



Australian Government

Australian Centre for
International Agricultural Research

The impact of ACIAR work in agricultural research for development 1982–2022

Volume 1: Quantifying returns on investment



100

ACIAR IMPACT ASSESSMENT SERIES

The impact of ACIAR work in agricultural research for development 1982–2022

Volume 1: Quantifying returns on investment

Centre for International Economics
Australia

ACIAR Impact Assessment Series Report No. 100



ACIAR

2022

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.

The Chief Executive Officer of ACIAR reports directly to the Australian Government Minister for Foreign Affairs. ACIAR operates solely on budget appropriation from Australia's Official Development Assistance (ODA).

Where trade names are used, this constitutes neither endorsement of nor discrimination against any product by ACIAR.

ACIAR IMPACT ASSESSMENT SERIES

ACIAR seeks to ensure that the outputs of the research it funds are adopted by farmers, researchers, extension officers, policymakers and other beneficiaries. In order to monitor the effects of its projects, ACIAR commissions independent assessments of selected projects. This series of publications reports the results of these independent studies. Publications in the series are available as hard copy, in limited numbers, and published on the ACIAR website at aciarc.gov.au.

© Australian Centre for International Agricultural Research (ACIAR) 2022

This work is copyright. Apart from any use as permitted under the *Copyright Act 1968*, no part may be reproduced by any process without prior written permission from ACIAR, GPO Box 1571, Canberra ACT 2601, Australia, aciarc@aciarc.gov.au

Volume 1:

Centre for International Economics (2022) 'The impact of ACIAR work in agricultural research for development 1982–2022: quantifying returns on investment', *ACIAR Impact Assessment 100 Vol 1*, Australian Centre for International Agricultural Research, Canberra.

Volume 2:

van der Heijden J (2022) 'The impact of ACIAR work in agricultural research for development 1982–2022: a qualitative comparative analysis', *ACIAR Impact Assessment 100 Vol 2*, Australian Centre for International Agricultural Research, Canberra.

ISSN 1832-1879 (print)

ISSN 1839-6097 (pdf)

ISBN 978-1-922635-92-1 (print)

ISBN 978-1-922635-93-8 (pdf)

Volume 1

ISBN 978-1-922635-88-4 (print)

ISBN 978-1-922635-89-1 (pdf)

Volume 2

ISBN 978-1-922635-90-7 (print)

ISBN 978-1-922635-91-4 (pdf)

Technical editing: Lorna Hendry

Design: Redtail Graphic Design

Printing: Instant Colour Press

Cover image: Pictured in the biocontrol nursery of the Plant Protection Unit, Ministry of Agriculture, Fiji, is research officer Aradhana Deesh (left) and her colleagues Pranesh Chand (middle) and Asma Begum (right). Mrs Deesh is a member of the inaugural cohort of the ACIAR Meryl Williams Fellowship. Photo: Dave Lavaki



Foreword

The Australian Centre for International Agricultural Research (ACIAR) was established in 1982 to deploy Australia's skill and expertise in agricultural science to improve food security, water security and biosecurity in the Indo-Pacific region.

Over 40 years, ACIAR has made a significant contribution to meeting the complex challenges of growing more food, reducing poverty and improving biosecurity. This 100th edition of our Impact Assessment Series is an opportunity to look back at what our research has achieved and reflect on what we have learned from 40 years of brokering and funding agricultural research partnerships in our region.

ACIAR has a longstanding commitment to assessing our impact and where possible, quantifying the achievements of our committed Australian and international research partners. Volume 1 of this report provides compelling evidence of the significant returns on our research investment across the Indo-Pacific region. This aligns with international research and evaluation work that has consistently found agricultural research for development to be an extremely effective and efficient way of investing overseas development assistance (ODA) funds.

ACIAR-supported research has made a huge contribution to regional agricultural growth. This analysis shows \$14.7 billion of additional value realised in our biggest partner Indonesia, \$1.4 billion of benefits in our closest neighbour Papua New Guinea, and \$2.7 billion in eastern and southern Africa. Major contributions have been made to key food basins such as the Eastern Gangetic Plains, where our cropping systems and water management work has delivered invaluable knowledge to underpin more sustainable development in a global hotspot for food and water security. This analysis also shows a significant flow of co-benefits back to Australia, with approximately \$3.7 billion dollars of benefits flowing to a range of sectors including crops, forestry, horticulture and agribusiness.

Volume 1 illuminates how ACIAR has contributed to this growth, not only through the well-acknowledged pathways of improved varieties and pest and disease management, but also through research into whole-of-systems management, markets and policy. The breadth of skills in the Australian and international research and innovation system is a strength that we continue to leverage as we work with partners to tackle pressing challenges including climate change, nutrition security and zoonotic diseases (such as COVID-19).

With increasing pressures on production and natural resource systems, the imperative to continually adapt and improve the management of agrifood systems remains a key priority for our partners – more than 400 organisations across 35 countries in the Indo-Pacific region. Our job is far from done.

ACIAR has a longstanding tradition as a learning organisation, committed to learning from our experience in order to continuously improve internal processes and systems, and research and extension practices in the field. Adaptive management is obviously an even more urgent imperative in a global pandemic with significant restrictions on international and in-country travel. To support this, we are increasingly investing in analyses of our collaborative, research for development model and improving our ability to synthesise, apply and share the lessons learned.

Volume 2 of this report presents the findings of a large cross-case analysis of past projects. Recognising that not all impacts can be crystallised in production numbers or financial returns, the study applied qualitative comparative analysis to identify the key research design, management and practice principles that have supported the effective translation of research knowledge into development outcomes.

This 100th report in our Impact Assessment Series showcases the scale of ACIAR achievement and the depth of what has been learned over 40 years. Our capacity to understand, celebrate and learn from past investments and past practices is fundamental to delivering further improvements in impact from this highly effective form of aid investment.

We would like to take this opportunity to thank all of the staff, researchers, government, non-government and community partners whose curiosity, drive and vision for a better future have made these achievements possible and generated the insights illustrated so clearly in these landmark volumes.



Andrew Campbell
Chief Executive Officer, ACIAR



Photo: Conor Ashleigh

Contents

Foreword	iii
List of figures	vi
List of boxes	vi
Summary	vii
1 Introduction	1
1.1 Data and sources	1
1.2 Referencing IAS studies	1
2 Context	3
2.1 ACIAR in AR4D	3
2.2 The legacy of international agricultural research for development	5
3 Impact assessment	7
3.1 Consistent impact assessment	7
3.2 A largely economic approach	8
4 Magnitude of impact	10
4.1 Cumulative costs and benefits	10
4.2 Benefit:cost ratios	10
4.3 Net dollar benefits	15
5 Impact pathways to benefit	19
5.1 Economic, environmental and social pathways	19
5.2 Pathways around new technologies or products	20
5.3 Measuring the magnitude of these pathways	22
6 Conclusion	25
References	26

List of figures

Figure 1	Key interactions of ACIAR in the agricultural research-for-development system	3
Figure 2	Continuing the Green Revolution with the development of international agricultural research centres	5
Figure 3	With and without research comparisons (a) avoiding a decline and (b) increasing rate of growth	9
Figure 4	Cumulative project costs, 1982–2021	11
Figure 5	Cumulative project net benefits, 1982–2039	11
Figure 6	Distribution of benefit:cost ratios	11
Figure 7	Ranked benefit:cost ratios by assessment	12
Figure 8	Ranked benefit:cost ratios by country	13
Figure 9	Ranked benefit:cost ratios by research area	13
Figure 10	Distribution of net benefits by country by dollar value	15
Figure 11	Distribution of net benefits by country as a percentage share	15
Figure 12	Australian benefits by broad product	16
Figure 13	Distribution of net benefits by broad research area by value	17
Figure 14	Distribution of net benefits by broad research area by percentage share	17
Figure 15	Economic, environmental and social classes of impact	19
Figure 16	Impact pathways	21
Figure 17	Pathways to benefits	22
Figure 18	Distribution of benefit:cost ratio by broad impact pathway	23
Figure 19	Distribution of benefit by broad impact pathway as a percentage share	23

List of boxes

Box 1:	Direct benefits to Australian agriculture	4
Box 2:	Systemwide benefits to Australia	4
Box 3:	Selection of projects	7
Box 4:	Dealing with uncertainty	9
Box 5:	Cost and dollar outcomes versus leverage impact	10
Box 6:	Top 10 assessments in terms of benefit:cost ratios	14
Box 7:	Top 10 assessments in terms of net dollar benefits	16
Box 8:	Biosecurity benefits to Australia	17
Box 9:	Assessment of environmental impacts	19
Box 10:	Measuring capacity building	20
Box 11:	Complex patterns of new varieties	22
Box 12:	Simple approaches to pests and diseases	24
Box 13:	Transfer of established knowledge for input management	24

Summary

The Australian Centre for International Agricultural Research (ACIAR) was established by the Australian Government in 1982 to deploy Australia's strengths in agricultural science to improve food security, water security and biosecurity in the Indo-Pacific region. For 40 years ACIAR has brokered international research partnerships and funded agricultural research for development to build more productive and sustainable agricultural systems for the benefit of developing countries and Australia.

Independent evaluations of ACIAR projects and programs over these 40 years have consistently found high returns on investment, reflecting the quality of Australian agricultural science, as well as the ACIAR partnership model that ensures a high level of engagement with in-country partners and take-up of research results.

Regular and ongoing impact evaluation is at the core of the ACIAR mode of operation. Evaluation helps us refine our priorities and learn lessons from current and past projects, as well as enabling accountability to our Minister, the Australian Government and the Australian public.

ACIAR has systematically commissioned independent impact assessment studies of its research for more than 30 years. This report is the 100th in the ACIAR Impact Assessment Series, which measures economic return on investment, assesses social and environmental impacts and seeks to understand the contribution that ACIAR has made to smallholder farmers, fishers and foresters in the region.



Photo: Conor Ashleigh

Improved outcomes through funding agricultural research

ACIAR support of agricultural research for development is part of a global effort to increase agricultural productivity to improve economic outcomes. The evidence shows this approach works and that the benefits greatly exceed the cost of the research.

This report examines the ways in which ACIAR has contributed to improved economic (and social and environmental) outcomes in partner countries through the brokering and funding of agricultural research.

A long history of impact assessment

The history of ACIAR impact assessments shows many interesting pathways through which research generates improved outcomes.

By looking at a long series of impact assessment studies commissioned by ACIAR and putting these in equivalent terms in an overall database, it is possible to summarise the overall impact of this sample of ACIAR-supported research.

Significant measured benefits

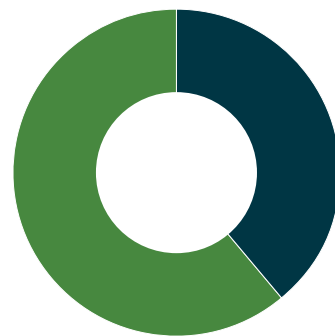
The total benefit of projects examined in this study, and expressed in today's dollars, is estimated at \$64.4 billion. Of this, \$25.2 billion can be attributed to ACIAR, based on the ACIAR share of total project funding.

The benefit:cost ratio of the research in which ACIAR is a partner, on average, is 41.8:1. For outcomes specifically attributed to ACIAR, the benefit:cost ratio is 43.3:1.

Total benefit of ACIAR-supported projects

\$64 billion

Projects in this study represent approximately 10% of ACIAR investment since 1982



- Benefits attributed to ACIAR \$25.2 billion
- Benefits attributed to partners \$39.2 billion

Benefit:cost ratio

43:1

For projects examined in this study with outcomes specifically attributed to ACIAR

4:1

For all ACIAR projects – based on the extreme assumption that projects not examined in this study generated no benefit at all

Source: ADIA

A variety of ways of looking at benefits

The net benefits from the projects studied amount to \$62.9 billion. These benefits can be examined from several perspectives: country, research area or impact pathway.

The greatest benefit from the projects studied have been to Indonesia, India, Vietnam, China and the Philippines.

Significant benefits also accrued to Australia, generally as an indirect consequence of partner country research.

In terms of research areas, benefits are relatively evenly distributed between crops, livestock systems and forestry.

In terms of impact pathways, new varieties have had the largest benefit, followed by pest and disease control and then capacity building.

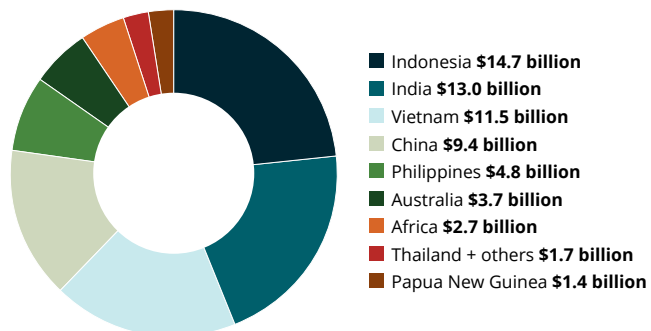
The nature of these impact pathways, and the fact that partner countries are continually developing, suggests considerable scope for ongoing benefits through the continuation of international collaborative research.

Evidence of high value for money

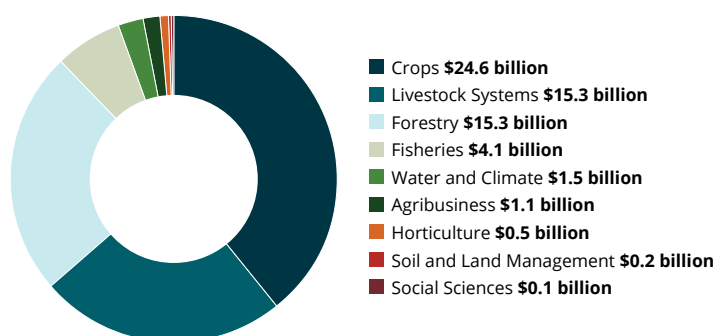
While these impacts reflect a snapshot of all ACIAR activities over the past 40 years, even if the projects not examined within the Impact Assessment Series had benefit:cost ratios of zero (that is, if they generated no benefits at all – an extreme assumption) the benefit:cost ratio for all ACIAR activities would be around 4.2:1.

This figure would still represent a very high demonstrated return to the public funds invested.

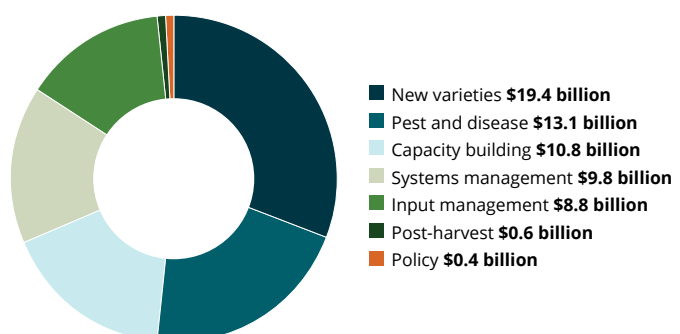
Net benefit by country



Net benefit by research area



Net benefit by impact pathway



Source: ADIA



MAIZE
VARIETY: Embu Synthetic
TYPE: Open Pollinated variety (OPV)
AREAS GROWN: Coffee-Sunflower Zones
PLANTED: 30th October 2010 (wet)
SPACING: 75cm x 50cm (2 plants/hill)
MATURITY DAYS: 120 -150 days
GRAIN YIELDS: 25 tons/ha



1 Introduction

Independent evaluations of ACIAR projects and programs over 40 years have consistently found high returns on investment, reflecting the quality of Australian agricultural science, as well as the ACIAR partnership model that ensures a high level of engagement with in-country partners and take-up of research results.

ACIAR has systematically commissioned independent impact assessment studies of its research for more than 30 years. This report is the 100th in the ACIAR Impact Assessment Series.

This report examines the impact of ACIAR-supported agricultural research for development since 1982. It addresses these 4 questions:

- What was the context for this impact, and what do we know about impact from other funding of international agricultural research? (Chapter 2)
- What methods have been used to measure the ACIAR impact? (Chapter 3)
- What does the series of ACIAR assessment studies, when combined on a common basis, say about the magnitude of ACIAR impact, and how that impact has been distributed across countries and research areas? (Chapter 4)
- What are the specific pathways through which these impacts emerge? (Chapter 5)

The answers to these 4 questions provide a picture of the quantitative impact of ACIAR and contribute to its importance and history, as ACIAR marks 40 years of operation.

1.1 Data and sources

Measuring impact and identifying impact pathways requires an underlying research basis that explicitly considers each of these factors for at least a selection of funded projects.

ACIAR is in the unique position of having a long and consistent series of impact assessment in which quantitative estimates have been assembled into a database that allows for the examination of different aspects of impact. The database is known as the ACIAR Database for Impact Assessments (ADIA) and was developed in 2006 to provide an ongoing repository of results from impact assessments and enable a regular summary of impact information to be reported in a consistent manner.

For this report (ACIAR Impact Assessment No. 100), ADIA has been updated with impact assessment studies completed since 2013. This report also comprehensively reviews new studies and those already in the database to capture known changes and developments since the original Impact Assessment Series (IAS) report. In some cases this has involved truncating streams of benefits, and in others it has involved replacing entries for projects that have been updated with subsequent impacts.

Despite the overall consistency of ACIAR IAS studies, compiling the database requires some judgement, particularly when individual studies contain different scenarios of impacts or different ways of constructing an impact pathway.

The IAS, and therefore ADIA, does not capture all ACIAR projects. We estimate that it provides a sample of 10% of ACIAR projects (in terms of funding). In this sense, the IAS studies can be seen as a window into the full range of ACIAR-supported projects.

1.2 Referencing IAS studies

This report adopts unconventional referencing for IAS reports. Rather than the usual author, date, title approach (used for all other references), IAS reports are referenced by their ACIAR publication number and full title. This gives the reader an immediate sense of the subject matter of the IAS study, which is useful for the flow of the discussion. The full list of IAS studies reproduced at the end of the report allows the reader to identify specific authors and dates.



2 Context

2.1 ACIAR in AR4D

To understand the ways in which ACIAR has had an impact – both in partner countries and Australia – it is important to have an overview of the full context of the work that ACIAR does. Figure 1 illustrates the ways in which ACIAR sits between a number of global and domestic interactions in the agricultural research for development (AR4D) system.

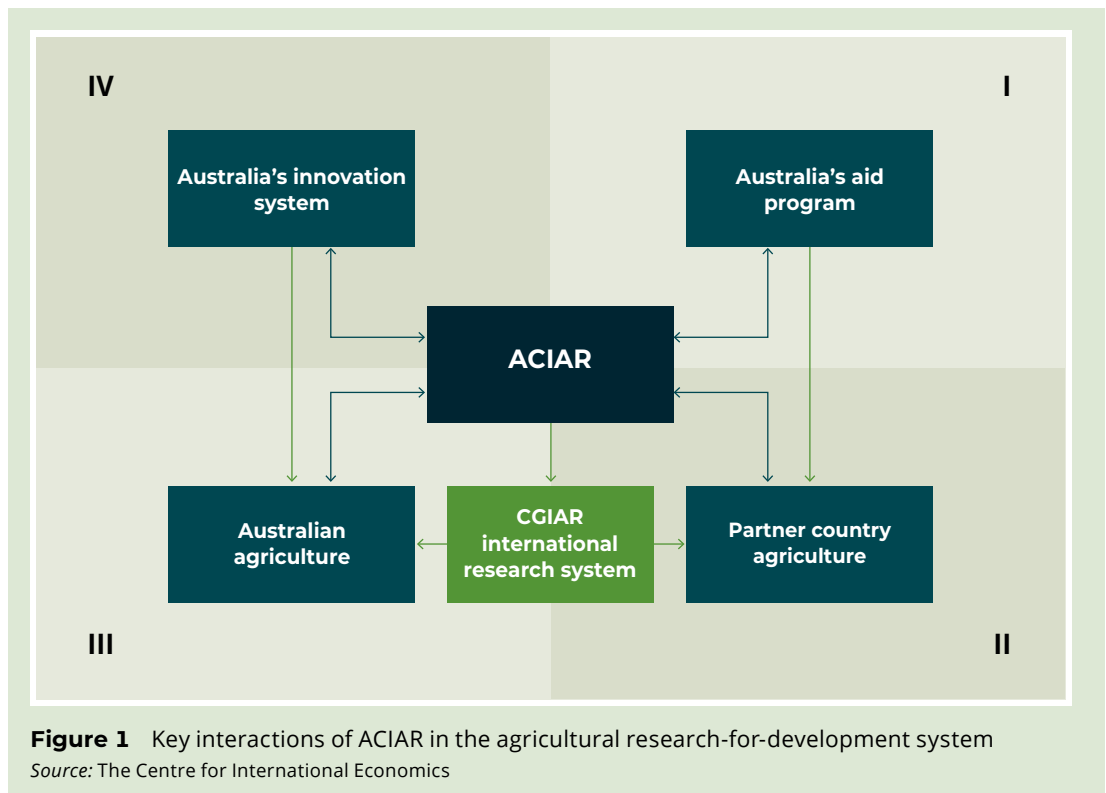
2.1.1 Delivering research outcomes to partner countries

The best known interaction is in quadrant II of Figure 1, the delivery of research outcomes – including lasting productivity benefits – to partner country agriculture. The measured success of ACIAR in this part of the system is discussed throughout this report.

2.1.2 Contributing to Australian aid

ACIAR contributes directly to Australia's development assistance program through the direct administration of projects requiring specialised technical and research skills on behalf of the foreign affairs portfolio, and by producing upstream research to inform the design and implementation of Australia's aid investments. This interaction (quadrant I of Figure 1) is the channel through which ACIAR directly contributes to the overall objectives of Australia's development program, and therefore to Australia's interests overseas.

For example, ACIAR-supported research and analysis of agriculture value chains in eastern Indonesia provided the technical information needed to target Australian aid investment in the Partnership for Promoting Rural Incomes through Support for Markets in Agriculture (PRISMA) program. Through supporting mango cultivation and pest management practices, PRISMA reported that almost 9,000 mango smallholder households in East Java and West Nusa Tenggara had increased income of IDR 40.2 billion (PRISMA n.d.).



2.1.3 Working with the international agriculture research system

In delivering research outcomes and contributing to Australia's development program, ACIAR contributes to, and draws on, resources in the international or multilateral system of agricultural research, represented in Figure 1 by CGIAR.

CGIAR is the peak body for a global network of 15 research centres located around the world, all conducting agricultural research and development (R&D). ACIAR works closely with many of these, and manages funds for the Australian Government to support multilateral research through the CGIAR system along with bilateral research with specific partner countries. Many Australian researchers have at various times also worked at centres within the CGIAR system. As noted below, this has a systemwide effect of increasing resources available to deal with agriculture issues both in Australia and overseas.

In addition, ACIAR partner countries all have domestic agricultural innovation systems that draw on domestic and international research to improve agricultural productivity. One of the major pathways for ACIAR impact is through capacity building of these domestic R&D systems.

2.1.4 Direct benefits to Australian agriculture

Quadrants III and IV of Figure 1 illustrate that the international work of ACIAR also provides direct and indirect benefits to Australian agriculture.

Direct benefits (quadrant III) result from partner country research and are summarised in Box 1. The magnitude of these benefits is set out in more detail in Chapter 4.

Box 1: Direct benefits to Australian agriculture

Direct benefits to Australian agriculture of ACIAR-supported research include:

- new production technologies
- direct and indirect protection from disease or incursion
- increased trade
- technology sales
- biodiversity
- training of researchers
- increased stock of knowledge.

(See IAS039 *Benefits to Australia of ACIAR-funded research*)

2.1.5 Interactions with Australia's innovation system

Indirect benefits, particularly to Australia, also arise through the interaction of ACIAR with Australia's agricultural innovation system (quadrant IV of Figure 1). This system includes Australia's agricultural R&D corporations as well as universities and national science organisations such as CSIRO.

Australian agricultural R&D expertise provides the backbone for the ability of ACIAR to commission and encourage R&D projects in developing countries that build on Australia's proven expertise. As will be further noted in this report, many ACIAR-supported projects involve the application, in partner countries, of technologies and techniques originally developed and proven in Australia.

Some systemwide benefits to Australia from ACIAR interaction with Australia's innovation system are set out in Box 2.

Box 2: Systemwide benefits to Australia

Systemwide benefits to Australian agriculture from ACIAR activities arise through the ability of ACIAR to:

- leverage funding from Australia's development assistance program to assist in R&D activities
- provide access to a greater pool of researchers through international links than might otherwise be available for particular issues
- increase the base of research activities through international links
- effectively explore a variety of research avenues through international interactions to avoid 'dry holes' for future Australian research
- maintain interest in particular research areas that may be of value to Australia.

(See IAS039 *Benefits to Australia of ACIAR-funded research*)



Photo: Conor Ashleigh

2.2 The legacy of international agricultural research for development

There are many ways of viewing the establishment of ACIAR and the history of its past 40 years. From an economic perspective, ACIAR is a clear continuation of the impetus that underlay the 'Green Revolution' of the 1960s and 1970s. In the discussions that led up to the establishment of ACIAR, and from the experience of international research centres, there was a widely held view that agricultural productivity could not only benefit farmers but would also lead to higher economic growth.

The Green Revolution represented agricultural innovation and increased productivity through the application of modern crop breeding techniques to the developing world. The adoption of new varieties (initially in rice, wheat and maize, and subsequently other crops) led to a large increase in yield and a massive increase in food production.

Both ACIAR and the CGIAR system can be seen as the continuation of the Green Revolution (Figure 2).

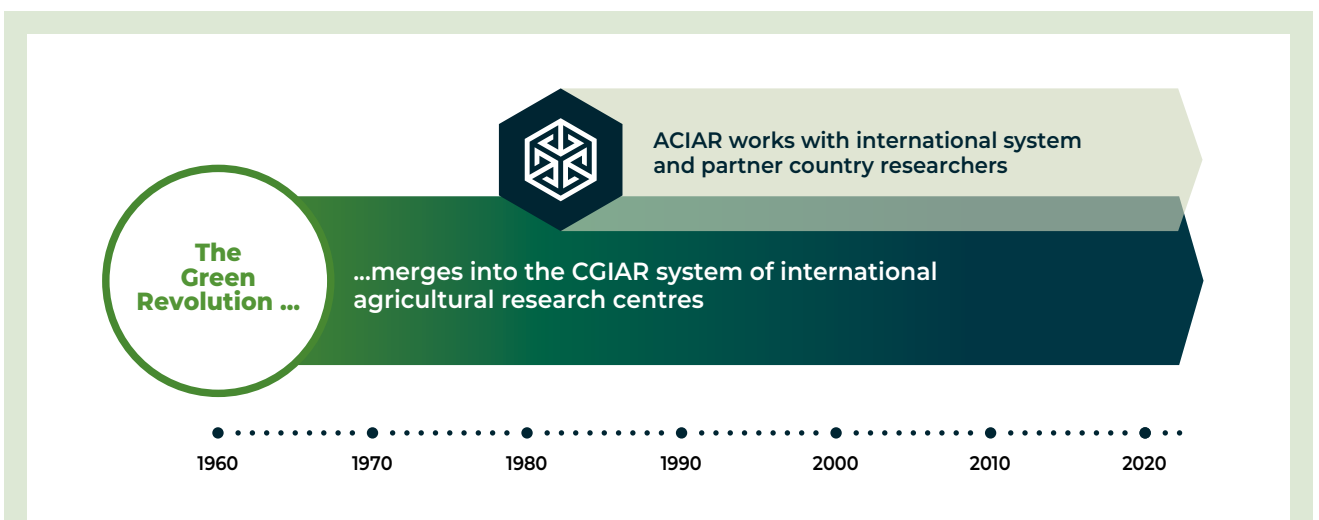


Figure 2 Continuing the Green Revolution with the development of international agricultural research centres

Source: The Centre for International Economics

2.2.1 Impact of the Green Revolution

A recent detailed study (Gollin et al. 2021) found that the Green Revolution was responsible for around half of total economic growth (defined as gross domestic product per capita) of developing countries over the period studied.

Further, the authors found that:

investments in the development and diffusion of agricultural technology have substantially improved living standards in the poorest places on our planet over the past half century. Further investments in agricultural science targeting the developing world may have the potential to sustain these gains in the decades ahead.

This prospect for future and ongoing benefits is crucial to ongoing research instigated and/or supported by ACIAR. As partner countries continue to develop (and most of them have transformed substantially over the past 40 years), the challenges faced by agriculture continue to evolve and emerge. Ongoing international and collaborative research – particularly as illustrated by the success of the ACIAR model – will be crucial to maintain and enhance the benefits seen to date.

2.2.2 Impact of the CGIAR system

The CGIAR system represents a substantive investment in agricultural research around the world. In present value terms, total expenditure is around US\$60 billion (around \$70 billion when using the average exchange rate for the relevant period, see Alston et al. 2020).

This compares with total ACIAR expenditure since its inception of around \$6 billion (expressed in similar present value terms). Thus, ACIAR accounts for around 8.6% of the expenditure in the CGIAR system.


Evaluation of the impact of CGIAR research – consistent with the evaluation of the impact of the Green Revolution noted above – suggests high benefit:cost ratios. Benefit:cost ratios for individual studies range from 1.4:1 to 200:1, with an overall median result of 10:1 (Alston et al. 2020).

As will be noted, this is a similar order of magnitude to the ACIAR project impacts that have emerged from studies in the ACIAR IAS.

The CGIAR impact assessments, and their overall magnitude, provide further confirming evidence of the very high value of agricultural research, particularly when conducted internationally and collaboratively.

Indeed, the legacy of past investments and the ability of ACIAR to leverage collaborative research investments to build capacity and strengthen regional agricultural innovation systems are a key part of how ACIAR delivers benefits through the research it funds. This is an important component of the magnitude of benefits discussed in this report.





3 Impact assessment

3.1 Consistent impact assessment

ACIAR has long maintained an interest in understanding how the research it funds generates benefits in partner countries. The first 12 ACIAR impact assessment studies were published in 1991 (9 years after the establishment of ACIAR). While considered early days, these studies provided a solid indication of how benefits (well in excess of research costs) were starting to emerge in partner countries.

Since then, some of these original projects, and many additional ones, have been examined in the current impact assessment series (IAS), which started in 1998. The IAS now covers 102 reports providing impact assessments (either individually or in groups) of just under 300 projects, with full quantification for just over 200 projects. In some cases, earlier assessments have been repeated as new information has become available.

Box 3 explains the process for selecting projects for detailed study in the impact assessment process.

3.1.1 An integrated database

As part of the IAS reports, ACIAR also commissioned the development of the ACIAR Database for Impact Assessments (ADIA) in 2006. The database was designed to take the individual benefit and cost streams from individual studies and combine them to allow meta-analysis of the aggregate impact of ACIAR funding.

The total ACIAR funding (expressed in current values) covered in the database is around \$580 million. This compares with total ACIAR funding over the life of the organisation (again expressed in current dollars) of around \$6 billion. Thus, ADIA represents a 10% sample of all ACIAR activity over the past 40 years.

Box 3: Selection of projects

While the projects studied in the IAS collectively represent a 10% sample of all ACIAR activity, it is important to note that they do not represent a random sample and so will not necessarily be representative of the whole ACIAR portfolio.

Projects, or groups of projects, that resulted in quantitative impacts (and therefore are included in the database) were generally selected:

- on the expectation that benefits had been achieved (although there are cases of zero benefits within the IAS)
- based on either the ready availability of data for the assessment or good contacts in partner countries to allow the development of data – although there are cases where considerable extra effort was used to derive data
- based on the ability to construct a coherent ‘with research’ and ‘without research’ comparison.

The result is that it is likely to be the high-impact projects that have found their way into the database.

There is scope to develop assessment approaches that can generate impact insights without necessarily requiring detailed economic quantification of benefits. This could allow more broader evaluation to take place.

3.2 A largely economic approach

The development of ADIA was facilitated by the consistent approach to impact assessment encouraged by ACIAR and undertaken by around 80 independent analysts over the course of the series to date.

ACIAR guidelines for impact assessment (IAS058 *Guidelines for assessing the impacts of ACIAR's research activities*) sets out the details of the approach taken in the majority of IAS studies of individual or groups of projects. To a large degree, these guidelines are in turn based on the internationally recognised approach set out in Alston et al. (1998).

3.2.1 Broad economic methodology

In essence, the assessment methodology sets out to generate estimates of benefits and costs – consistent with modern cost-benefit analysis – that can be placed on a common basis and then compared in order to make judgements about the impact of the research.

One common comparison is the benefit:cost ratio (BCR). This measure compares the total benefits of the project over time (expressed in present value terms) with the total costs of the project (again in present value terms) to form the ratio of benefits over costs. Thus, a ratio of 2:1 implies that for every \$1 of costs, \$2 of benefits are generated.

Another common comparison is the difference between the total benefits of the project over time and the total cost of the project over time (both expressed in present value terms). This net benefit measure is an indication of the total dollar amount of value gained by the project (assuming benefits are greater than costs).

Each of these comparisons involves placing costs and benefits occurring at different times on a common basis (the so-called present value) so that they can be consistently compared. The common discount rate used across IAS studies is 5%.

3.2.2 Use of 'surplus' measures

The broad economic methodology adopted in most IAS studies has 2 key characteristics:

- 'Surplus' measures are used to identify benefits (as well as costs in appropriate cases).
- The focus is on comparing the 'with' and 'without' research scenario. This involves carefully identifying exactly what has changed as a consequence of the research compared with what would otherwise have been the case. The without research scenario is sometimes called a 'counterfactual' scenario, as it attempts to measure the difference between what actually happened ('with' research) and what might otherwise have happened.

Two sorts of economic surplus are usually estimated:

- Producer surplus essentially refers to the increase in farmer or smallholder profits (revenue after accounting for all costs) that results from the application of the outcomes of the research. A focus on surplus is important, because research can only lead to true economic benefits if something is left over after all additional costs are accounted for.
- Consumer surplus essentially refers to an increase in real income (or purchasing power) experienced by consumers of the relevant agricultural product. If, for example, the research leads to a reduction in prices, then consumers experience a gain as they can continue to consume the same amount, but have income left over to devote to other goods and services.

3.2.3 With and without research scenarios

The consideration of the without research (or counterfactual) scenario is an important component of the analysis. Figure 3 illustrates possible with and without research comparisons.

For example, the without research scenario could involve the steady reduction in yield (perhaps due to disease), as illustrated in Figure 3a. In this case, even if the with research scenario only manages to maintain yield, the benefits are positive because of the difference between the scenarios. In contrast, looking at a yield alone might imply that the research had no impact, when in fact it led to an avoided loss.

Alternatively, the research may lead to an increase in the rate of growth of a relevant variable (Figure 3b).

Sometimes the magnitude of the impact can be explained by the nature of the with and without research scenarios. Avoiding a decline in yield, for example, can lead to very large benefits, especially if that decline was expected to otherwise have continued over many years.

When interpreting the overall impact measures set out below, the nature of this counterfactual comparison should be kept in mind. The impact reported from IAS studies do not represent commercial returns in the sense that they could have been appropriated by any single corporation or business. Rather, they represent the overall socioeconomic value generated by improving the world compared with what would otherwise have been the case.

Box 4: Dealing with uncertainty

The assessment of the quantitative impact of research requires dealing with uncertainty at 3 levels.

- Some outcomes, such as biosecurity benefits, are inherently probabilistic. For example, the research reduces the likelihood of an incursion but cannot eliminate it altogether.
- In many cases, underlying data is limited or requires estimation (sometimes through survey techniques).
- The construction of with and without research scenarios is itself inherently uncertain and often requires considerable judgement in the construction of scenarios.

These sources of uncertainty are usually recognised in the individual IAS studies. The construction of the ADIA database involves choosing a 'central' or 'most likely' scenario for inclusion.

Underlying uncertainty, however, should be kept in mind when interpreting the magnitude of results presented throughout this report.

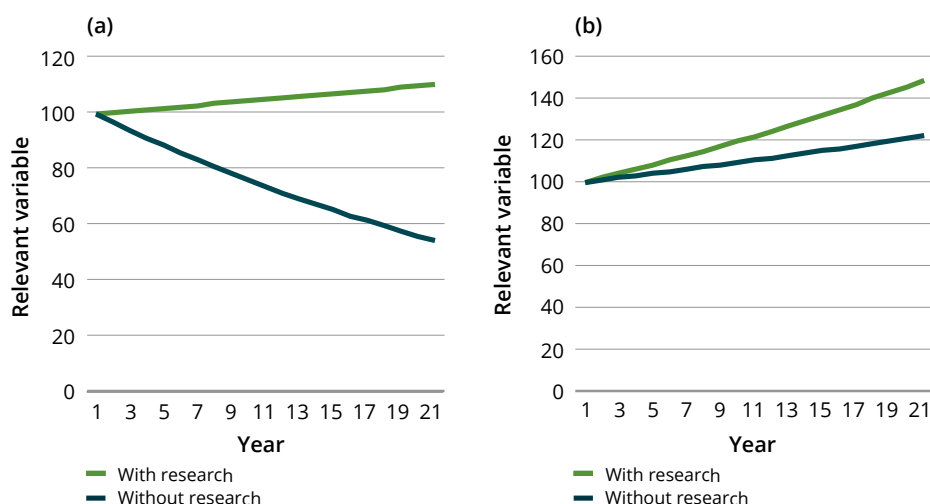


Figure 3 With and without research comparisons (a) avoiding a decline and (b) increasing rate of growth

Source: The Centre for International Economics

4 Magnitude of impact

Chapter 4 looks at the magnitude of impacts of projects in the IAS studies in 3 stages:

- growth in cumulative costs and net benefits over time
- benefit:cost ratios (BCRs) from the research, in total and for specific categories of outcomes
- dollar magnitude of net benefits for specific categories of outcome.

4.1 Cumulative costs and benefits

ACIAR-supported projects are collaborative. Figure 4 shows the cumulative value of project costs (which includes direct funding from various sources as well as other relevant opportunity costs). In total (and in present value terms) these costs amount to \$1.5 billion over the life of the projects analysed to date.

Importantly, as Figure 4 shows, ACIAR funds are on average a minority of total project costs, coming in at just under \$0.6 billion for the projects analysed to date. The collaborative nature of these projects means that ACIAR funds make up around 38% of total project costs on average.

Figure 5 shows the value of net benefits (that is, benefits minus all costs) accumulating over time. From the projects currently in the database, the total value of net benefits is \$63 billion. Note that this includes some benefits that the individual IAS studies expect to accrue in the future.

Figure 5 also allocates the source of the net benefits between ACIAR and other sources. Given the collaborative nature of the projects, the attribution of benefits to a particular organisation is inevitably difficult and is in most cases based on the professional assessment of the researchers undertaking the IAS study.

Overall, 39% of the total net benefits of projects, which amounts to approximately \$24.6 billion, are attributed to ACIAR. The remaining 61% is attributed to ACIAR partners and collaborators, which is proportional to their contribution for the costs of these projects.

4.2 Benefit:cost ratios

4.2.1 Total benefit:cost ratios

Figure 6 shows the distribution of BCRs from ACIAR-supported research evaluated as part of the IAS studies. Most BCRs fall in the range of 1 to 10 (1:1 to 10:1), but a significant proportion fall into the range of 50 to 100.

The unweighted average (that is, not accounting for the relative magnitude of absolute benefits) is 61:1. This is slightly higher than the weighted average of 42:1. This means there are some projects with a high BCR but low absolute magnitude of benefits (Box 5).

Figure 6 also indicates that the median BCR is 22. This is a similar order of magnitude (although slightly higher) than the median BCR reported for CGIAR projects of 10:1 (see Alston et al. 2020).

Box 5: Cost and dollar outcomes versus leverage impact

A project reported in IAS034 *Identifying the sex pheromone of the sugarcane borer moth* is an example of low cost and high impact. The project had a very small outlay (around \$400,000 in current terms) but generated high benefits (around \$27 million). The very high leverage was the result of ACIAR being able to respond to a very effective proposition from the project proponent, an agronomist in Papua New Guinea. The project involved the relatively easy use of pheromone traps for a major pest of sugarcane in a way that allowed very cost-effective integrated pest management.

Other assessments report relatively high total dollar impacts (in the top 10) but lower than average BCRs because of the magnitude of the resources devoted to the project to achieve the dollar impact, such as the project reported in IAS030 *Eucalypt tree improvement in China*.

Other assessments report both high dollar outcomes and high BCRs (such as IAS071 *Plantation forestry research in Indonesia*).

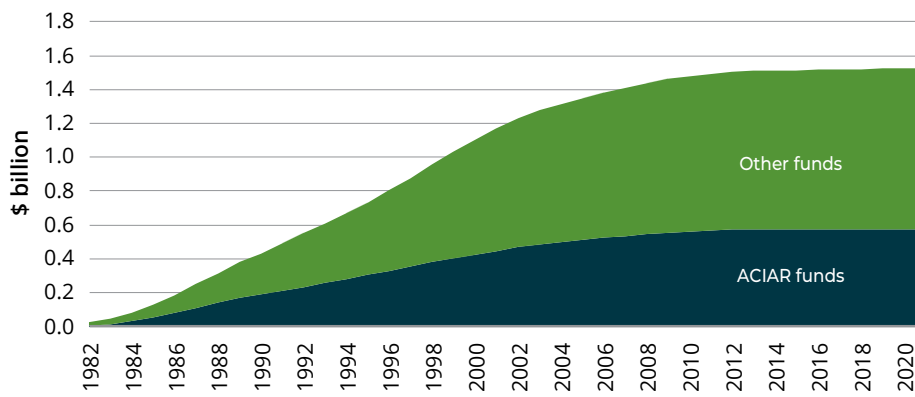


Figure 4 Cumulative project costs, 1982-2021

Note: All numbers expressed in 2021 present values

Source: ADIA

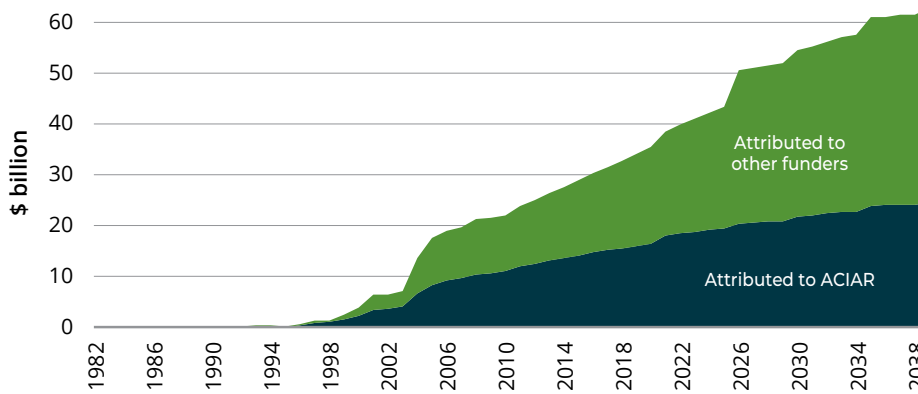


Figure 5 Cumulative project net benefits, 1982-2039

Note: All numbers expressed in 2021 present values

Source: ADIA

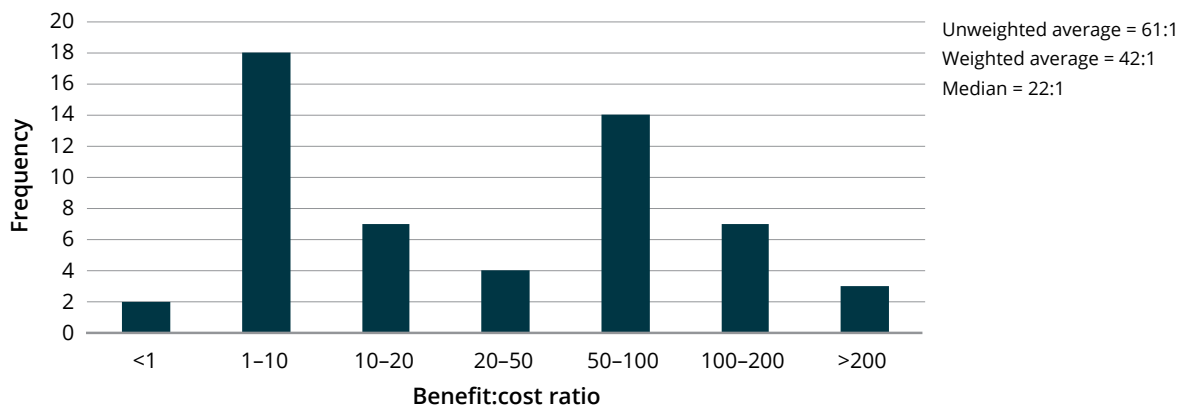


Figure 6 Distribution of benefit:cost ratios

Source: ADIA

4.2.2 BCRs across projects, countries and research area

Figure 7 to Figure 9 show an alternative way of looking at the same BCRs by illustrating the range across projects, countries and broad research areas. An interesting feature of these results is that the variance of outcomes declines significantly when moving from projects to countries to research areas.

Figure 7 shows the BCRs for all projects in the IAS studies, ranked in descending order. This is the dataset underlying the distribution of BCRs illustrated in Figure 6. The variance here is very high, at 136%.

Figure 8 shows the BCRs when the assessments are arranged by country. The highest BCRs are in Indonesia, followed by Vietnam, Philippines and China. In moving from projects to countries, the variance has reduced to 109%.

Figure 9 shows the BCRs by broad research area. It is important to note that the research areas identified by ACIAR have changed over time. Figure 9 is designed to be a reasonable representation of the research programs recognised by ACIAR over its life. The BCRs for most of the research areas are similar, with only small differences between forestry, fisheries and livestock systems, for example. Once again, in moving from countries to research areas, the variance in BCRs has further reduced.

Measured BCRs depend on specific project and country contexts. A wide variety of factors determine the outcomes, including institutional arrangements, incentives for adoption of research, dissemination of research results within the country and potential barriers to adoption. This helps create the relatively wide variance in results across projects and across countries.

When the results are combined into research areas, however, much of this individual variability disappears and there are clear and convergent benefits from different research areas. This illustrates the potential for ongoing future benefits through the focus on key production systems, and on maintaining effort across a variety of countries.

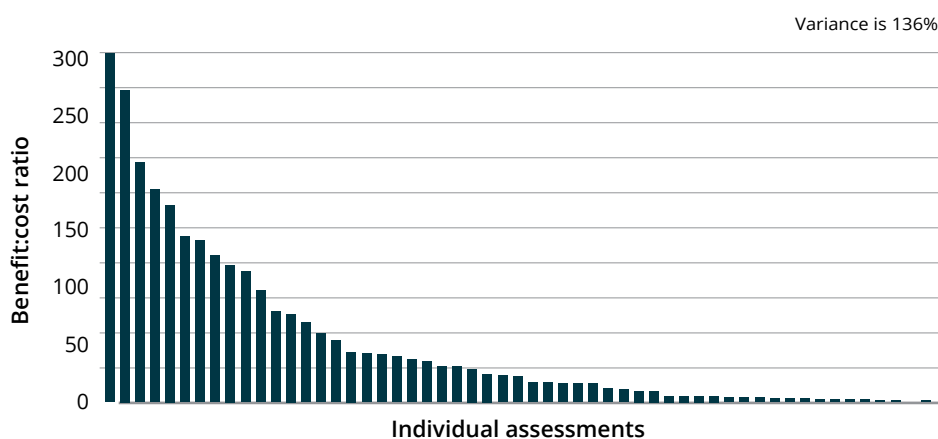


Figure 7 Ranked benefit:cost ratios by assessment

Note: Variance is defined as the standard deviation expressed as a percentage of the mean.

Source: ADIA

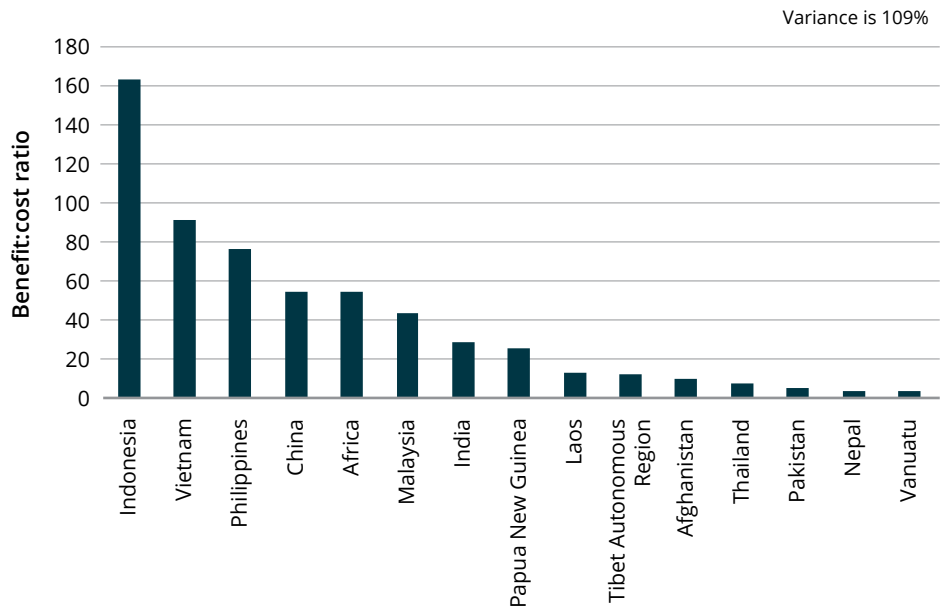


Figure 8 Ranked benefit:cost ratios by country

Note: Variance is defined as the standard deviation expressed as a percentage of the mean.

Source: ADIA

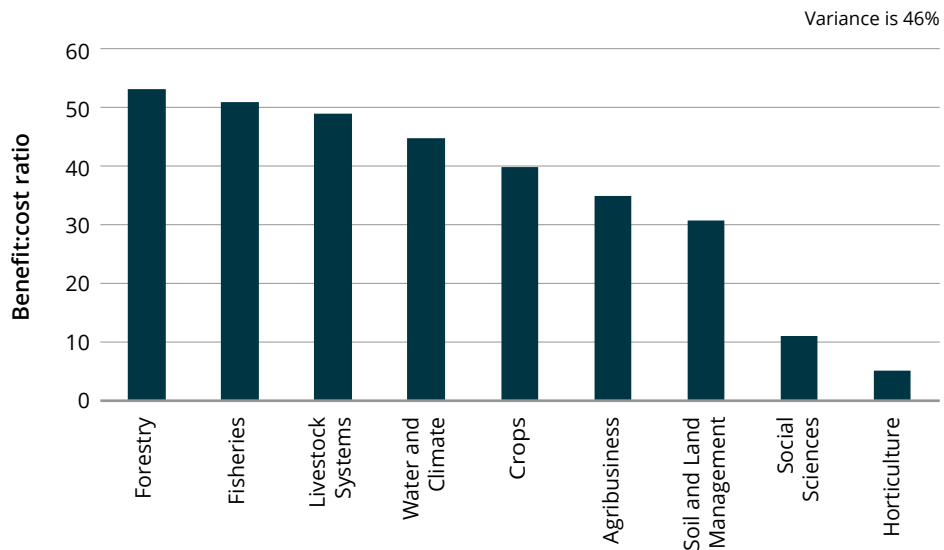


Figure 9 Ranked benefit:cost ratios by research area

Note: Variance is defined as the standard deviation expressed as a percentage of the mean.

Source: ADIA

To give a sense of the variety of projects underlying these BCRs, Box 6 summarises the top 10 impact assessments in terms of the estimated BCR.

A wide range of countries and assessments give rise to these overall results. Looking at these studies, some interesting themes emerge.

Outcomes can arise from:

- the extension and adoption of well-known production techniques (IAS099 *An impact assessment of conservation tillage research in China and Australia*)
- adoption within a partner country of Australian developed technologies (IAS053 *The impact of increasing efficiency and productivity of ruminants in India by the use of protected nutrient technology*)
- more complex and long-term project with a range of impacts (IAS018 *Controlling Phalaris minor in the Indian rice-wheat belt*).

Sometimes high BCRs come from special types of intervention, such as biological control (IAS012 *Biological control of banana skipper in PNG*), which were in turn based on particular Australian expertise.

Sometimes groups of related projects conducted over a long period of time constitute a research program that has a very large impact (IAS071 *Plantation forestry research in Indonesia*).

Benefits are often distributed up and down the production chain, sometimes going predominantly to consumers (IAS062 *Integrated management of insect pests of stored grain in the Philippines*).

Box 6: Top 10 assessments in terms of benefit:cost ratios

IAS048 *Assessment of capacity building: overcoming production constraints to sorghum in rainfed environments in India and Australia*

- Assessment of a grains-related project, with a special focus on broader capacity-building impacts as well as on grain yield impacts, in both India and Australia

IAS012 *Biological control of banana skipper in PNG*

- Effective control of a major pest of bananas in PNG, with additional biosecurity benefits to Australia

IAS018 *Controlling Phalaris minor in the Indian rice-wheat belt*

- Assessment of complex project with wide variety of benefits to India

IAS099 *An impact assessment of conservation tillage research in China and Australia*

- Assessment of large impacts of the wide application of a well-known technique for productivity improvement

IAS062 *Integrated management of insect pests of stored grain in the Philippines*

- Assessment of 4 post-farm projects, with a large proportion of benefits accruing to consumers

IAS027 *Acacia hybrids in Vietnam*

- Assessment of a project leading to the advanced commercial introduction of an Australian tree species

IAS075 *Extending rice crop yield improvements in Lao PDR: an ACIAR–World Vision collaborative project*

- Assessment of an extension project on improving rice crop yields with significant gains in food security for the adopting farmers

IAS071 *Plantation forestry research in Indonesia*

- Assessment of 12 forestry research project with a major set of impacts for both Indonesia and Australia

IAS052 *Breeding and feeding pigs in Vietnam: assessment of capacity building and update of impacts*

- Extending assessment of a high-impact project to include a measure of capacity-building impacts

IAS053 *The impact of increasing efficiency and productivity of ruminants in India by the use of protected nutrient technology*

- Assessment of the application of a well-used Australian technology in India

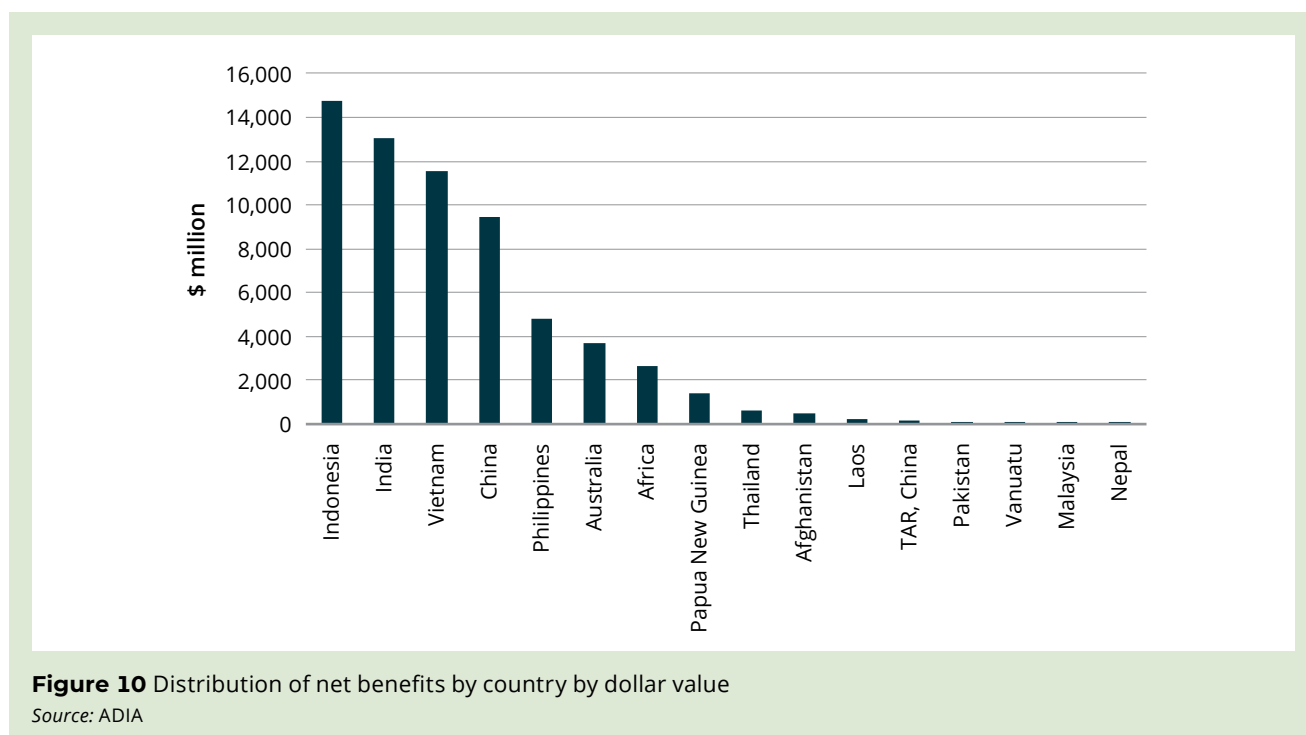
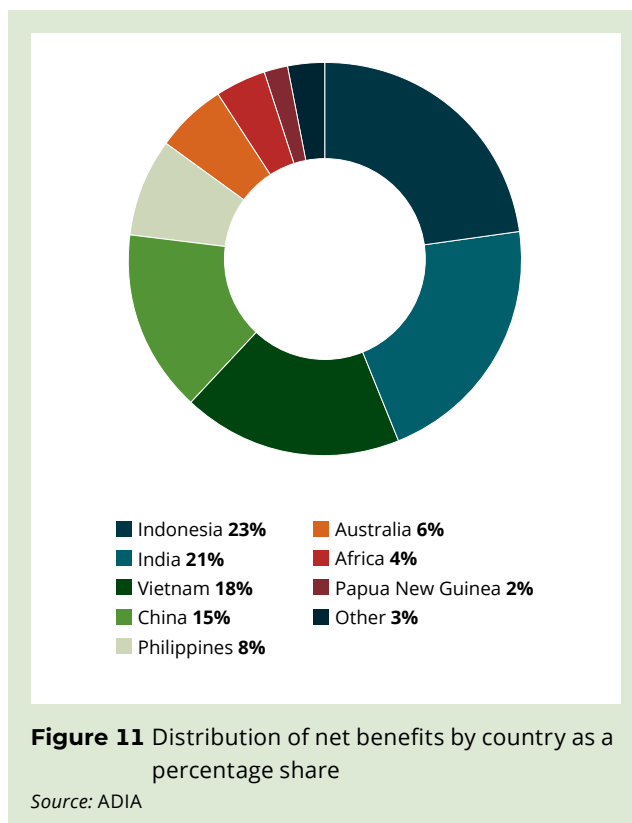
4.3 Net dollar benefits

4.3.1 Impacts by country

Figure 10 shows the dollar value of net benefits and Figure 11 shows the country shares in net benefits.

The largest benefits (around \$14 billion, or 23% of the total) accrue to Indonesia. This is closely followed by India (21%), and then Vietnam (18%), and China (15%).

To give a sense of the projects that underly these overall impacts, Box 7 lists the top 10 impact assessments (in terms of the net value of benefits). Together these account for around 80% of the total measured benefits within the ACIAR Database for Impact Assessments (ADIA). It is interesting that there is some overlap between this list, and the list for the top 10 projects in terms of BCRs in Box 6.



Box 7: Top 10 assessments in terms of net dollar benefits

IAS071 *Plantation forestry research in Indonesia*

- Assessment of 12 forestry research project with a major set of impacts for both Indonesia and Australia

IAS048 *Assessment of capacity building: overcoming production constraints to sorghum in rainfed environments in India and Australia*

- Assessment of a grains-related project, with a special focus on broader capacity-building impacts as well as on grain yield impacts, in both India and Australia

IAS052 *Breeding and feeding pigs in Vietnam: assessment of capacity building and update of impacts*

- Extending assessment of a high-impact project to include a measure of capacity-building impacts

IAS062 *Integrated management of insect pests of stored grain in the Philippines*

- Assessment of 4 post-farm projects, with a large proportion of benefits accruing to consumers

IAS099 *An impact assessment of conservation tillage research in China and Australia*

- Assessment of large impacts of the wide application of a well-known technique for productivity improvement

IAS055 *ACIAR fisheries projects in Indonesia: review and impact assessment*

- Assessment of 8 projects with a focus on tuna fisheries, benefits going to both producers and consumers in Indonesia and Australia

IAS030 *Eucalypt tree improvement in China*

- Assessment of 7 forestry projects drawing on Australian knowledge of eucalypts

IAS065 *ACIAR investment in research on forages in Indonesia*

- Assessment of 6 projects looking at input management for livestock

IAS087 *Newcastle disease control in Africa*

- Assessment of 2 projects dealing with a major disease of economically important village chickens

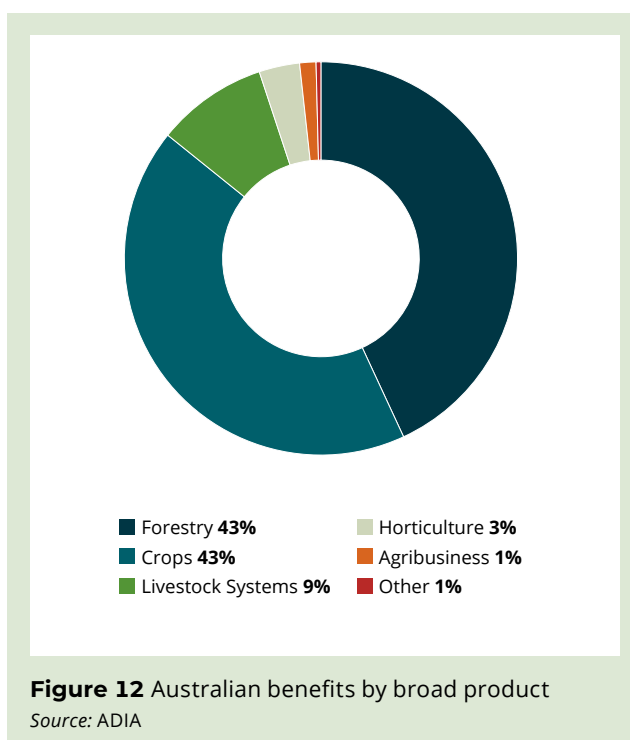
IAS012 *Biological control of banana skipper in PNG*

- Effective control of a major pest of bananas in PNG, with additional biosecurity benefits to Australia

4.3.2 Nature of benefits to Australia

As shown in Figure 12, the \$3.7 billion in benefits that accrue to Australia are distributed across 5 broad product groups. Most of the benefits accrue to forestry, crops and livestock systems.

It is important to note that the benefits to Australia within ADIA are not likely to be fully representative as not all IAS studies attempt to estimate benefits to Australia. This may be because there were no benefits expected, but it may also reflect the particular focus of the IAS.



4.3.3 Impacts by research area

Figure 13 and Figure 14 show the dollar value, and shares, of net benefits by broad research area. Most of the benefits accrue to crops, livestock systems and forestry.

The largest net benefits (\$25 billion, or 39% of the total) accrue to crop-related projects, followed by livestock systems (24%) and forestry (24%). The share of benefits for the other research areas are comparatively small.

Because livestock systems, crops, forestry and fisheries all have similar BCRs, this distribution of benefits largely reflects the relative representation of these research areas in the IAS analyses. That is, the relative proportions of the number of projects in each area reflects the relative proportion of benefits. This is not the case, however, for horticulture, which has lower average BCRs and so has a lower proportion of benefits than its proportion in the number of projects assessed.

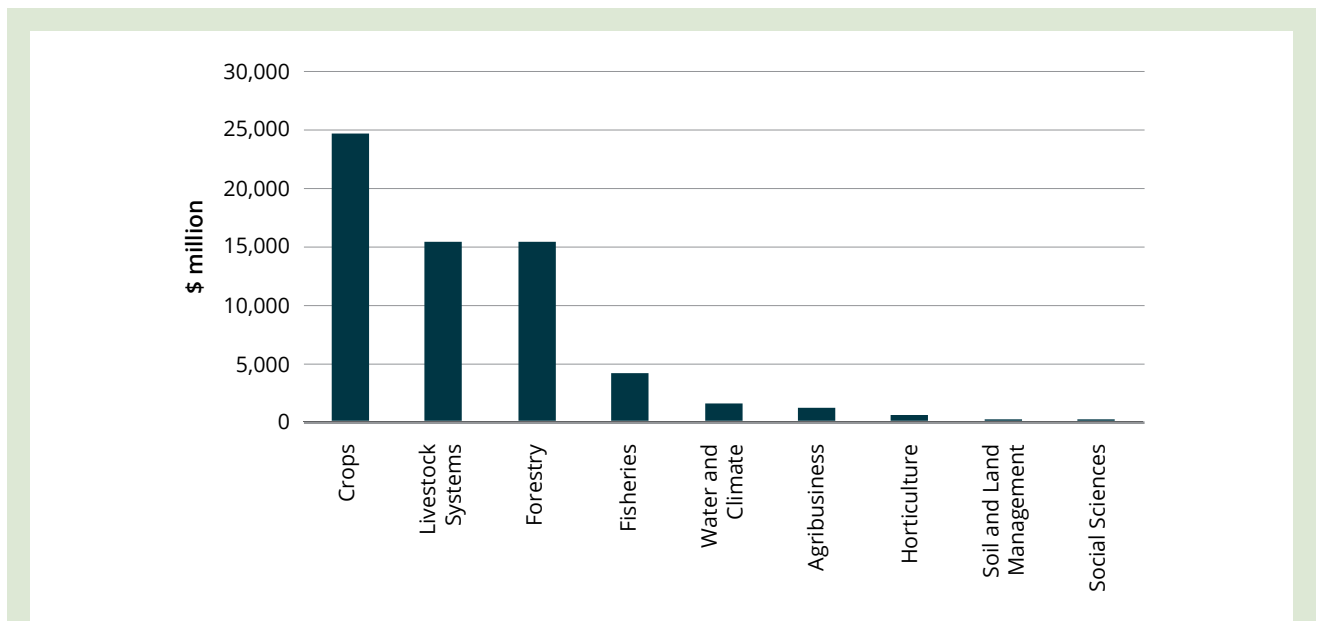


Figure 13 Distribution of net benefits by broad research area by value

Source: ADIA

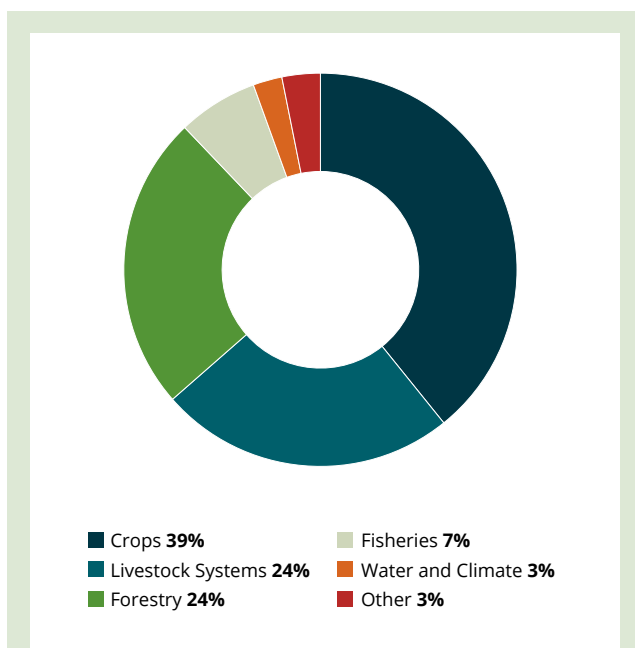


Figure 14 Distribution of net benefits by broad research area by percentage share

Source: ADIA

Box 8: Biosecurity benefits to Australia

In a number of assessments, benefits accruing to Australia arose for biosecurity reasons.

For example, IAS012 *Biological control of banana skipper in PNG* found that effective control of a major pest of bananas in PNG reduced the probability of an incursion in Australia, which could have been very damaging to banana production in Queensland.

Similarly, IAS046 *Mite pests of honeybees in the Asia-Pacific region* found that increased the knowledge and understanding of the mite *Varroa destructor* helped reduce the chances of an incursion in Australia, which would have had major economic effects.



Photo: Conor Ashleigh

5 Impact pathways to benefit

One way to understand how ACIAR-supported research has led to benefits of various kinds is to explore some impact pathways. An impact pathway is the sequence of connections that lead from the outputs of the research to the ultimate impacts of that research on farmers, consumers and other stakeholders that produce or use agricultural commodities.

In terms of social outcomes, some assessments have explicitly included poverty measures (IAS022 *Saving a staple crop; impact of biological control of the banana skipper on poverty reduction in PNG* and IAS020 *Mama Lus Frut scheme: an assessment of poverty reduction*).

5.1 Economic, environmental and social pathways

There are different ways of thinking about impact pathways. Figure 15 divides impacts into economic, environmental and social classes.

Most IAS studies measure ACIAR impact pathways through improved economic outcomes in some way – lower costs, higher productivity, higher prices or the reallocation of resources from one sector to another. Some of these economic pathways are considered in more detail below.

Some ACIAR-supported projects have been concerned with delivering environmental outcomes, either through lower waste or more efficient production techniques (Box 9).

Box 9: Assessment of environmental impacts

An early study (IAS003 *Establishment of a protected area in Vanuatu*) explicitly valued environmental outcomes in terms of willingness to pay for forest area protection.

In addition, a broad framework study undertaken in 2012 (IAS081 *Including natural resource management and environmental impacts within impact assessment studies*) noted that a large proportion of ACIAR-supported projects included environmental impacts, even if these were not necessarily explicitly measured. This study identified 356 projects that could be considered to have environmental impacts, with 73% of them likely to require specialist environmental valuation to capture the magnitude of the benefits.

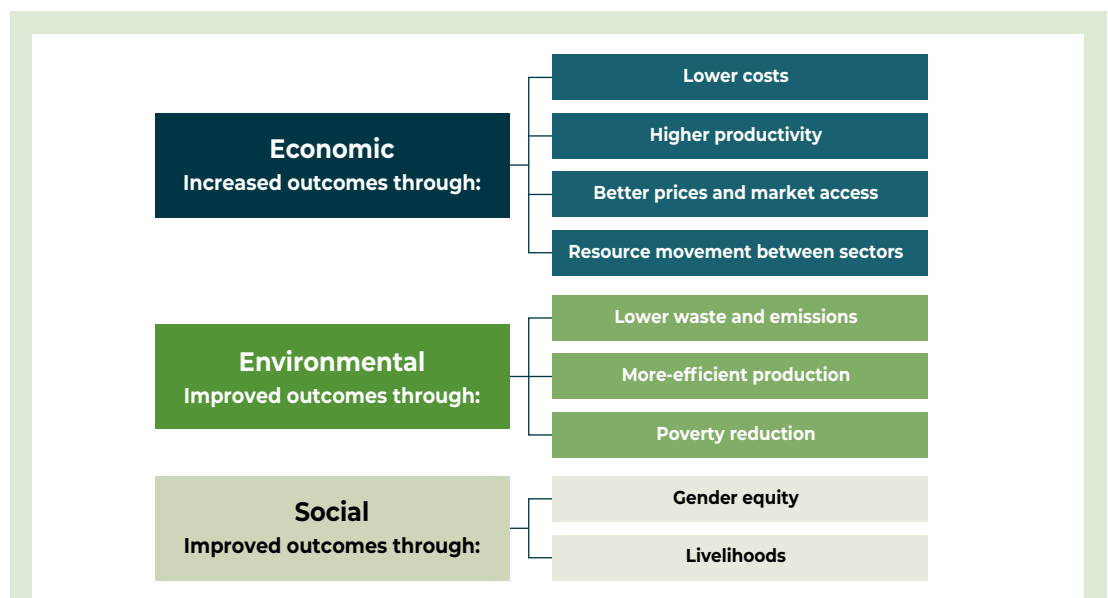


Figure 15 Economic, environmental and social classes of impact

Source: The Centre for International Economics

5.2 Pathways around new technologies or products

The outputs from ACIAR-supported projects can also be thought of as falling into 3 broad categories:

- **new technologies or practical approaches** for dealing with particular problems or issues, which are designed to be applied ultimately at the farm, processing or marketing level, or in some cases at the breeder level
- **new scientific knowledge or basic understanding** (pure or basic science) of the phenomena or social institutions that affect agriculture, which are designed as inputs into further research processes, ultimately to help in the future development of practical approaches for smallholders, processors, wholesalers and retailers
- **knowledge, models and frameworks for policymakers** or broad-level decision-makers, which are not necessarily for use at the farm level but will influence the contextual environment in which farmers, processors, wholesalers and retailers must operate.

Figure 16 illustrates how these 3 broad categories lead to specific impact pathways.

5.2.1 New technologies or practical approaches

New technologies or practical approaches can be applied at the farm level, post-harvest level or at the marketing level for any particular commodity or product. At the farm level, the new techniques may be new varieties, new technologies for pest and disease control, or input or system management approaches. At the post-harvest level, the new techniques may relate to managing pests (for example, in storage) or introducing systems to minimise post-harvest losses (for example, through spoilage). At the marketing level, the new approaches may assist with international market access or biosecurity concerns (which is sometimes another aspect of pest and disease management).

Each of the new technologies or approaches has an economic impact through the pathways identified in Figure 15 – cost reductions, productivity improvements or improved prices.

There are many IAS studies that measure the importance of this pathway.

5.2.2 New scientific knowledge or basic understanding

New scientific knowledge is one step further back on an impact pathway as it needs to be further applied and developed to become something that smallholders or farmers can use. The new knowledge could in turn apply to pests and diseases or to a range of other factors that ultimately influence economic outcomes.

In general, most IAS studies are not concerned with valuing scientific knowledge alone.

5.2.3 Knowledge, models and frameworks for policymakers

An important impact pathway is influencing policymakers and their decision-making. Common to this pathway is the generation of information to assist in international trade negotiations to allow increased market access (which in turn has implications for farmers as it can effectively increase the prices they receive).

5.2.4 The importance of capacity building

Figure 16 also illustrates that capacity building underlies all the other impact pathways. Most ACIAR-supported projects considered in IAS studies were also concerned with capacity building of various kinds. While not all IAS reports explicitly valued capacity building, it has been quantitatively considered in a number of cases.

Box 10 lists IAS reports that studied projects that measured capacity building outcomes.

Box 10: Measuring capacity building

A number of IAS studies explicitly considered capacity building in their measures of benefits.

These studies explicitly measured capacity building impacts:

- IAS044 *Impact assessment of capacity building and training*
- IAS048 *Assessment of capacity building: overcoming production constraints to sorghum*
- IAS052 *Breeding and feeding pigs in Vietnam: assessment of capacity building.*

These studies found capacity building to be a key part of the impacts:

- IAS066 *Extending low-cost fish farming in Thailand*
- IAS075 *Extending rice crop yield improvements in Lao PDR.*

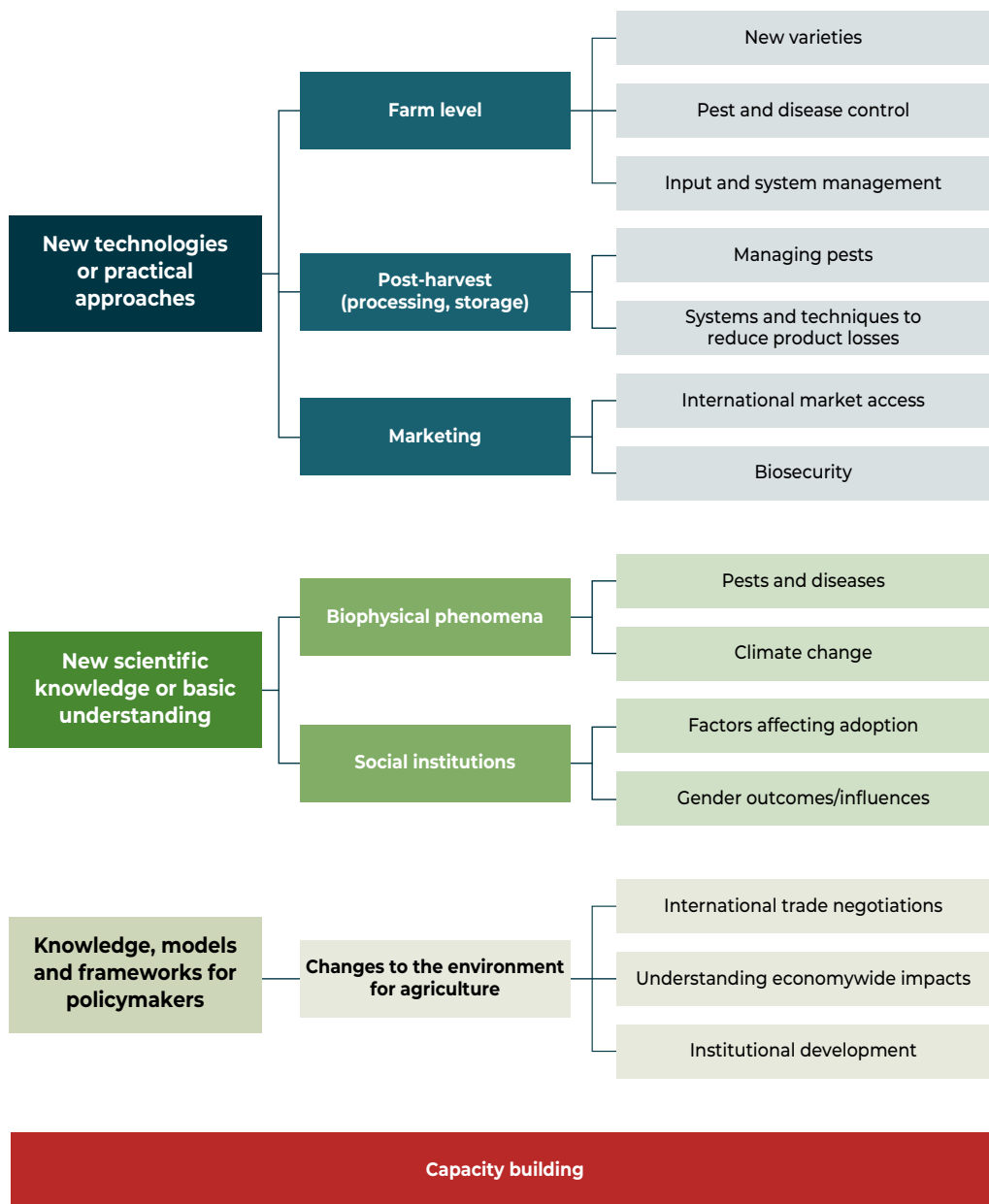


Figure 16 Impact pathways

Source: The Centre for International Economics

5.3 Measuring the magnitude of these pathways

Figure 17 shows the magnitude of benefits arising from different impact pathways.

Figure 18 and Figure 19 show the distribution of benefit:cost ratio and benefits across impact pathways.

5.3.1 New varieties

Nearly one-third (31%, or \$19.7 billion) of benefits estimated within the IAS studies are associated with new varieties: new crops, new varieties of trees or alternative livestock breeds. Varieties may be completely new, or new to the particular country or region associated with the project.

There is a direct pathway from the adoption of new varieties to economic benefits because of the higher yield generally associated with new varieties. This yield may be higher in an absolute sense, or it may be associated with avoiding a further decline in yields.

In many ways, the importance of new varieties reflects the ongoing contribution of ACIAR to the Green Revolution, which started in the 1960s.

Box 11: Complex patterns of new varieties

In some cases the pattern of new varieties is complex. IAS085 *ACIAR wheat and maize projects in Afghanistan* found a range of patterns of adoption of a wide set of new varieties.

This study also illustrates the importance of careful with and without research scenario analysis. The history of yields in Afghanistan does not show any significant evidence of yield increases following the introduction of the new varieties. However, a detailed survey of farmers showed clearly that the new varieties prevented further yield decline.

This source of benefit also includes techniques to better select varieties and undertake the breeding process.

New varieties are closely related to pest and disease management. Sometimes the target for breeding is pest or disease resistance.

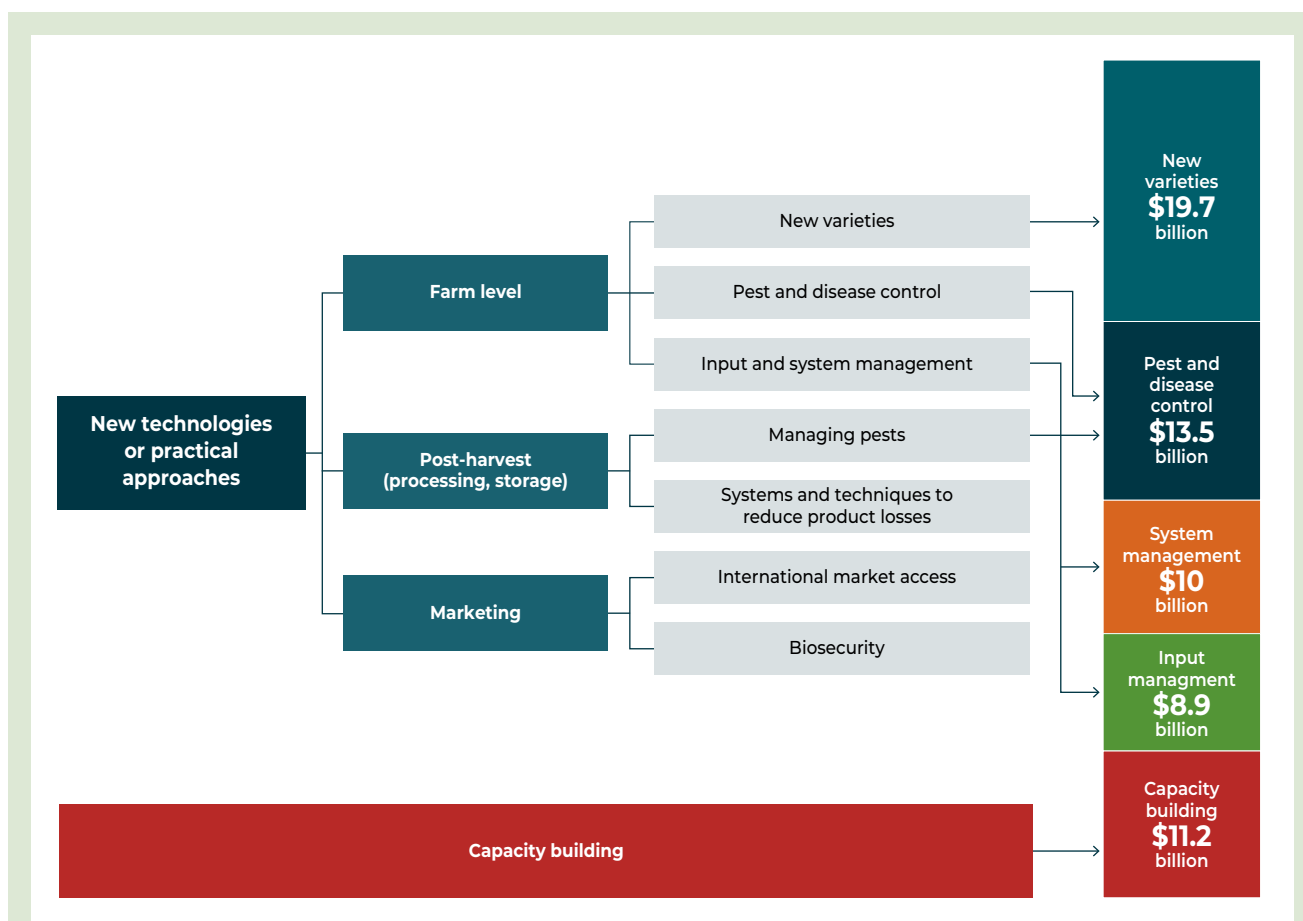


Figure 17 Pathways to benefits

Source: The Centre for International Economics estimates based on ADIA

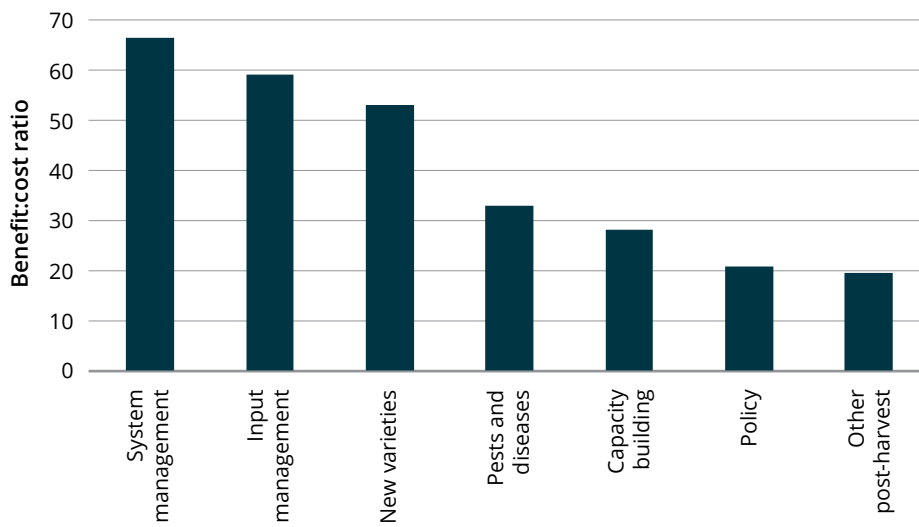


Figure 18 Distribution of benefit:cost ratio by broad impact pathway

Source: ADIA

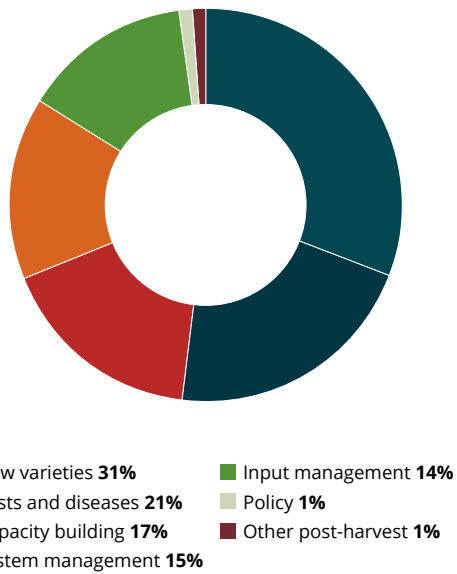


Figure 19 Distribution of benefit by broad impact pathway as a percentage share

Source: ADIA

5.3.2 Pests and diseases

Just over one-fifth (23%) of benefits estimated in the IAS studies are associated with new products and techniques to deal with pests and diseases. The specific technique varies but includes vaccines, pesticides and herbicides and management techniques that invoke specific scientific knowledge of the pest or disease involved.

It also includes biological control, which is an important approach that takes adoption out of the hands of individuals.

The importance of diseases reflects an ongoing feature of agricultural R&D. Pest and disease management requires ongoing effort as they can never be completely eradicated. Sometimes success in one area of R&D provides an avenue for diseases to emerge in another.

Generally, the without research baseline when considering pests and diseases is a continual decline in yields, or a significant increase in farming costs. Thus, research in this area can have a substantive impact without necessarily leading to an increase in yield in a given base year.

Box 12: Simple approaches to pests and diseases

Often, approaches to pest and disease management can be relatively simple but have substantive impact and significant benefit.

In the case of cocoa pod borer (a moth pest of cocoa plants) in Papua New Guinea and Indonesia, a relatively straightforward hygiene regime (regularly harvesting pods, cleaning around trees, disposing of plant waste where the moth could otherwise breed) proved successful (IAS089 *Sustaining cocoa production: impact evaluation of cocoa projects in Indonesia and Papua New Guinea*).

5.3.3 Capacity building

Around 17% of benefits estimated in IAS studies are specifically associated with capacity building.

This is an interesting impact pathway, as capacity building is associated with every ACIAR-supported project, and is often assumed as an element in the successful adoption of other techniques and new products.

Most IAS studies do not directly measure capacity building as a component of the benefits. However, there are a number of studies where the dissemination of techniques through capacity building was considered crucial to achieve subsequent income increases. In these cases, the reorganisation of production, for example, allowed through the development of specific capacity was crucial to realise the benefits from a project. In these cases, the primary pathway to benefits was seen as the development of that capacity.

5.3.4 System management

A number of ACIAR-supported projects are concerned with better management of farming, forestry or fishing systems. This management uses scientific knowledge and techniques to improve the allocation of effort, leading to a measured increase in productivity, or reduction in costs.

Around 15% of total benefits estimated in the IAS studies is associated with this impact pathway.

5.3.5 Management of inputs

Inputs to farming systems include feed (in the case of livestock, for example), soil health (in the case of crops) and water (applicable to many farming systems). Around 14% of the total benefits estimated in the IAS studies is associated with this impact pathway.

Box 13: Transfer of established knowledge for input management

Some of the projects in the management of inputs involve the implementation in a partner country of technologies already well established in countries such as Australia. For example, IAS053 *The impact of increasing efficiency and productivity of ruminants in India by the use of protective nutrient technology* involved the application in India of a well-established feed technique developed in Australia.

5.3.6 Comparing BCRs for different pathways

Figure 18 includes a comparison of the BCRs that arise from these different impact pathways. Given the considerable overlap between categories and the inevitable uncertainties in allocation of benefits and costs, these BCRs should be considered as being very close.



6 Conclusion

Since very early in its history, ACIAR has paid careful attention to the impacts of the projects it has funded. The results of a large number of studies of individual or groups or projects as part of the ACIAR Impact Assessment Series can be compiled into a systematic overview representing 10% of the project investment made by ACIAR since 1982, to support agricultural research for development in the Indo-Pacific region.

This overview indicates that the majority of projects studied have a benefit:cost ratio (BCR) of between 1:1 and 10:1. Some projects have very high BCRs, with the median BCR across all projects examined being 22:1, with a weighted average of 42:1.

In dollar terms (expressed in present values in today's dollars) total benefits amount to \$64.4 billion, and net benefits (net of costs) amount to \$62.9 billion.

While it is difficult to attribute benefits of collaborative projects to specific funds (on average, ACIAR funds made up around 38% of the cost of the ACIAR-supported projects studies), the estimates from the IAS reports suggest that the benefits attributed to ACIAR funds alone are around \$25.2 billion.

While these impacts are a snapshot of all ACIAR activities over the past 40 years, even if the projects that have not been examined had BCRs of zero (that is, if they generated no benefits at all – an extreme assumption) the BCR for all of ACIAR activities would be around 4.2:1. This lower bound represents a very high return on the public funds invested.

Finally, the ongoing changes to agriculture in partner countries – along with substantive developments in the broader economy of these partners over the past 40 years – when combined with the measured impact of agricultural research (both for ACIAR and international agencies) suggest considerable scope for future benefits through continued funding and collaboration in international agricultural research.



References

- Alston, J., Norton, G. & Pardey, P. 1998. *Science under scarcity*, Centre for Agriculture and Bioscience International.
- Alston, J., Pardey, P. & Rao, X. 2020. *The payoff to investing in CGIAR research*, SOAR Foundation.
- Gollin, D., Hansen, C. & Wingender, A. 2021. Two blades of grass: the impact of the Green Revolution. *Journal of Political Economy*, 129(8), doi.org/10.1086/714444.
- PRISMA n.d. *Mango*, PRISMA website, accessed 8 February 2021. <https://aip-prisma.or.id/en/commodities/mango>





Photo: Khanh Long

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, AS1/1993/222
2	George P.S. 1998	Increased efficiency of straw utilisation by cattle and buffalo	AS1/1982/003, AS2/1986/001, 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, CS2/1989/019
6	Ryan J.G. 1998	Pigeonpea improvement	CS1/1982/001, 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, FST/1988/048
9	ACIL Consulting 1998	Sulfur test KCL-40 and growth of the Australian canola industry	PN/1983/028, 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, 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, CS1/1988/039
14	McLeod R., Isvilanonda S. and Wattanutchariya S. 1999	Improved drying of high moisture grains	PHT/1983/008, PHT/1986/008, 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, 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 South-East Asia	AS1/1983/067, AS1/1988/035, AS1/1992/004, AS1/1994/038

No.	Author(s) and year of publication	Title	ACIAR project numbers
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, 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
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, CS1/1988/014
26	Mullen J.D. 2004	Impact assessment of ACIAR-funded projects on grain-market reform in China	ADP/1997/021, ANRE1/1992/028
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/1984/057, FST/1987/036, FST/1988/048, FST/1990/044, FST/1994/025, FST/1996/125, 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, FIS/1999/076
37	McLeod R. 2005	Management of fruit flies in the Pacific	CS2/1989/020, CS2/1994/003, CS2/1994/115, CS2/1996/225
38	ACIAR 2006	Future directions for ACIAR's animal health research	

ACIAR Impact Assessment Series (continued)

No.	Author(s) and year of publication	Title	ACIAR project numbers
39	Pearce D., Monck M., Chadwick K. and Corbishley J. 2006	Benefits to Australia from ACIAR-funded research	AS2/1990/028, AS2/1994/017, AS2/1994/018, AS2/1999/060, CS1/1990/012, CS1/1994/968, FST/1993/016, PHT/1990/051
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 CABl products	
43	Harris D.N. 2006	Water management in public irrigation schemes in Vietnam	LWR1/1998/034, LWR2/1994/004
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, 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, AS2/1999/060
47	Fisher H. and Gordon J. 2007	Improved Australian tree species for Vietnam	FST/1993/118, 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	CS1/1990/012, PHT/1990/051
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 in India	CS2/1994/050

No.	Author(s) and year of publication	Title	ACIAR project numbers
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, FIS/2006/144
56	Lindner B. and McLeod P. 2008	A review and impact assessment of ACIAR's fruitfly research partnerships—1984–2007	CP/1997/079, CP/2001/027, CP/2002/086, CP/2007/002, CP/2007/187, 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, PHT/1990/051, PHT/1993/87, PHT/1994/133
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., Kagaon C.V., Laguna J.P., Ramos M., Garabig K.A., Pagua 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, PHT/1990/009
63	Harding M., Tingsong Jiang and Pearce D. 2009	Analysis of ACIAR's returns on investment: appropriateness, efficiency and effectiveness	
64	Mullen J.D. 2010	Reform of domestic grain markets in China: a reassessment of the contribution of ACIAR-funded economic policy research	ADP/1997/021, ANRE1/1992/028
65	Martin G. 2010	ACIAR investment in research on forages in Indonesia	AS2/2000/103, AS2/2000/124, AS2/2001/125, LPS/2004/005, SMAR/2006/061, SMAR/2006/096
66	Harris D.N. 2010	Extending low-cost fish farming in Thailand: an ACIAR–World Vision collaborative program	PLIA/2000/165
67	Fisher H. 2010	The biology, socioeconomics and management of the barramundi fishery in Papua New Guinea's Western Province	FIS/1998/024

ACIAR Impact Assessment Series (continued)

No.	Author(s) and year of publication	Title	ACIAR project numbers
68	McClintock A. and Griffith G. 2010	Benefit-cost meta-analysis of investment in the International Agricultural Research Centres	
69	Pearce D. 2010	Lessons learned from past ACIAR impact assessments, adoption studies and experience	
70	Harris D.N. 2011	Extending low-chill fruit in northern Thailand: an ACIAR-World Vision collaborative project	PLIA/2000/165
71	Lindner R. 2011	The economic impact in Indonesia and Australia from ACIAR's investment in plantation forestry research, 1987-2009	FST/1986/013, FST/1990/043, FST/1993/118, FST/1995/110, FST/1995/124, FST/1996/182, FST/1997/035, FST/1998/096, FST/2000/122, FST/2000/123, FST/2003/048, FST/2004/058
72	Lindner R. 2011	Frameworks for assessing policy research and ACIAR's investment in policy-oriented projects in Indonesia	ADP/1994/049, ADP/2000/100, ADP/2000/126, AGB/2000/072, AGB/2004/028, ANREI/1990/038, ANREI/1993/023, ANREI/1993/705, EFS/1983/062, EFS/1988/022
73	Fisher H. 2011	Forestry in Papua New Guinea: a review of ACIAR's program	FST/1994/033, FST/1995/123, FST/1998/118, FST/2002/010, FST/2004/050, FST/2004/055, FST/2004/061, FST/2006/048, FST/2006/088, FST/2006/120, FST/2007/078, FST/2009/012
74	Brennan J.P. and Malabayabas A. 2011	International Rice Research Institute's contribution to rice varietal yield improvement in South-East Asia	
75	Harris D.N. 2011	Extending rice crop yield improvements in Lao PDR: an ACIAR-World Vision collaborative project	CIIM/1999/048, CS1/1995/100, PLIA/2000/165
76	Grewal B., Grunfeld H. and Sheehan P. 2011	The contribution of agricultural growth to poverty reduction	
77	Saunders C., Davis L. and Pearce D. 2012	Rice-wheat cropping systems in India and Australia, and development of the 'Happy Seeder'	LWR/2000/089, LWR/2006/132, CSE/2006/124
78	Carpenter D. and McGillivray M. 2012	A methodology for assessing the poverty-reducing impacts of Australia's international agricultural research	
79	Dugdale A., Sadleir C., Tennant-Wood R. and Turner M. 2012	Developing and testing a tool for measuring capacity building	
80	Fisher H., Sar L. and Winzenried C. 2012	Oil palm pathways: an analysis of ACIAR's oil palm projects in Papua New Guinea	ASEM/1999/084, ASEM/2002/014, ASEM/2006/127, CP/1996/091, CP/2007/098, PC/2004/064, PC/2006/063

No.	Author(s) and year of publication	Title	ACIAR project numbers
81	Pearce D. and White L. 2012	Including natural resource management and environmental impacts within impact assessment studies: methodological issues	
82	Fisher H. and Hohnen L. 2012	ACIAR's activities in Africa: a review	AS1/1983/003, AS1/1995/040, AS1/1995/111, AS1/1996/096, AS1/1998/010, AS2/1990/047, AS2/1991/018, AS2/1993/724, AS2/1996/014, AS2/1999/063, AS2/1996/090, AS2/1996/149, AS2/1996/203, AS2/1997/098, CP/1994/126, CS2/1990/007, EFS/1983/026, FST/1983/020, FST/1983/031, FST/1983/057, FST/1988/008, FST/1988/009, FST/1991/026, FST/1995/107, FST/1996/124, FST/1996/206, FST/2003/002, IAP/1996/181, LPS/1999/036, LPS/2002/081, LPS/2004/022, LPS/2008/013, LWR/2011/015, LWR1/1994/046, LWR2/1987/035, LWR2/1996/049, LWR2/1996/163, LWR5/1996/215, LWR2/1997/038, SMCN/1999/003, SMCN/1999/004, SMCN/2000/173, SMCN/2001/028
83	Palis F.G., Sumalde Z.M., Torres C.S., Contreras A.P. and Datar F.A. 2013	Impact pathway analysis of ACIAR's investment in rodent control in Vietnam, Lao PDR and Cambodia	ADP/2000/007, ADP/2003/060, ADP/2004/016, AS1/1994/020, AS1/1996/079, AS1/1998/036, CARD 2000/024, PLIA/2000/165
84	Mayne J. and Stern E. 2013	Impact evaluation of natural resource management research programs: a broader view	
85	Jilani A., Pearce D. and Bailo F. 2013	ACIAR wheat and maize projects in Afghanistan	SMCN/2002/028, CIM/2004/002, CIM/2007/065
86	Lindner B., McLeod P. and Mullen J. 2013	Returns to ACIAR's investment in bilateral agricultural research	
87	Fisher H. 2014	Newcastle disease control in Africa	AS1/1995/040, AS1/1996/096
88	Clarke M. 2015	ACIAR-funded crop-livestock projects, Tibet Autonomous Region, People's Republic of China	LPS/2002/104, CIM/2002/093, LPS/2005/018, LPS/2005/129, LPS/2006/119, LPS/2008/048, LPS/2010/028, C2012/228, C2013/017
89	Pearce D. 2016	Sustaining cocoa production: impact evaluation of cocoa projects in Indonesia and Papua New Guinea	SMAR/2005/074, HORT/2010/011, ASEM/2003/015, ASEM/2006/127, PC/2006/114

ACIAR Impact Assessment Series (continued)

No.	Author(s) and year of publication	Title	ACIAR project numbers
90	Pearce D. 2016	Impact of private sector involvement in ACIAR projects: a framework and cocoa case studies	PC/2006/114, ASEM/2006/127, SMAR/2005/074, HORT/2010/011
91	Brown P. R., Nidumolu U. B., Kuehne G., Llewellyn R., Mungai O., Brown B. and Ouzman J. 2016	Development of the public release version of Smallholder ADOPT for developing countries	
92	Davila F., Sloan T. and van Kerkhoff L. 2016	Knowledge systems and RAPID framework for impact assessments	CP/1997/017
93	Mullen J.D., de Meyer J., Gray D. and Morris G. 2016	Recognising the contribution of capacity building in ACIAR bilateral projects: Case studies from three IAS reports.	FST/1986/030, FST/1993/118, FST/1998/096, FIS/2005/114
94	Davila F. Sloan T. Milne M. and van Kerkhoff L., 2017	Impact assessment of giant clam research in the Indo-Pacific region	FIS/1982/032, FIS/1987/033, EFS/1988/023, FIS/1995/042
95	Ackerman J.L. and Sayaka B. 2018	Impact assessment of ACIAR's Aceh aquaculture rehabilitation projects	FIS/2005/009, FIS/2006/002
96	Clarke M. and Mikhailovich K. 2018	Impact assessment of investment in aquaculture-based livelihoods in the Pacific islands region and tropical Australia	FIS/2001/075, FIS/2006/138
97	Mullen J.D., Malcolm B. and Farquharson R.J. 2019	Impact assessment of ACIAR-supported research in lowland rice systems in Lao PDR	CSI/1995/100, CIM/1999/048, CSE/2006/041
98	Clarke M. 2019	Impact assessment of ACIAR investment in citrus rootstock, scion and production improvement in China, Vietnam, Bhutan and Australia	CSI/1987/002, CSI/1996/076, HORT/2005/142, HORT/2010/089
99	Abell J., Chudleigh P. and Hardaker T., 2021	An impact assessment of conservation tillage research in China and Australia	LWR2/1992/009, LWR2/1996/143
100 (1)	Centre for International Economics, 2022	The impact of ACIAR work in agricultural research for development 1982-2022: quantifying returns on investment	Selected projects since 1982
100 (2)	van der Heijden, J. 2022	The impact of ACIAR work in agricultural research for development 1982-2022: a qualitative comparative analysis	Selected projects since 1982
101	Davila F., Vanzetti D. and Sloan T., 2021	Mixed-methods impact assessment of sandalwood research in Vanuatu	FST/2002/097, FST/2008/010
102	Williams L.J., McMillan L., Van Wensveen M., Butler J.R.A., Camacho Jr J.D.V., Lapitan A., Datoon R., Gapas J., Pinca E., Macavinta-Gabunada F., Serino M.N.V., Nunez L., Recto A.L., Ruales J.H., Enerlian W.C., Ani P.A.B and Aranas M.B. 2021	An integrated approach to ex-post impact assessment	ASEM/1998/052, ASEM/2002/051, ASEM/2009/044

40
YEARS



ACIAR
EST. 1982

**Australian
Aid** 