*	Control of Newcastle disease in village chickens	Centre for International Economics (1998)	AS1/1983/034, AS1/1987/017 and AS1/1993/222
2*	Increased efficiency of straw utilisation by cattle and buffalo	George P.S. (1998)	AS1/1982/003, AS2/1986/001 and AS2/1988/017
3*	Establishment of a protected area in Vanuatu	Centre for International Economics (1998)	ANRE/1990/020
4*	Raw wool production and marketing in China	Watson A.S. (1998)	ADP/1988/011
5	Fruit fly in Malaysia and Thailand 1985–1993	Collins D.J. and Collins B.A. (1998)	CS2/1983/043 and CS2/1989/019
6*	Pigeonpea improvement	Ryan J.G. (1998)	CS1/1982/001 and CS1/1985/067
7*	Reducing fish losses due to epizootic ulcerative syndrome—an ex ante evaluation	Centre for International Economics (1998)	FIS/1991/030
8	Australian tree species selection in China	McKenney D.W. (1998)	FST/1984/057 and FST/1988/048
9*	Sulfur test KCL-40 and growth of the Australian canola industry	ACIL Consulting (1998)	PN/1983/028 and PN/1988/004
10	Conservation tillage and controlled traffic	AACM International (1998)	LWR2/1992/009
11*	Postharvest R&D concerning tropical fruits	Chudleigh P. (1998)	PHT/1983/056 and PHT/1988/044
12	Biological control of the banana skipper in Papua New Guinea	Waterhouse D, Dillon B. and Vincent D. (1999)	CS2/1988/002-C
13*	Breeding and quality analysis of rapeseed	Chudleigh P. (1999)	CS1/1984/069, CS1/1988/039
14*	Improved drying of high moisture grains	McLeod R., Isvilanonda S. and Wattanutchariya S. (1999)	PHT/1983/008, PHT/1986/008 and PHT/1990/008
15*	Use and management of grain protectants in China and Australia	Chudleigh P. (1999)	PHT/1990/035

Appendix. List of ACIAR Impact Assessment Series reports (continued)

No.	Title	Author(s) and year of publication	ACIAR project numbers
16*	Control of footrot in small ruminants of Nepal	McLeod R. (2001)	AS2/1991/017 and AS2/1996/021
17	Breeding and feeding pigs in Australia and Vietnam	Tisdell C. and Wilson C. (2001)	AS2/1994/023
18*	Controlling <i>Phalaris minor</i> in the Indian rice–wheat belt	Vincent D. and Quirke D. (2002)	CS1/1996/013
19	Measuring the poverty impact of ACIAR projects — a broad framework	Pearce D. (2002)	
20	<i>Mama Lus Fruit</i> scheme: an assessment of poverty reduction	Warner R. and Bauer M. (2002)	ASEM/1999/084
21*	Improved methods in diagnosis, epidemiology, and information management of foot-and-mouth disease in Southeast Asia	McLeod R. (2003)	AS1/1983/067, AS1/1988/035, AS1/1992/004 and AS1/1994/038
22*	Saving a staple crop: impact of biological control of the banana skipper on poverty reduction in Papua New Guinea	Bauer M., Pearce D. and Vincent D. (2003)	CS2/1988/002-C
23*	Improved methods for the diagnosis and control of bluetongue in small ruminants in Asia and the epidemiology and control of bovine ephemeral fever in China	McLeod R. (2003)	AS1/1984/055, AS2/1990/011 and AS2/1993/001
24	Assessment of the rodent control projects in Vietnam funded by ACIAR and AusAID: adoption and impact	Palis F.G., Sumalde Z.M. and Hossain M. (2004)	AS1/1998/036
25*	Genetics of and breeding for rust resistance in wheat in India and Pakistan	Brennan J.P. and Quade K.J. (2004)	CS1/1983/037 and CS1/1998/014
26*	Impact assessment of ACIAR-funded projects on grain-market reform in China	Mullen J.D. (2004)	ANRE1/1992/028 and ADP/1997/021
27*	Acacia hybrids in Vietnam	van Bueren M. (2004)	FST/1986/030
28*	Water and nitrogen management in wheat–maize production on the North China Plain	Harris D. (2004)	LWR1/1996/164
29*	Impact assessment of research on the biology and management of coconut crabs on Vanuatu	Lindner R. (2004)	FIS/1983/081
30*	Eucalypt tree improvement in China	van Bueren M. (2004)	FST/1990/044, FST/1994/025, FST/1984/057, FST/1998/048, FST/1987/036, FST/1996/125 and FST/1997/077

Appendix. List of ACIAR Impact Assessment Series reports (continued)

No.	Title	Author(s) and year of publication	ACIAR project numbers
31	Review of ACIAR's research on agricultural policy	Pearce D. (2005)	
32*	Shelf-life extension of leafy vegetables — evaluating the impacts	Jiang T. and Pearce D. (2005)	PHT/1994/016
33*	Research into conservation tillage for dryland cropping in Australia and China	Vere D. (2005)	LWR2/1992/009 and LWR2/1996/143
34*	Identifying the sex pheromone of the sugarcane borer moth	Pearce D. (2005)	CS2/1991/680
35	Review of the returns to ACIAR's bilateral R&D investments	Raitzer D.A. and Lindner R. (2005)	
36	Impacts of mud crab hatchery technology in Vietnam	Lindner R. (2005)	FIS/1992/017 and FIS/1999/076
37	Management of fruit flies in the Pacific	McLeod R. (2005)	CS2/1989/020, CS2/1994/003, CS2/1994/115 and CS2/1996/225
38	Future directions for ACIAR's animal health research	ACIAR (2006)	
39	Benefits to Australia from ACIAR-funded research	Pearce D., Monck M., Chadwick K. and Corbishley J. (2006)	FST/1993/016, PHT/1990/051, CS1/1990/012, CS1/1994/968, AS2/1990/028, AS2/1994/017, AS2/1994/018 and AS2/1990/060
40	Zero tillage for weed control in India: the contribution to poverty alleviation	Corbishley J. and Pearce D. (2006)	CS1/1996/013
41	ACIAR and public funding of R&D. Submission to Productivity Commission study on public support for science and innovation	ACIAR (2006)	
42	Benefits to Australia of selected CABI products	Pearce D. and Monck M. (2006)	
43*	Water management in public irrigation schemes in Vietnam	Harris D.N. (2006)	LWR2/1994/004 and LWR1/1998/034
44	Impact assessment of capacity building and training: assessment framework and two case studies	Gordon J. and Chadwick K. (2007)	CS1/1982/001, CS1/1985/067, LWR2/1994/004 and LWR2/1998/034
45	Development of sustainable forestry plantations in China: a review	Turnbull J.W. (2007)	
46*	Mite pests of honey bees in the Asia-Pacific region	Monck M. and Pearce D. (2007)	AS2/1990/028, AS2/1984/017, AS2/1994/018 and AS2/1999/060
47*	Improved Australian tree species for Vietnam	Fisher H. and Gordon J. (2007)	FST/1993/118 and FST/1998/096

Appendix. List of ACIAR Impact Assessment Series reports (continued)

No.	Title	Author(s) and year of publication	ACIAR project numbers
48*	Assessment of capacity building: overcoming production constraints to sorghum in rainfed environments in India and Australia	Longmore C., Gordon J. and Bantilan M.C. (2007)	CS1/1994/968
49*	Minimising impacts of fungal disease of eucalypts in South-East Asia	Fisher H. and Gordon J. (2007)	FST/1994/041
50	Improved trade in mangoes from the Philippines, Thailand and Australia	Monck M. and Pearce D. (2007)	PHT/1990/051 and CS1/1990/012
51*	Growing trees on salt-affected land	Corbishley J. and Pearce D. (2007)	FST/1993/016
52*	Breeding and feeding pigs in Vietnam: assessment of capacity building and an update on impacts	Fisher H. and Gordon J. (2008)	AS2/1994/023
53*	The impact of increasing efficiency and productivity of ruminants in India by the use of protected-nutrient technology	Monck M. and Pearce D. (2008)	AH/1997/115
54*	Impact of improvement management of white grubs in peanut-cropping systems	Monck M. and Pearce D. (2008)	CS2/1994/050
55*	ACIAR fisheries projects in Indonesia: review and impact assessment	Martin G. (2008)	FIS/1997/022, FIS/1997/125, FIS/2000/061, FIS/2001/079, FIS/2002/074, FIS/2002/076, FIS/2005/169 and FIS/2006/144
56*	A review and impact assessment of ACIAR's fruit-fly research partnerships, 1984–2007	Lindner B. and McLeod P. (2008)	CS2/1983/043, CS2/1989/019, CS2/1989/020, CS2/1994/003, CS2/1994/115, CS2/1996/225, CS2/1997/101, CS2/1998/005, CS2/2003/036, CP/2007/002, CP/2007/1987, PHT/1990/051, PHT/1994/133, PHT/1993/087, CP/1997/079, CP/2001/027 and CP/2002/086
57*	Management of internal parasites in goats in the Philippines	Montes N.D., Zapata Jr N.R., Alo A.M.P. and Mullen J.D. (2008)	AS1/1997/133
58	Guidelines for assessing the impacts of ACIAR's research activities	Davis J., Gordon J., Pearce D. and Templeton D. (2008)	
59	Two-stage grain drying in the Philippines	Chupungco A., Dumayas E. and Mullen J. (2008)	PHT/1983/008, PHT/1986/008 and PHT/1990/008

Note: Assessment numbers marked with an asterisk indicate assessments for which there is quantitative information in the database.

Source: <http://www.aciar.gov.au/publication/term/25>

IMPACT ASSESSMENT SERIES

No.	Author(s) and year of publication	Title	ACIAR project numbers
1	Centre for International Economics (1998)	Control of Newcastle disease in village chickens	AS1/1983/034, AS1/1987/017 and AS1/1993/222
2	George, P.S. (1998)	Increased efficiency of straw utilisation by cattle and buffalo	AS1/1982/003, AS2/1986/001 and AS2/1988/017
3	Centre for International Economics (1998)	Establishment of a protected area in Vanuatu	ANRE/1990/020
4	Watson, A.S. (1998)	Raw wool production and marketing in China	ADP/1988/011
5	Collins, D.J. and Collins, B.A. (1998)	Fruit fly in Malaysia and Thailand 1985–1993	CS2/1983/043 and CS2/1989/019
6	Ryan, J.G. (1998)	Pigeonpea improvement	CS1/1982/001 and CS1/1985/067
7	Centre for International Economics (1998)	Reducing fish losses due to epizootic ulcerative syndrome—an ex ante evaluation	FIS/1991/030
8	McKenney, D.W. (1998)	Australian tree species selection in China	FST/1984/057 and FST/1988/048
9	ACIL Consulting (1998)	Sulfur test KCL–40 and growth of the Australian canola industry	PN/1983/028 and PN/1988/004
10	AACM International (1998)	Conservation tillage and controlled traffic	LWR2/1992/009
11	Chudleigh, P. (1998)	Postharvest R&D concerning tropical fruits	PHT/1983/056 and PHT/1988/044
12	Waterhouse, D., Dillon, B. and Vincent, D. (1999)	Biological control of the banana skipper in Papua New Guinea	CS2/1988/002-C
13	Chudleigh, P. (1999)	Breeding and quality analysis of rapeseed	CS1/1984/069 and CS1/1988/039
14	McLeod, R., Isvilanonda, S. and Wattanutchariya, S. (1999)	Improved drying of high moisture grains	PHT/1983/008, PHT/1986/008 and PHT/1990/008
15	Chudleigh, P. (1999)	Use and management of grain protectants in China and Australia	PHT/1990/035
16	McLeod, R. (2001)	Control of footrot in small ruminants of Nepal	AS2/1991/017 and AS2/1996/021
17	Tisdell, C. and Wilson, C. (2001)	Breeding and feeding pigs in Australia and Vietnam	AS2/1994/023
18	Vincent, D. and Quirke, D. (2002)	Controlling <i>Phalaris minor</i> in the Indian rice–wheat belt	CS1/1996/013
19	Pearce, D. (2002)	Measuring the poverty impact of ACIAR projects—a broad framework	
20	Warner, R. and Bauer, M. (2002)	<i>Mama Lus Frut</i> scheme: an assessment of poverty reduction	ASEM/1999/084
21	McLeod, R. (2003)	Improved methods in diagnosis, epidemiology, and information management of foot-and-mouth disease in Southeast Asia	AS1/1983/067, AS1/1988/035, AS1/1992/004 and AS1/1994/038
22	Bauer, M., Pearce, D. and Vincent, D. (2003)	Saving a staple crop: impact of biological control of the banana skipper on poverty reduction in Papua New Guinea	CS2/1988/002-C
23	McLeod, R. (2003)	Improved methods for the diagnosis and control of bluetongue in small ruminants in Asia and the epidemiology and control of bovine ephemeral fever in China	AS1/1984/055, AS2/1990/011 and AS2/1993/001
24	Palis, F.G., Sumalde, Z.M. and Hossain, M. (2004)	Assessment of the rodent control projects in Vietnam funded by ACIAR and AUSAID: adoption and impact	AS1/1998/036

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No.	Author(s) and year of publication	Title	ACIAR project numbers
25	Brennan, J.P. and Quade, K.J. (2004)	Genetics of and breeding for rust resistance in wheat in India and Pakistan	CS1/1983/037 and CS1/1988/014
26	Mullen, J.D. (2004)	Impact assessment of ACIAR-funded projects on grain-market reform in China	ANRE1/1992/028 and ADP/1997/021
27	van Bueren, M. (2004)	Acacia hybrids in Vietnam	FST/1986/030
28	Harris, D. (2004)	Water and nitrogen management in wheat–maize production on the North China Plain	LWR1/1996/164
29	Lindner, R. (2004)	Impact assessment of research on the biology and management of coconut crabs on Vanuatu	FIS/1983/081
30	van Bueren, M. (2004)	Eucalypt tree improvement in China	FST/1990/044, FST/1994/025, FST/1984/057, FST/1988/048, FST/1987/036, FST/1996/125 and FST/1997/077
31	Pearce, D. (2005)	Review of ACIAR's research on agricultural policy	
32	Tingsong Jiang and Pearce, D. (2005)	Shelf-life extension of leafy vegetables—evaluating the impacts	PHT/1994/016
33	Vere, D. (2005)	Research into conservation tillage for dryland cropping in Australia and China	LWR2/1992/009, LWR2/1996/143
34	Pearce, D. (2005)	Identifying the sex pheromone of the sugarcane borer moth	CS2/1991/680
35	Raitzer, D.A. and Lindner, R. (2005)	Review of the returns to ACIAR's bilateral R&D investments	
36	Lindner, R. (2005)	Impacts of mud crab hatchery technology in Vietnam	FIS/1992/017 and FIS/1999/076
37	McLeod, R. (2005)	Management of fruit flies in the Pacific	CS2/1989/020, CS2/1994/003, CS2/1994/115 and CS2/1996/225
38	ACIAR (2006)	Future directions for ACIAR's animal health research	
39	Pearce, D., Monck, M., Chadwick, K. and Corbishley, J. (2006)	Benefits to Australia from ACIAR-funded research	FST/1993/016, PHT/1990/051, CS1/1990/012, CS1/1994/968, AS2/1990/028, AS2/1994/017, AS2/1994/018 and AS2/1999/060
40	Corbishley, J. and Pearce, D. (2006)	Zero tillage for weed control in India: the contribution to poverty alleviation	CS1/1996/013
41	ACIAR (2006)	ACIAR and public funding of R&D. Submission to Productivity Commission study on public support for science and innovation	
42	Pearce, D. and Monck, M. (2006)	Benefits to Australia of selected CABI products	
43	Harris, D.N. (2006)	Water management in public irrigation schemes in Vietnam	LWR2/1994/004 and LWR1/1998/034
44	Gordon, J. and Chadwick, K. (2007)	Impact assessment of capacity building and training: assessment framework and two case studies	CS1/1982/001, CS1/1985/067, LWR2/1994/004 and LWR2/1998/034
45	Turnbull, J.W. (2007)	Development of sustainable forestry plantations in China: a review	
46	Monck M. and Pearce D. (2007)	Mite pests of honey bees in the Asia–Pacific region	AS2/1990/028, AS2/1994/017, AS2/1994/018 and AS2/1999/060

IMPACT ASSESSMENT SERIES <CONTINUED>

No.	Author(s) and year of publication	Title	ACIAR project numbers
47	Fisher, H. and Gordon, J. (2007)	Improved Australian tree species for Vietnam	FST/1993/118 and FST/1998/096
48	Longmore, C., Gordon, J., and Bantilan, M.C. (2007)	Assessment of capacity building: overcoming production constraints to sorghum in rainfed environments in India and Australia	CS1/1994/968
49	Fisher, H. and Gordon, J. (2007)	Minimising impacts of fungal disease of eucalypts in South-East Asia	FST/1994/041
50	Monck, M. and Pearce, D. (2007)	Improved trade in mangoes from the Philippines, Thailand and Australia	PHT/1990/051 and CS1/1990/012
51	Corbishley, J. and Pearce, D. (2007)	Growing trees on salt-affected land	FST/1993/016
52	Fisher H. and Gordon J. (2008)	Breeding and feeding pigs in Vietnam: assessment of capacity building and an update on impacts	AS2/1994/023
53	Monck M. and Pearce D. (2008)	The impact of increasing efficiency and productivity of ruminants in India by the use of protected-nutrient technology	AH/1997/115
54	Monck M. and Pearce D. (2008)	Impact of improved management of white grubs in peanut-cropping systems	CS2/1994/050
55	Martin G. (2008)	ACIAR fisheries projects in Indonesia: review and impact assessment	FIS/1997/022, FIS/1997/125, FIS/2000/061, FIS/2001/079, FIS/2002/074, FIS/2002/076, FIS/2005/169 and FIS/2006/144
56	Lindner, B. and McLeod, P. (2008)	A review and impact assessment of ACIAR's fruit-fly research partnerships – 1984 to 2007	CS2/1983/043, CS2/1989/019, CS2/1989/020, CS2/1994/003, CS2/1994/115, CS2/1996/225, CS2/1997/101, CS2/1998/005, CS2/2003/036, CP/2007/002, CP/2007/187, PHT/1990/051, PHT/1994/133, PHT/1993/87, CP/1997/079, CP/2001/027 and CP/2002/086
57	Montes N.D., Zapata Jr N.R., Alo A.M.P. and Mullen J.D. (2008)	Management of internal parasites in goats in the Philippines	AS1/1997/133
58	Davis J., Gordon J., Pearce D. and Templeton D. (2008)	Guidelines for assessing the impacts of ACIAR's research activities	
59	Chupungco A., Dumayas E. and Mullen J. (2008)	Two-stage grain drying in the Philippines	PHT/1983/008, PHT/1986/008, PHT/1990/008
60	Centre for International Economics (2009)	ACIAR Database for Impact Assessments (ADIA): an outline of the database structure and a guide to its operation	
61	Fisher H. and Pearce D. (2009)	Salinity reduction in tannery effluents in India and Australia	AS1/2001/005
62	Francisco S.R., Mangabat M.C., Mataia A.B., Acda M.A., Kagaoan C.V., Laguna J.P., Ramos M., Garabiag K.A., Paguia F.L. and Mullen J.D. (2009)	Integrated management of insect pests of stored grain in the Philippines	PHT/1983/009, PHT/1983/011, PHT/1986/009 and PHT/1990/009
63	Harding M., Tingsong Jiang and Pearce D. (2009)	Analysis of ACIAR's returns on investment: appropriateness, efficiency and effectiveness	



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